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Langley Research Center

Scientific and Technical Information Program Office

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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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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20040075552 NASA Langley Research Center, Hampton, VA, USA

Suggested Procedures for Installing Strain Gauges on Langley Research Center Wind Tunnel Balances, Custom Force Measuring Transducers, Metallic and Composite Structural Test Articles

Moore, Thomas C., Sr.; May 1, 2004; 72 pp.; In English

Contract(s)/Grant(s): 23-761-20-5H

Report No.(s): NASA/TM-2004-213017; L-19020; No Copyright; Avail: CASI; A04, Hardcopy

The character of force and strain measurement testing at LaRC is such that the types of strain gauge installations, the materials upon which the strain gauges are applied, and the test environments encountered, require many varied approaches. In 1997, a NASA Technical Memorandum (NASA TM 110327) was generated to provide the strain gauge application specialist with a listing of recommended procedures for strain gauging various transducers and test articles at LaRC. The technical memorandum offered here is an effort to keep the strain gauge user informed of new technological enhancements in strain-gauging methodology while preserving the strain-gauging guidelines set forth in the 1997 TM. This document provides detailed recommendations for strain gauging LaRC-designed balances and custom transducers, composite materials, cryogenic and high-temperature test articles, and selected non-typical or unique materials or test conditions. Additionally, one section offers details for installing Bragg-Grating type fiber-optic strain sensors for non-typical test scenarios.

Author

Strain Measurement; Strain Gages; Fiber Optics; High Temperature Tests; Composite Materials

20040076998 Nebraska Univ., Omaha, NE, USA

The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 2

Bowen, Brent, Editor; Gudmundsson, Sveinn, Editor; Oum, Tae, Editor; July 2003; 228 pp.; In English; Air Transport Research Society (ATRS) World Conference, 10-12 Jul. 2003, Toulouse, France; See also 20040076999 - 20040077011

Contract(s)/Grant(s): NCC5-572

Report No.(s): UNOAI-03-6-Vol-2; Copyright; Avail: CASI; A11, Hardcopy

The UNO Aviation Institute Monograph Series began in 1994 as a key component of the education outreach and information transfer missions of the Aviation Institute and the NASA Nebraska Space Grant & EPSCoR Programs. The series is an outlet for aviation materials to be indexed and disseminated through an efficient medium. Publications are welcome in all aspects of aviation. Publication formats may include, but are not limited to, conference proceedings, bibliographies, research reports, manuals, technical reports, and other documents that should be archived and indexed for future reference by the aviation and world wide communities.

Author

Air Transportation; Air Traffic Control; Flight Safety

20040077006 Instituto Tecnologico de Aeronautica, Sao Paulo, Brazil

Aircraft Noise Perception Study in Brazil: A Perspective on Airport Sustainable Growth and Environmental Awareness

deArantesGomes, Rogeria Eller; Urbina, Ligia Maria Soto; Porto, Protogenes Pires; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 16 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Aircraft noise perception is related to several variables that are tangible and objective, such as the number of operations, flight schedules. Other variables, instead, are more subjective, such as preferences. However, although their elusiveness, they contribute to determine the individuals' perception of this type of externality. Despite the fact that the complaints related to aeronautical noise have been registered since the decade of 50, it has been observed that the perception of noise seems to have grown, especially since the 80's. It has been argued that this change in noise perception has its roots on the accelerated expansion of air traffic. But, it is necessary to point out the important role played on modeling preferences, by the growing environmental conscience and the higher welfare and quality of life standards and expectations. In that context, the main objective of this paper is to study the aeronautical noise perception in the neighborhoods of the Aeroporto Internacional de Sao Paulo - AISP (the biggest airport of South America). Specifically, it analyzes the relationship between aircraft noise perception and social class, which is expected to be positive. Since noise perception is an intangible variable, this study chose as a proxy the value losses of residential properties, caused by aeronautical noise. The variable social class has been measured utilizing average per capita income of the population who live nearby the airport. The comparison of both, the lowest and the highest social class suggests that the relationship between social class and noise perception is positive in the AISP region. Moreover, it was observed that all social classes are very susceptible to aircraft noise annoyance. In fact, the magnitude of the noise perception proxy for both social classes -the residential value losses- was found to be comparable to levels encountered in developed countries.

Author

Aerodynamic Noise; Aircraft Noise; Airports; Aeroacoustics; Air Traffic

20040077182 NASA Ames Research Center, Moffett Field, CA, USA

Evaluation of Aeronautical Design Standard-33 Using a UH-60A Black Hawk

Blanken, Christopher L.; Arterburn, David R.; Cicolani, Luigi S.; Research and Technology 1999; December 2000, pp. 26; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The U.S. Army's Aeronautical Design Standard- 33 (ADS-33D-PRF) is a rotorcraft handling-qualities specification that was developed at Ames. Because this specification was initially applied in the RAH-66 Comanche helicopter program, the requirements generally related more to scout and attack rotorcraft. Recently, Ames expanded its handling-qualities research work to include utility rotorcraft, with and without externally slung loads. As part of this research, an 80-hour flight-test assessment of ADS-33D-PRF was conducted at Ames using an instrumented UH-GOA Black Hawk, the Army s primary utility helicopter. The trial was performed (1) to assess the required compliance testing and to evaluate the requirements in a good visual environ- ment; (2) to tailor the existing flight-test maneuvers and develop new maneuvers specifically designed to adequately evaluate the handling-qualities of utility helicopters, with and without externally slung loads; (3) to correlate the results from the quantitative testing with those from the qualitative evaluations; and (4) to establish a handling-qualities baseline of the UH-60A in terms of ADS-33 against which the effects of future modifications to the aircraft may be better quantified. The 80-hour flight test was performed in three phases. Six pilots participated in Phase 1, the purpose of which was to tailor the existing ADS-33D-PRF flight-test maneuvers and to develop new ones. As shown in figure 1, course cueing for these flight-test maneuvers was constructed and refined to provide sufficient cues such that the evaluation pilots could determine Desired and Adequate maneuver performance standards. Eight experimental test pilots participated in the Phase 2 formal handling-qualities evaluations of the Black Hawk for these maneuvers and for three aircraft configurations: empty (approximate average weight = 13,500 pounds); with an internal ballast (1 7,300 pounds); and empty but with a 6,000-pound externally slung load (total operating weight 19,300 pounds). Data were collected in calm (<5 knots) and light wind conditions (7-1 5 knots). During Phase 3, the empty and internal ballast configurations were used to assess the compliance testing and criteria from the quantitative requirements in ADS-33D-PRF at hover and in forward flight. Selected flight-test maneuvers from ADS-33D- PRF and from a CH-47D cargo helicopter assessment were refined for the utility mission. The maneuver performance standards were generally aligned with those developed in the cargo helicopter flight test. The addition of light winds (7-1 5 knots) tended to degrade the handling-qualities for some maneuvers more so than others. From the internal ballast con- figuration, the qualitative results for calm conditions (shown in figure 2) suggest that except for the Hover Turn and the Pirouette maneuvers, the average Handling Quality Rating (HQR) for the UH-GOA, as tested, i s close to the Level 1-2 boundary. The Phase 3 results showed that with real-time monitoring of the control inputs and aircraft response, the frequency-sweep testing and the steps, doublets, and pulse control inputs were performed in a routine and efficient manner. The initial lessons learned and results from this flight-test assessment of ADS-33D- PRF using a UH-GOA Black Hawk helicopter will be instrumental in expanding the D-version of ADS-33 into an E-version that includes a first-cut at criteria suitable for utility rotorcraft, with and without externally slung loads.

Derived from text

Flight Tests; Controllability; Military Helicopters; Rotary Wing Aircraft; Loads (Forces); Flight Characteristics

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*.

20040074340 NASA Langley Research Center, Hampton, VA, USA
Evaluation of a Multigrid Scheme for the Incompressible Navier-Stokes Equations
Swanson, R. C.; May 2004; 47 pp.; In English
Contract(s)/Grant(s): WU 23-762-45-CA
Report No.(s): NASA/TM-2004-213026; L-18375; No Copyright; Avail: CASI; A03, Hardcopy

A fast multigrid solver for the steady, incompressible Navier-Stokes equations is presented. The multigrid solver is based upon a factorizable discrete scheme for the velocity-pressure form of the Navier-Stokes equations. This scheme correctly distinguishes between the advection-diffusion and elliptic parts of the operator, allowing efficient smoothers to be constructed. To evaluate the multigrid algorithm, solutions are computed for flow over a flat plate, parabola, and a Karman-Trefftz airfoil. Both nonlifting and lifting airfoil flows are considered, with a Reynolds number range of 200 to 800. Convergence and accuracy of the algorithm are discussed. Using Gauss-Seidel line relaxation in alternating directions, multigrid convergence behavior approaching that of O(N) methods is achieved. The computational efficiency of the numerical scheme is compared with that of Runge-Kutta and implicit upwind based multigrid methods.
Author
Multigrid Methods; Navier-Stokes Equation; Incompressible Flow; Airfoils

20040074457 NASA Langley Research Center, Hampton, VA, USA
The Effect of Nozzle Trailing Edge Thickness on Jet Noise
Henderson, Brenda; Kinzie, Kevin; Haskin, Henry; [2004]; 11 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Report No.(s): AIAA Paper 2004-2948; No Copyright; Avail: CASI; A03, Hardcopy

The effect of nozzle trailing edge thickness on broadband acoustic radiation and the production of tones is investigated for coannular nozzles. Experiments were performed for a core nozzle trailing edge thickness between 0.38 mm and 3.17 mm. The on-set of discrete tones was found to be predominantly affected by the velocity ratio, the ratio of the fan velocity to the core velocity, although some dependency on trailing edge thickness was also noted. For a core nozzle trailing edge thickness greater than or equal to 0.89 mm, tones were produced for velocity ratios between 0.91 and 1.61. For a constant nozzle trailing edge thickness, the frequency varied almost linearly with the core velocity. The Strouhal number based on the core velocity changed with nozzle trailing edge thickness and varied between 0.16 and 0.2 for the core nozzles used in the experiments. Increases in broadband noise with increasing trailing edge thickness were observed for tone producing and non-tone producing conditions. A variable thickness trailing edge (crenellated) nozzle resulted in no tonal production and a reduction of the broadband trailing edge noise relative to that of the corresponding constant thickness trailing edge.
Author
Aeroacoustics; Trailing Edges; Aerodynamic Noise; Frequencies; Broadband

20040075096 Army Aviation and Missile Command, Redstone Arsenal, AL
Verification of Simulation Results Using Scale Model Flight Test Trajectories
Obermark, Jeff; May 2004; 66 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422954; AMSAM-RD-TR-AMR-AE-04-01; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this effort was to compare limited amounts of scale model trajectory data with appropriate full-scale data. The scale model data was scaled up to equivalent full-scale conditions. Two Degree-of-Freedom (2-DOF) trajectories and calculated miss-distances were compared to full-scale data. Likely error sources in the scale test process were identified. Simulation was used to estimate the effects of these errors on the trajectory. Simulation trends were used to estimate the scale trajectory without these errors. A second compromise scaling law was investigated as a possible improvement. For ejector-driven events at minimum sideslip, the most important variables for scale model construction are the mass moment of inertia and ejector forces. For these events, the pitch motion and resulting miss- distance calculations correspond well with

the full-scale events. Additional testing is required to enable a thorough uncertainty analysis of the scale model test data, especially for sideslip conditions.
DTIC
Flight Tests; Scale Models; Simulation; Trajectories

20040075127 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Flow Around an Object Projected from a Cavity into a Supersonic Freestream
Bjorge, Scott T.; Mar. 2004; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422998; AFIT/GAE/ENY/04-M02; No Copyright; Avail: CASI; A05, Hardcopy

The pressure and flow field of a supersonic flow over a cavity, with and without a store, was the focus of this experiment. One cavity geometry (length to depth ratio 3.6) was studied; the freestream Mach number and the placement of the store relative to the cavity floor were varied. The pressure spectra on the cavity floor were markedly different between Mach numbers of 1.8 and 2.9. The Mach 1.8 case exhibited clear spectral peaks consistent with predictions by Rossiter, whereas the Mach 2.9 flow did not. With the store placed within the free shear layer, the pressure fluctuations on the cavity floor decreased for Mach 1.8 and increased for Mach 2.9. High-speed Schlieren photography was used to visualize the interaction of the free shear layer and the modeled store. Images revealed that flow structures in the free shear layer of the Mach 2.9 flow exhibited less spanwise coherence then their Mach 1.8 flow counterparts. Images also revealed vertical displacement of the free shear layer as the store traversed through it. Pressure-sensitive paint (PSP) was utilized to quantify the full-field mean pressure on the cavity floor and store. A pressure rise near the trailing edge was noted for both freestream Mach numbers. The mean pressure contour of the floor for the Mach 1.8 exhibited considerable three-dimensionality, despite the generally spanwise coherent structures in the free shear layer. (4 tables, 33 figures, 37 refs.)
DTIC
Air Flow; Atmospheric Pressure; Cavities; Flow Distribution; Free Flow; Gas Pressure; Supersonic Flow

20040075188 Georgia Inst. of Tech., Atlanta, GA
Fluidic Virtual Aerosurfaces for Flow Control Applications
Glezer, Ari; Mar. 2004; 74 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0015
Report No.(s): AD-A423090; AFRL-SR-AR-TR-04-0245; No Copyright; Avail: CASI; A04, Hardcopy

This research program has focused on a novel approach to the control of the aerodynamic performance of lifting surfaces by fluidic modification of their apparent aerodynamic shape, or virtual aerosurface shaping, This flow control approach emphasizes fluidic modification of the "apparent" aerodynamic shape of the surface with the objective of altering or prescribing the streamwise pressure gradient. Control is typically effected by the interactions of arrays of synthetic jet actuators with the cross flow that displace the local streamlines near the surface and thereby induces an "apparent" modification of the flow boundary. The operating frequency of the control jets is high enough so that the actuation period at least an order of magnitude lower than the relevant characteristic time scale of the flow. Therefore, the interaction domains between the control jets and the cross flow are quasi-steady and hence the induced aerodynamics forces are virtually time-invariant.
DTIC
Aerodynamic Configurations; Fluidics

20040075220 Army Research Lab., Aberdeen Proving Ground, MD
Analytical Calculation of Helicopter Main Rotor Blade Flight Loads in Hover and Forward Flight
Kim, Ki C.; Apr. 2004; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A423149; ARL-TR-3180; No Copyright; Avail: CASI; A03, Hardcopy

An aeroelastic analysis was conducted to calculate flight loads on the OH-58D Kiowa Warrior main rotor blade at hover and forward flight conditions. Centrifugal force and flap and chord bending moments were calculated with the University of Maryland Advanced Rotorcraft Code (UMARC) comprehensive helicopter aeroelastic analysis code. The calculated loads were correlated with available flight data for the Bell model 406LM helicopter (model 406T rotor blade) to validate the analytical model. After the correlation study, UMARC was used to calculate blade loads at the ballistic test section radial

stations. These baseline loads were represented during the ballistic tests. This report presents the methods and results of the aeroelastic analysis.
DTIC
Aerodynamic Loads; Helicopters; Horizontal Flight; Hovering; Rotary Wings

20040075526 NASA Langley Research Center, Hampton, VA, USA
Avian Wings
Liu, Tianshu; Kuykendoll, K.; Rhew, R.; Jones, S.; 2004; 24 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Report No.(s): AIAA Paper 2004-2186; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the avian wing geometry (Seagull, Merganser, Teal and Owl) extracted from non-contact surface measurements using a three-dimensional laser scanner. The geometric quantities, including the camber line and thickness distribution of airfoil, wing planform, chord distribution, and twist distribution, are given in convenient analytical expressions. Thus, the avian wing surfaces can be generated and the wing kinematics can be simulated. The aerodynamic characteristics of avian airfoils in steady inviscid flows are briefly discussed. The avian wing kinematics is recovered from videos of three level-flying birds (Crane, Seagull and Goose) based on a two-jointed arm model. A flapping seagull wing in the 3D physical space is re-constructed from the extracted wing geometry and kinematics.
Author
Wing Planforms; Aerodynamic Characteristics; Airfoils; Flapping; Kinematics; Inviscid Flow; Wings

20040075708 NASA Ames Research Center, Moffett Field, CA, USA
Improved Experimental/Computational Aerodynamics Comparisons
Olsen, Michael; Research and Technology 1997; September 1998, pp. 44-45; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Improved turbulence modeling requires accurate computational simulation of carefully controlled experiments. Discrepancies between computational predictions and experimental results are the measure of turbulence model performance. The simulation of experimental conditions is one possible source of discrepancy between computation and experiment. This problem is most acute for the separated flow cases, in which small changes in experimental conditions can sometimes change the flow substantially. An improvement in the simulation of the wind tunnel walls dramatically improves the simulation of wind tunnel experiments at transonic speeds, the speed range in which civil transport aircraft fly. The improved simulations include the effect of the tunnel-wall boundary layers. The boundary layer is a region, very close to a wall, where the airspeed changes dramatically in a very small distance. In this work, the fidelity of experimental simulations is increased by computing, instead of approximating, the effects of the tunnel-wall boundary layers.
Author (revised)
Aerodynamics; Turbulent Flow; Turbulence Models; Wind Tunnel Walls

20040075766 NASA Ames Research Center, Moffett Field, CA, USA
Global Interferometric Skin-Friction Measurements on a Wingtip Model
Zilliac, Gregory; Research and Technology 1997; September 1998, pp. 56; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Skin-friction distribution on surfaces of flight vehicles is desirable for several reasons. Aerodynamicists would like to know where transition occurs and if separation is present. Turbulence modelers are interested in validating skin-friction (drag) predictions. Finally, if it were possible to sum the skin-friction distribution on a lifting wind tunnel model, it would be possible to determine the viscous contribution to the total drag, a quantity not readily measured independently of the induced drag. For these reasons research scientists have expended a great deal of energy in an ongoing effort to develop accurate, high-resolution skin-friction measurement techniques. A high-resolution fringe-imaging skin-friction system (FISF) has been developed. Skin-friction measurements are made at points on an aerodynamic surface by imaging the flow of oil drops and applying lubrication theory to determine the skin-friction level. At the heart of this system is a wide-field digital camera capable of imaging 4096 x 4096 pixels. The system was recently tested on a wingtip model in the Flight Mechanics Laboratory's 3- by 4-Foot Indraft Wind Tunnel. Image data processing based on digital photogrammetry is a key component of the system and is the enabling technology that permitted the gathering of 2500 independent measurements of skin friction on a wing. The FISF

system described has recently been used in production tests of a Boeing 777 and also of a high-speed research model in the Ames 12-Foot Wind Tunnel.
Author (revised)
Interferometry; Skin Friction; Friction Measurement; Wing Tips

20040075791 NASA Ames Research Center, Moffett Field, CA, USA
Interaction Energy of Nitrogen Molecules
Partridge, Harry; Stallcop, James R.; Research and Technology 1997; September 1998, pp. 78; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The interaction energy between two nitrogen molecules is an important basic property needed to determine certain input data required for a real-gas analysis of aerodynamic flows. An accurate representation of the rigid-rotor interaction potential has been constructed by combining the ab initio data and the experimental second virial data to determine the interaction energy in the van der Waals region in a manner consistent with the physics of the interaction. The construction of the potential energy surface is based on the potential function developed by Tang and Toennies for the atom-atom van der Waals interaction.
Derived from text
Nitrogen; Potential Energy; Gas Flow; Molecules

20040075794 NASA Ames Research Center, Moffett Field, CA, USA
Adaptive Refinement and Structured Grids for Unsteady Aerodynamics
Meakin, Robert; Research and Technology 1997; September 1998, pp. 72; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this research is to develop robust adaptive refinement methods for unsteady geometrically complex (moving-body) applications that exploit the computational advantages inherent in structured data. The physical domain of complex problems is decomposed into near body and off body regions. The near body domain is discretized with "Chimera" overset grids that need to extend only a short distance into the field. The off body domain is discretized with overset structured Cartesian grids (uniform) of varying levels of refinement. The near body grids resolve viscous boundary layers and other flow features expected to develop near body surfaces. Off-body grids automatically adapt to the proximity of near body components and evolving flow features. The adaption scheme automatically maintains solution accuracy at the resolution capacity of the near-body system of grids. The approach is computationally efficient and has high potential for scalability. Grid components are automatically organized into groups of equal size, facilitating parallel scale-up on the number of groups requested. The method has been implemented in the OVERFLOW-D2 code being developed within the Computational Fluid Dynamics-Computational Technology Area of the Common High Performance Computing Software Support Initiative (CHSSI). CHSSI is, in turn, part of the Department of Defense High Performance Computing Modernization Program. Demonstration of OVERFLOW-D2 on a large scale application such as the X-38 is significant because of the broad class of problems of interest to the DoD and NASA. These problems require the accuracy available through adaption and the computational efficiency realizable through structured data. Some of the target problems for the method are unsteady moving geometry applications such as aircraft store separation, helicopter rotor-body interaction, crew escape systems, flight maneuvers, and launch vehicle staging.
Author
Structured Grids (Mathematics); Computational Fluid Dynamics; Unsteady Aerodynamics; Cartesian Coordinates; Rotor Body Interactions

20040077041 NASA Langley Research Center, Hampton, VA, USA
Textbook Multigrid Efficiency for Leading Edge Stagnation
Diskin, Boris; Thomas, James L.; Mineck, Raymond E.; May 2004; 49 pp.; In English
Contract(s)/Grant(s): WU 23-762-45-CA
Report No.(s): NASA/TM-2004-213037; L-19023; No Copyright; Avail: CASI; A03, Hardcopy

A multigrid solver is defined as having textbook multigrid efficiency (TME) if the solutions to the governing system of equations are attained in a computational work which is a small (less than 10) multiple of the operation count in evaluating the discrete residuals. TME in solving the incompressible inviscid fluid equations is demonstrated for leading- edge stagnation flows. The contributions of this paper include (1) a special formulation of the boundary conditions near stagnation allowing convergence of the Newton iterations on coarse grids, (2) the boundary relaxation technique to facilitate relaxation and residual restriction near the boundaries, (3) a modified relaxation scheme to prevent initial error amplification, and (4) new

general analysis techniques for multigrid solvers. Convergence of algebraic errors below the level of discretization errors is attained by a full multigrid (FMG) solver with one full approximation scheme (F.4S) cycle per grid. Asymptotic convergence rates of the F.4S cycles for the full system of flow equations are very fast, approaching those for scalar elliptic equations. Author

Flow Equations; Incompressible Fluids; Inviscid Flow; Stagnation Flow; Boundary Conditions

20040077052 NASA Ames Research Center, Moffett Field, CA, USA

Rotor Design Options for Whirl Flutter

Acree, C. W.; Peyran, R. J.; Johnson, Wayne; Research and Technology 1999; December 2000, pp. 14; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Coupled wing/rotor whirl-mode aeroelastic instability is the major barrier to increasing tilt-rotor speeds. This research investigated the unusually simple approach of adjusting the chordwise positions of the rotor blade aerodynamic center (a.c.) and center of gravity (c.g.) to improve the stability boundary of the full aircraft. The XV-15 tilt-rotor research aircraft was modeled with the CAMRAD II rotorcraft analysis program; the model was then modified to simulate a thinner wing, which had lower drag but also a lower stability boundary than the baseline wing. Numerous rotor modifications were studied to determine their effects on whirl flutter for the XV-15 with the new wing.

Author

Rotor Aerodynamics; Aeroelasticity; Aerodynamic Stability; Flutter; Xv-15 Aircraft

20040077056 NASA Ames Research Center, Moffett Field, CA, USA

Planar Doppler Velocimetry: Three-Component Velocity Measurements in a Full-Scale Rotor Flow Field

Reinath, Michael S.; McKenzie, Robert L.; Research and Technology 1999; December 2000, pp. 48-49; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Planar Doppler velocimetry (PDV) is an optical, laser-based flow-field measurement technique that is being developed for the large wind tunnels at Ames Research Center. The PDV technique measures the Doppler shift of light that is scattered from aerosol particles that are added to the flow and illuminated by a pulsed laser sheet. Images of the planar measurement region are acquired with scientific-grade digital cameras and then processed to yield instantaneous, three-dimensional (3-D) velocity maps, which are limited in size only by the field of view of the cameras and any requirement to meet a particular spatial resolution.

Derived from text

Doppler Effect; Velocity Distribution; Flow Distribution; Flow Visualization; Optical Measurement; Pulsed Lasers

20040077068 NASA Ames Research Center, Moffett Field, CA, USA

Wake Flow in Adverse Pressure Gradient

Driver, Dave; Research and Technology 1999; December 2000, pp. 68; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

High lift developed by multi-element airfoils can be limited by flow reversals in the wake of the main element. Turbulent mixing in the wake controls the growth of the wake and dictates the extent to which the wake experiences flow reversal. Consequently, subtle differences in turbulence models make a significant difference in the prediction of wake growth. The AST program, in an effort to improve predictions of high-lift systems, provided funding for basic experiments that would provide data for guiding turbulence model development.

Derived from text

Airfoils; Wakes; Turbulent Mixing; Pressure Gradients

20040077093 NASA Ames Research Center, Moffett Field, CA, USA

The Effects of Thin Paint Coatings on the Aerodynamics of Semi-Span Wings

Schairer, Edward; Mehta, Rabi; Olsen, Mike; Research and Technology 1999; December 2000, pp. 72-73; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this research was to measure the effect of pressure-sensitive paint (PSP) on the aerodynamic performance of high-aspect-ratio, semi-span wings at transonic cruise and landing conditions. The PSP technique for measuring pressure distributions on wind-tunnel models requires coating the surface of the model with special paint that luminesces when illuminated by light of appropriate frequency. The technique has the potential to eliminate the need for pressure taps in wind tunnel models while yielding pressure information over entire surfaces rather than just at discrete points. The presence of paint

on a model, however, can alter the flow (that is, it can become "intrusive") by adding thickness to the model or by changing the roughness of the model and thus altering the development of the boundary layer. Changes in surface roughness are likely to be most critical at high Reynolds numbers where boundary layers are thinner.
Derived from text
Aerodynamic Characteristics; Wings; Surface Roughness; Paints; Pressure Measurement; High Aspect Ratio; Boundary Layers

20040077150 NASA Ames Research Center, Moffett Field, CA, USA
Model Hingeless Rotor Dynamics Program
Maier, Thomas H.; Research and Technology 1999; December 2000, pp. 19-20; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

A wind tunnel experiment was conducted to measure the aeroelastic stability of a soft in-plane hingeless rotor with swept-tip blades. The data from this experiment will be used to assess current helicopter analytical tools and to guide future improvements to these codes. Aeroelastic and aeromechanical stability are important elements in the design of helicopters. Poor design, in this regard, can lead to the loss of prototype aircraft and loads problems, and can limit cyclic annoyances. For this reason it is important for helicopter designers to have analytical tools that accurately predict such phenomena.
Author
Rotor Dynamics; Wind Tunnel Tests; Aeroelasticity; Aerodynamic Stability; Rigid Rotors

20040077151 NASA Ames Research Center, Moffett Field, CA, USA
Active Control of Stall on Helicopter Rotors
Nguyen, Khanh Q.; Research and Technology 1999; December 2000, pp. 20; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In an effort to expand helicopter flight envelopes, this analytical study explores the potential of using higher harmonic blade pitch to reduce the adverse effects of dynamic stall on rotor blades. Since excessive stall-induced loads can damage rotor structural components, stall severely restricts helicopter maximum speed and loading capabilities. On the other hand, successful control of stall can enhance the utility of helicopters. The rotorcraft analysis code UMARC (University of Maryland Advanced Rotorcraft Code) was modified for a stall suppression investigation of the UH-60A rotor. At a severe stalled condition, the analysis predicts three distinct stall events spreading over the retreating side of the rotor disk. Prescribed 2-per-rev input can reduce stall moderately, as shown in the figure, where the lift excess is used as a measure of stall; the other input harmonics are less effective. Stall responses to individual input harmonics exhibit highly nonlinear behaviors, rendering the closed-loop controller ineffective in suppressing stall and the combined effects of individual harmonics non-additive.
Derived from text
Rotor Dynamics; Uh-60a Helicopter; Aerodynamic Stalling; Active Control

20040077154 NASA Ames Research Center, Moffett Field, CA, USA
A Study of Dynamic Stall Using Two-Dimensional Oscillating Wing Experimental Data
Rhee, Myung; Research and Technology 1999; December 2000, pp. 22-23; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Dynamic stall produces a significant limitation on the operation and performance of rotorcraft at high-speed. To understand this complex and unsteady aerodynamic phenomenon, a number of studies have been performed to obtain and analyze test data from nonrotating oscillating wings in wind tunnels. Many of these experiments have failed to generate sufficient information to capture the complicated aerodynamic flow characteristics occurring during the dynamic stall process. However, data from one test are now available that afford an opportunity for detailed analysis. The Army Aeroflightdynamics Directorate performed the test at Ames Research Center in a 7- by 10-foot wind tunnel. The objective of the experiment was to produce high quality data of two-dimensional (2-D) and three-dimensional (3-D) dynamic stall on a semi-span and full-span wing undergoing pitching motions designed to simulate typical rotor blade motions. The airfoil section, a NACA 0015, was tested at a Mach number of 0.3. Various tests were performed for a combination of parameters such as pitch oscillation amplitudes and reduced frequencies. Results from this experiment included the integrated measurements from pressure transducer arrays in the form of lift, drag, and pitching moment coefficients at various wing span locations. Instantaneous pressure distributions have now been made available as a part of the present work.
Author
Rotor Aerodynamics; Aerodynamic Stalling; Wind Tunnel Tests

20040077155 NASA Ames Research Center, Moffett Field, CA, USA

Rotor Blade Analysis Using the Mixed Finite-Element Method

Ruzicka, Gene; Hodges, Dewey H.; Research and Technology 1999; December 2000, pp. 24; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Accurate and efficient analysis of rotorcraft blades has long been a challenge. Using classic finite-element methods, it is possible to model blades of geometry, but a high price is paid for this capability in the form of large models with correspondingly large computational costs. It is possible in many applications to reduce computational costs by employing a technique called modal reduction, which seeks to collapse the analytical model to a handful of coordinates. Unfortunately, the modal reduction process is often ineffective for a rotor blade composed of finite elements that parameterize all unknown quantities as displacements. The reason is that the blade s axial force, which is the most critical factor in determining the blade s bending stiffness, is composed of contributions that nearly cancel, one from the axial displacement, and one from the bending displacements. Thus, the error in the axial force can be expected to be significantly larger than the error in either of the contributions; this is an example of the classic 'small difference of large quantities' conundrum that often confronts numerical analysts.

Author

Rotor Dynamics; Rotary Wings; Finite Element Method

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*.

20040075027 Nebraska Univ., Omaha, NE, USA

The Airline Quality Rating 2004

Fink, Mary M., Editor; Bowen, Brent D.; Headley, Dean E.; April 2004; 61 pp.; In English

Contract(s)/Grant(s): NCC5-572

Report No.(s): UNOAI-04-1; Copyright; Avail: CASI; A04, Hardcopy

The Airline Quality Rating (AQR) was developed and first announced in early 1991 as an objective method of comparing airline quality on combined multiple performance criteria. This current report, the Airline Quality Rating 2004, reflects monthly Airline Quality Rating scores for 2003. AQR scores for the calendar year 2003 are based on 15 elements in four major areas that focus on airline performance aspects important to air travel consumers. The Airline Quality Rating 2004 is a summary of month-by-month quality ratings for U.S. airlines that have at least 1 % of domestic passenger volume during 2003. Using the Airline Quality Rating system of weighted averages and monthly performance data in the areas of on-time arrivals, involuntary denied boardings, mishandled baggage, and a combination of 12 customer complaint categories, airlines comparative performance for the calendar year of 2003 is reported. This research monograph contains a brief summary of the AQR methodology, detailed data and charts that track comparative quality for domestic airline operations for the 12-month period of 2003, and industry results. Also, comparative Airline Quality Rating data for 2002 are included, where available, to provide historical perspective regarding performance quality in the industry.

Author

Airline Operations; Ratings; Civil Aviation; Air Transportation; Surveys

20040075701 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Methodological Issues in the Study of Airplane Accident Rates by Pilot Age: Effects of Accident and Pilot Inclusion Criteria and Analytic Strategy

Broach, Dana; May 2004; 26 pp.; In English

Contract(s)/Grant(s): AAM-00-A-HRR-520

Report No.(s): DOT/FAA/AM-04/8; No Copyright; Avail: CASI; A03, Hardcopy

At the direction of the U.S. Senate, Broach, Schroeder, and Joseph examined accident rates by age for professional air transport and commercial pilots using an analysis of variance (ANOVA) approach. As an extension of that work, this report focuses on methodological issues requiring careful consideration and definition in any analysis of aviation accident rates by pilot age. Three methodological issues are considered: (a) accident inclusion criteria; (b) pilot inclusion criteria; and (c)

analytic strategy. Previous studies are interpreted with respect to these issues, and an additional analysis is presented to illustrate the impact of methodological choices on study outcomes. Overall, the comparisons and additional analysis indicate that accident and pilot inclusion criteria and analytic strategy have substantial impact on study outcomes. Recommendations are presented for future studies of the relationship of pilot age to aviation accidents.
Author
Aircraft Accident Investigation; Aircraft Pilots; Age Factor

20040075711 NASA Ames Research Center, Moffett Field, CA, USA
Object-Oriented Design of a Dynamic Planner for Air-Traffic Control Real-time Sequencer, Scheduler, and Runway Allocator
Wong, Gregory L.; Swenson, Harry N.; Research and Technology 1997; September 1998, pp. 24-26; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Dynamic Planner was designed, implemented and integrated in to the Center/Tracon (Terminal Radar Approach Control) Automation System (CTAS) to assist Traffic Management Coordination (TMCs) in their task of planning and scheduling arrival traffic when the traffic is approximately 35 to 200 nautical miles from the destination airport. The TMC may input to the DP a series of current and future scheduling constraints that reflect the operational and environmental conditions of the airspace. Under these constraints the DP uses flight plans, track updates, and estimated time of arrival (ETA) predictions to calculate favorable runway assignments and arrival schedules that ensure a smooth flow of traffic into the terminal areal.
Derived from text
Air Traffic Control; Airports; Runways; Scheduling; Terminal Guidance; Flight Management Systems

20040075748 NASA Ames Research Center, Moffett Field, CA, USA
Conflict Probe Performance Evaluation
Bilimoria, Karl D.; Research and Technology 1997; September 1998, pp. 5-6; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A conflict probe is a software tool that assists air traffic controllers in maintaining safe separation between aircraft by predicting conflicts up to 20 minutes in advance, using information on aircraft state (track data), intent (flight plans), and atmospheric conditions (wind and temperature) Such a tool would be especially useful in a "free-fliqht" environment which is expected to have a less structured traffic flow than is afforded by the current operating environment. The objective of this research is to develop a comprehensive method for quantitatively evaluating the performance of any conflict probe, and then to apply the method to the Center/TRACON (Terminal Radar Approach Control) Automation System (CTAS) Conflict Probe Tool developed at Ames Research Center
Derived from text
Performance Tests; Air Traffic Control; Aircraft Approach Spacing

20040075755 NASA Ames Research Center, Moffett Field, CA, USA
Surface Operations Research and Evaluation Vehicle
Kaiser, Mary K.; Research and Technology 1997; September 1998, pp. 81-82; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The new research vehicle sited at Moses Lake Airport in central Washington doesn't look like it has much in common with the conceptual drawings for the next-generation supersonic airliner, the High-Speed Civil Transport (HSCT). In fact, the Surface Operations Research and Evaluation Vehicle (SOREV) bears more passing resemblance to the large, ing the airport than it does to the sleek, delta-winged HSCT that will one day fly the Pacific Rim at over twice the speed of sound. Yet to researchers addressing issues associated with HSCT taxi operations, the SOREV is a thing of beauty.
Derived from text
Research Vehicles; Civil Aviation; Supersonic Transports; Transport Aircraft; Operations Research

20040076999 Chang Gung Univ., Taipei, Taiwan, Province of China
Modeling the Effect of Enlarged Seating Room on Passengers' Preferences of Domestic Airlines in Taiwan
Lu, Jin-Long; Tsau, Li-Non; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 13 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

This study addresses the need for measuring the effect of enlarging seating room in airplane on passengers preferences of airline in Taiwan. The results can assist Taiwan s domestic air carriers in better understanding their customers expectations.

Stated choice experiment is used to incorporate passengers trade-offs in the preferred measurement, and three major attributes are taken into account in the stated choice experiment: (1) type of seat (enlarged or not), (2) price, and (3) brand names of airlines. Furthermore, a binary logit model is used to model the choice behavior of air passengers. The findings show that the type of seat is a major significant variable; price and airline's brand are also significant as well. It concludes that air carriers should put more emphasis on the issue of improving the quality of seat comfort.
Author
Airline Operations; Commercial Aircraft; Seats; Taiwan; Mathematical Models

20040077000 Wenzao Usruline Coll. of Languages, Kaohsiung, Taiwan
The Study of Airline Merger and Acquisition in the Greater China Area
Shon, Zhengyi; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 13 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

The Asian financial crisis in the late 20th century has some long lasting effect on the air transportation industry in Asia, especially in the Great China Area. Starting from 1998, airlines in both China and Taiwan suffered some serious financial losses due to the diminishing travel demand caused by the economic recession. Airlines were forced to cut price to attract passengers and hence crashed the market discipline. A number of airline mergers and acquisitions were then driven by the markets and the governments. After China and Taiwan have both entered the World Trade Organization, some mega-merging cases were finalized in late 2002 for better fitting the world's aviation competitions. This paper reviews the nine merging and acquiring cases in the Great China Area in the past 5 years. Almost all the airlines in the area were involved. The new groups of airlines and the survival airlines are introduced. Market response to the airline mergers will also be examined. A general look over the performance of the new airlines will be discussed. And the future of the market will also be analyzed. Finally, the practices and the impacts of current inter-state mergers in the Great China Area will be examined. The study has expected a highly concentrated domestic market in both China and Taiwan. Each of the market will be dominated by three major airline groups of their own. Cross-holding equity within these 6 leading aviation groups would also be possible after further deregulations.
Author
Air Transportation; Airline Operations; China; Commercial Aircraft

20040077001 Trieste Univ., Italy
An Airline-based Multilevel Analysis of Airfare Elasticity for Passenger Demand
Castelli, Lorenzo; Ukovich, Walter; Pesenti, Raffaele; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 19 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Price elasticity of passenger demand for a specific airline is estimated. The main drivers affecting passenger demand for air transportation are identified. First, an Ordinary Least Squares regression analysis is performed. Then, a multilevel analysis-based methodology to investigate the pattern of variation of price elasticity of demand among the various routes of the airline under study is proposed. The experienced daily passenger demands on each fare-class are grouped for each considered route. 9 routes were studied for the months of February and May in years from 1999 to 2002, and two fare-classes were defined (business and economy). The analysis has revealed that the airfare elasticity of passenger demand significantly varies among the different routes of the airline.
Author
Air Transportation; Elastic Properties; Passengers; Costs; Demand (Economics); Mathematical Models

20040077002 Universidade Federal do Rio de Janeiro, Brazil
Developing a "Fleet Standardization Index" for Airline Planning
deBorgesPan, Alexis George; Santo, Respicio A. Espirito, Jr.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 15 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Quantifying subjective aspects is a difficult task that requires a great dedication of time from researchers and analysts. Nevertheless, one of the main objectives of it is to pave the way for a better understanding of the focused aspects. Fleet standardization is one of these subjective aspects that is extremely difficult to turn into numbers. Although, it is of great importance to know the benefits that may come with a higher level of standardization for airlines, which may be economical advantages, maintenance facilitation and others. A more standardized fleet may represent lower costs of operations and

maintenance plus a much better planning of routes and flights. This study presents the first step on developing an index, herein called Fleet Standardization Index or FSI (or IPF in Portuguese, for "Indice de Padronizacao de Frotas"), that will allow senior airline planners to compare different fleets and also simulate some results from maintaining or renewing their fleets. Although being a preliminary study, the results obtained may already be tested to compare different fleets (different airlines) and also analyze some possible impacts of a fleet renewal before it takes place. Therefore, the main objective of this paper is to introduce the proposed IPF index and to demonstrate that it is inversely proportional to the number of different airplane models, engines and other equipment, such as avionics.
Author
Airline Operations; Commercial Aircraft; Cost Reduction; Standardization; Aircraft Models

20040077003 SangJi Univ., Wonju, South Korea
The Carrier's Liability for Damage Caused by Delay in International Air Transport
Lee, Kang Bin; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 15 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Delay in the air transport occurs when passengers, baggage or cargo do not arrive at their destination at the time indicated in the contract of carriage. The causes of delay in the carriage of passengers are booking errors or double booking, delayed departure of aircraft, incorrect information regarding the time of departure, failure to land at the scheduled destination and changes in flight schedule or addition of extra landing stops. Delay in the carriage of baggage or cargo may have different causes: no reservation, lack of space, failure to load the baggage on board, loading baggage on the wrong plane, failure to off-load the baggage or cargo at the right place, or to deliver the covering documents at the right place. The Montreal Convention of 1999 Article 19 provides that 'The carrier is liable for damage occasioned by delay in the carriage by air of passengers, baggage or cargo. Nevertheless, the carrier shall not be liable for damage occasioned by delay if it proves that it and its servants and agents took all measures that could reasonably be required to avoid the damage or that it was impossible for it or them to take such measures'. The Montreal Convention Article 22 provides liability limits of the carrier in case of delay for passengers and their baggage and for cargo. In the carriage of persons, the liability of the carrier for each passenger is limited to 4,150 SDR. In the carriage of baggage, the liability of the carrier is limited to 1,000 SDR for each passenger unless a special declaration as to the value of the baggage has been made. In the carriage of cargo, the liability of the carrier is limited to 17 SDR per kilogram unless a special declaration as to the value of the cargo has been made.
Author
Air Transportation; Air Cargo; Baggage; Liabilities; Damage

20040077004 Charles Sturt Univ., Wagga Wagga, Australia
Consumer Expectations of Capacity Constraints and Their Effect on the Demand for Multi-class Air-travel
Battersby, Bryn D.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 19 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

This paper argues that a consumer s decision on ticket class takes into account the expected likelihood of obtaining a seat in a particular class which, in turn, partially depends on an optimum "transaction cost". Taking into account the preferences of the consumer and the information that the consumer is endowed with, the consumer will select a ticket that includes its own optimal transaction cost. This motivates the inclusion of the capacity constraint as a proxy independent variable for these consumer expectations. This then forms the basis of a model of air-travel demand with specific reference to Australia. A censored likelihood function allowing for correlation in the disturbance term across k classes is introduced. The correlation in the disturbances arises as a result of the interdependence of the capacity constraints in k different ticket classes on each flight.
Author
Air Transportation; Consumers; Independent Variables; Costs

20040077005 Centre National de la Recherche Scientifique, Paris, France
Auction Mechanism to Allocate Air Traffic Control Slots
Raffarin, Marianne; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 23 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

This article deals with an auction mechanism for airspace slots, as as a means of solving the European airspace congestion problem. A disequilibrium, between Air Traffic Control (ATC) services supply and ATC services demand, are at the origin of almost one fourth of delays in the air transport industry in Europe. In order to tackle this congestion problem, we suggest

modifying both pricing and allocation of ATC services, by setting up an auction mechanism. Objects of the auction will be the right for airlines to cross a part of the airspace, and then to benefit from ATC services over a period corresponding to the necessary time for the crossing. Allocation and payment rules have to be defined according to the objectives of this auction. The auctioneer is the public authority in charge of ATC services, whose aim is to obtain an efficient allocation. Therefore, the social value will be maximized. Another objective is to internalize congestion costs. To that end, we apply the principle of Clarke-Groves mechanism auction: each winner has to pay the externalities imposed on other bidders. The complex context of ATC leads to a specific design for this auction.
Author
Air Traffic Control; Airline Operations; Demand (Economics); Costs

20040077007 Vrije Univ., Amsterdam, Netherlands
The Economics of Airport Congestion Pricing
Pels, Eric; Verhoef, Erik T.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 18 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Many airports are facing capacity problems. In the U.S., 25 airports are classified as "severely congested" by the Federal Aviation Administration (Daniel, 2001), while also in Europe many airports face congestion problems (e.g. London Heathrow, Frankfurt and Amsterdam Schiphol). In the U.S., the (runway) capacity of (larger) airports is usually allocated based on a first-come first-served principle. When capacity is limited, arriving aircraft cause delays (and thus costs) for other arriving aircraft. Only four US airports (Washington Ronald Reagan, New York LaGuardia, New York Kennedy and Chicago O' Hare) are slot-constrained; slot trading between airlines is allowed at these airports (see e.g Starkie, 1992). European airports are usually slot-constrained; slots are allocated by a slot coordinator. The slot-allocation mechanism at most airports is economically inefficient. The users of capacity (airlines) may pay less than the marginal social cost (congestion costs are not paid, entry is deterred), and are not necessarily the (potential) users that attach the highest economic value to the capacity. Airport congestion pricing also to allocate scarce capacity to those parties that attach the highest economic value to it.
Derived from text
Congestion; Airports; Airline Operations; Air Traffic; Economics; Civil Aviation

20040077008 Energyarc Industrial, Ltd., Sao Paulo, Brazil
Airport Choice in Sao Paulo Metropolitan Area: An Application of the Conditional Logit Model
Moreno, Marcelo Baena; Muller, Carlos; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 22 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Using the conditional LOGIT model, this paper addresses the airport choice in the Sao Paulo Metropolitan Area. In this region, Guarulhos International Airport (GRU) and Congonhas Airport (CGH) compete for passengers flying to several domestic destinations. The airport choice is believed to be a result of the tradeoff passengers perform considering airport access characteristics, airline level of service characteristics and passenger experience with the analyzed airports. It was found that access time to the airports better explain the airport choice than access distance, whereas direct flight frequencies gives better explanation to the airport choice than the indirect (connections and stops) and total (direct plus indirect) flight frequencies. Out of 15 tested variables, passenger experience with the analyzed airports was the variable that best explained the airport choice in the region. Model specifications considering 1, 2 or 3 variables were tested. The model specification most adjusted to the observed data considered access time, direct flight frequencies in the travel period (morning or afternoon peak) and passenger experience with the analyzed airports. The influence of these variables was therefore analyzed across market segments according to departure airport and flight duration criteria. The choice of GRU (located neighboring Sao Paulo city) is not well explained by the rationality of access time economy and the increase of the supply of direct flight frequencies, while the choice of CGH (located inside Sao Paulo city) is. Access time was found to be more important to passengers flying shorter distances while direct flight frequencies in the travel period were more significant to those flying longer distances.
Author
Airports; Air Transportation; Mathematical Models; Cities

20040077009 Sao Paulo Univ., Brazil
An Analysis of Delay and Travel Time at Sao Paulo Int'l Airport (AISP/GRU): Planning Based on Simulation Model
Santana, Erico Soriano Martins; Mueller, Carlos; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 15 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

The occurrence of flight delays in Brazil, mostly verified at the ground (airfield), is responsible for serious disruptions at the airport level but also for the unchaining of problems in all the airport system affecting also the airspace. The present study develops an analysis of delay and travel times at Sao Paulo International Airport / Guarulhos (AISP/GRU) airfield based on simulation model. Different airport physical and operational scenarios had been analyzed by means of simulation. SIMMOD Plus! 4.0, the computational tool developed to represent aircraft operation in the airspace and airside of airports, was used to perform these analysis. The study was mainly focused on aircraft operations on ground, at the airport runway, taxi-lanes and aprons. The visualization of the operations with increasing demand facilitated the analyses. The results generated in this work certify the viability of the methodology, they also indicated the solutions capable to solve the delay problem by travel time analysis, thus diminishing the costs for users mainly airport authority. It also indicated alternatives for airport operations, assisting the decision-making process and in the appropriate timing of the proposed changes in the existing infrastructure.
Author
Airports; Computerized Simulation; Airport Planning; Air Transportation; Flight Time

20040077010 Japan Airlines System Corp., Tokyo, Japan
JAL/JAS Integration: Toward a New Era of Competition
Kanenari, Hideyuki; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 11 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

On October 2, 2002, JAL and JAS established a new holding company after obtaining the necessary approval from the government bodies. Full integration is planned to take place in April 2004. This paper will primarily explain how JAL/JAS integration will enable JAL to compete effectively with ANA, the giant in the domestic market, and how it will reinforce JAL s competitiveness through further cost reduction and revenue enhancement. In addition, the paper will explain how the keener domestic competition brought about by this integration could resolve the following two issues for the first time in the Japanese aviation history. Those two issues are: (1) providing better service to domestic customers, and (2) making Japanese airlines more competitive against foreign airlines in the international market. As a result, the paper will argue that such an integration, a logical outcome of the post-war civil aviation history of Japan, will significantly benefit customers, Japanese aviation industry and Japanese society as a whole.
Author
Aircraft Industry; Airline Operations; Japan; Commercial Aircraft

20040077011 Demokritos National Centre for Scientific Research, Greece
The Empirical Analysis of the Impact of Alliances on Airline Operations
Iatrou, Kostas; Alamdari, Fariba; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference Volume 2; July 2003; 17 pp.; In English; See also 20040076998; Copyright; Avail: CASI; A03, Hardcopy

Airline alliances are dominating the current air transport industry with the largest carriers of the world belonging to one of the four alliance groupings - "Wings", Star Alliance, one world, SkyTeam - which represent 56% of world Revenue Passenger Kilometers. Although much research has been carried out to evaluate the impact of alliance membership on performance of airlines, it would be of interest to ascertain the degree of impact perceived by participating airlines in alliances. It is the purpose of this paper to gather the opinion of all the airlines, belonging to the four global alliance groupings on the impact alliances have had on their traffic and on their performance in general. To achieve this, a comprehensive survey of the alliance management departments of airlines participating in the four global strategic alliances was carried out. With this framework the survey has examined which type of cooperation among carriers (FFP, Code Share, Strategic Alliance without antitrust immunity, Strategic Alliance with antitrust immunity) has produced the most positive impact on traffic and which type of route (short haul, long haul, hub-hub, hub-non hub, non hub-non hub) has been mostly affected. In addition, the respondent airlines quantified the effect alliances have had on specific areas of their operation, such as load factors, traffic, costs, revenue and fares. Their responses have been analysed under each global alliances grouping, under airline and under geographic region to establish which group, type of carrier and geographic region has benefited most. The results show that each of the four global alliances groupings has experienced different results according to the type of collaboration agreed amongst their member airlines.
Author
Airline Operations; Air Transportation; Aircraft Industry; Market Research

20040077051 NASA Ames Research Center, Moffett Field, CA, USA
Distributed Air/Ground Traffic Management
Bilimoria, Karl; Green, Steve; Research and Technology 1999; December 2000, pp. 6-8; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Distributed Air/Ground Traffic Management (DAG-TM) is an integrated gate-to-gate operational concept in which flight deck crews, air traffic service providers, and aeronautical operational control (AOC) personnel use distributed decision-making to enable user preferences and increase system capacity, while meeting air traffic management requirements. The DAG-TM operational concept was developed by NASA (Ames, Langley and Glenn Research Centers) under the Advanced Air Transportation Technologies (AATT) Project, as a detailed instantiation of possible operational modes for Free Flight. It embodies the far-term vision of the AATT Project regarding air traffic operations in the National Airspace System (NAS).
Author
Air Traffic Control; National Airspace System; Decision Support Systems

20040077139 NASA Ames Research Center, Moffett Field, CA, USA
Information Management for Airline Operations
Wales, Roxana; ONeill, John; Research and Technology 1999; December 2000, pp. 8; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames researchers are investigating airline delays in a collaborative project with United Airlines (UAL). The research team is conducting a systemic study of airline operations and delay situations in United's operations at San Francisco airport in order to identify potential sources of up-to-the-minute, real-time delay information and ways to feed that information, electronically, into the Ames-developed Surface Management System (SMS) technology. Such information will improve traffic movement on the ramp (non-taxiway) area of the airport and increase the overall efficiency of the air traffic system. By collaborating in the project and opening their operations to Ames researchers, United is benefiting from an increased understanding of their own delay situations, their work-practice procedures, and the ways that information technology and communications systems can be used to better manage their operations and to reduce delays and their effects.
Author
Airline Operations; Information Management; Air Traffic Control; Airports

20040077147 NASA Ames Research Center, Moffett Field, CA, USA
Direct-To Controller Tool
Erzberger, Heinz; McNally, Dave; Research and Technology 1999; December 2000, pp. 4-5; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Instead of being able to fly the most efficient route to a destination, aircraft operators in today's air traffic control system are usually constrained to follow established airways that are often composed of inefficient route segments. Current air traffic control user-interface inefficiencies inhibit controllers from issuing user-preferred routes, even under light traffic conditions. The objective was to develop and validate a controller tool that identifies and facilitates time-saving direct routes in en route (or 'Center') airspace. The Direct-To Controller Tool identifies aircraft that can save at least 1 minute flying time by flying direct to a downstream fix along their route of flight. A list ordered by time-savings is displayed on the controller s monitor showing the call sign, time savings, Direct-To fix, wind-corrected magnetic heading to the fix, and conflict status for eligible aircraft. A point-and-click button next to the call sign on the Direct-To list activates a trial planning function that allows the controller to quickly visualize the direct route, choose a different fix if necessary, and automatically input the direct route flight plan amendment to the FAA Host computer. The Direct-To Tool was implemented in the Center-TRACON Automation System (CTAS) by adding one additional module to the existing software architecture for the Traffic Management Advisor (TMA).
Author
Air Traffic Control; Flight Plans

20040077153 NASA Ames Research Center, Moffett Field, CA, USA
Communication Strategies for Correcting Errors
Orasanu, J.; Fischer, U.; VanAken, C.; McDonnell, L.; Research and Technology 1999; December 2000, pp. 12-13; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Maintaining safety in high-risk engineered environments like aviation is a team effort that depends crucially on the team members' efficiency in monitoring each other's performance and on their effectiveness in intervening if they consider a decision or action to be unsafe. Unfortunately, analyses of aviation accidents and incidents indicate that pilots, in particular junior pilots, have frequently failed in this important crew function, especially in situations in which their interventions posed a direct challenge to the other crewmember's judgment and decision-making skill. In such situations, junior crewmembers will sometimes only hint at the possibility of a problem rather than tell the captain explicitly to perform a corrective action. This kind of communication failure has been identified as a 'monitoring/challenging error' by the National Transportation Safety

Board (NTSB) and was found to occur in over 75 percent of the accidents reviewed. Moreover, monitoring/challenging failures appear to contribute to 'plan continuation errors.' These are errors in which the crew continues with its planned course of action in the face of cues suggesting that the plan should be reconsidered. The research reported here is an effort to understand communication strategies for correcting crew errors, and looks at differences in strategies as a function of crew position (captain vs. first officer) and of risk and face-threat posed by the problem.
Author
Pilot Error; Safety Management; Flight Safety

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20040075694
Remote Operations and Ground Control Centers
Bryant, Barry S.; Lankford, Kimberly; Pitts, R. Lee; 2004; 1 pp.; In English; Space Ops 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Payload Operations Integration Center at the Marshall Space Flight Center supports the International Space Station (ISS) through remote interfaces around the world. The POI$ was originally designed as a gateway to space for remote facilities; ranging from an individual user to a fullscale multi-user environment. This achievement was accomplished while meeting program requirements and accommodating the injection of modem technology on an ongoing basis to ensure cost operations. This paper will discuss the open POIC architecture developed to support similar and dissimilar remote operations centers. It will include technologies, protocols, and compromises which on a day to day basis support ongoing operations. Additional areas covered include centralized management of shared resources and methods utilized to provide highly available and restricted resources to remote users. Finally, the effort of coordinating the actions of participants will be discussed.
Author
Ground Based Control; Resources Management; Payload Integration; Protocol (Computers)

20040075707 NASA Ames Research Center, Moffett Field, CA, USA
Collaborative Arrival Planning
Zelenka, Rick; Research and Technology 1997; September 1998, pp. 6-7; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The continued expansion of air-traffic and air-carrier economic pressures is necessitating changes in the relationship between the air traffic control service provider and the system user. Such pressures have resulted in efforts to increase the flexibility of air traffic management operations and allow collaboration between the service provider and system user. The government/industry "free-flight" initiative, whose ultimate vision is to allow users to select their own flightpath and speed in real time with air traffic control (ATC) imposing restrictions only when necessary, i s the most visible of such efforts. Shared decision making and collaboration between system users and service providers have been identified as providing benefits necessary to support subsequent phases of free flight.
Derived from text
Air Traffic Control; Air Transportation; Flight Paths; Economics; Air Traffic

20040075764 NASA Ames Research Center, Moffett Field, CA, USA
The Concept of Airspace Complexity and Its Use in Air-Traffic Management
Sridhar, Banavar; Chatterji, Gano; Sheth, Kapil; Research and Technology 1997; September 1998, pp. 3; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The growth in air traffic and the new concepts in air traffic management (e.g., free flight) have increased the need to develop models and measures to describe traffic in the national airspace in order to predict air traffic controller workload and to make flow management decisions like resectorization. The complexity of the airspace depends on both structural measures and flow measures. The structural measures are fixed for a Sector/Center and depend on the spatial and physical features of the Sector. They are a function of attributes like terrain, number of airways, airway crossings, and navigation aids. The flow

measures vary as a function of time and depend on such factors as the number of aircraft, mix of aircraft, weather, separation between aircraft, closing rates, aircraft speeds, and flow restrictions.
Derived from text
Air Traffic Control; Air Traffic; Workloads (Psychophysiology); Free Flight; Airspace; Air Traffic Controllers (Personnel)

20040077053 NASA Ames Research Center, Moffett Field, CA, USA
Piloted Simulation Investigation of Helicopter Flight Envelope Tactile Cueing
Whalley, Matthew S.; Research and Technology 1999; December 2000, pp. 32; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Two ground-based piloted simulation trials of helicopter flight envelope tactile cueing have been conducted. The objective of the trials was to develop methods of helping the pilot to observe flight envelope limits while conducting precise and demanding evaluation tasks. In one trial, large-displacement conventional inceptors were used; in the other, short displacement sidesticks. The inceptors in both trials were programmable and active.
Derived from text
Simulation; Cues; Flight Envelopes

20040077140 NASA Ames Research Center, Moffett Field, CA, USA
Taxiway Navigation and Situation Awareness Operational Integration
Hooey, Becky; Foyle, David C.; Andre, Anthony; Research and Technology 1999; December 2000, pp. 9-10; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Taxiway Navigation and Situation Awareness (T-NASA) system is a suite of cockpit displays (com- posed oi a head-up display (HUD), and an electronic moving map (EMM) as shown in figure 1) designed in support of the Aero-Space Technology Enterprise research objective to maintain safety while tripling throughput in all weather conditions. The T-NASA taxi HUD uses scene-linked symbology, superimposed on the forward scene, to present taxi route information, situational awareness information, and ground speed. The EMM depicts the cleared taxi route, as well as real-time information about own- ship position, airport traffic, and hold-short locations. The T-NASA system assumes that in the future taxi clearances will be data linked, allowing for both a textual and graphical representation in the cockpit, improved taxi route conformance, and improved traffic flow.
Derived from text
Air Traffic; Situational Awareness; Ground Speed; Position (Location); Head-Up Displays; Cockpits

20040077148 NASA Ames Research Center, Moffett Field, CA, USA
Active Final Approach Spacing Tool Development
Robinson, John E.; Quinn, Cheryl; Isaacson, Douglas; Research and Technology 1999; December 2000, pp. 5-6; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In many highly congested terminal areas, air traffic controllers often do not provide optimal aircraft runway assignment, sequencing, and spacing while maintaining the public's expected level of safety. NASA and the Federal Aviation Administration (FAA) are continuing to design, develop, and deploy a software-based decision support tool (DST), called the Final Approach Spacing Tool (FAST), for terminal-area air traffic management and control of arrival aircraft. FAST incorporates advanced-knowledge engineering algorithms, accurate trajectory prediction, and a specialized graphical-user interface (GUI) to provide detailed schedule information to TRACON traffic management coordinates and commands to TRACON approach controllers. An early version of this DST, known as Passive FAST (pFAST), provided a reduced set of advisories, namely runway assignments and landing sequences. These advisories enabled controllers to achieve a more balanced airport, as well as throughput increases of 9%-13%. The follow-on version of this DST, known as Active FAST (aFAST), will provide additional tactical advisory information, namely, heading, speed, and altitude commands. These advisories, if followed, allow reduction of excess-in-trail separation between aircraft at touchdown. Continued research is required to enhance FAST so that it can provide this additional advisory information. This research includes the development of advanced scheduling algorithms and automated conflict-resolution schemes and the definition of an appropriate computer-human interface (CHI).
Author
Aircraft Approach Spacing; Software Engineering; Decision Support Systems

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*.

20040075058 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Prepositioned Trailers for Aircraft Battle Damage Support
Murray, Scott M.; Mar. 2004; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422886; AFIT/GLM/ENS/04-13; No Copyright; Avail: CASI; A06, Hardcopy

Air superiority is essential in today's wartime environment. Aircraft that are damaged and not returned to combat can have a considerable impact on the quest for dominance in the air. To maintain operational effectiveness, an organization must have the capability to quickly repair damaged aircraft. The purpose of an Aircraft Battle Damage Repair (ABDR) program is to rapidly and effectively repair damaged aircraft to fly additional operational sorties and further contribute to wartime objectives. This capability must consist of providing the necessary tools and equipment for the rapid repair of aircraft. When an ABDR team deploys in support of an organization in a wartime environment, it is expected that the team will be fully functional, autonomous, and have on hand the resources necessary to complete all tasks. From a logistics standpoint, this is a feasible objective using different methods, with the present method used being prepositioning. During combat operations, Air Mobility Command (AMC) is heavily tasked with movement of personnel and equipment. The prepositioning of ABDR trailers could provide relief on AMC resources already strained to their limits. This research seeks to determine if the AF should continue to preposition ABDR trailers to augment strategic airlift during combat operations by determining the best course of action for providing ABDR trailers to ABDR teams during combat operations. This research will evaluate the effectiveness of both prepositioning and airlifting ABDR trailers.
DTIC
Aircraft Maintenance; Damage; Maintenance; System Effectiveness; Trailers

20040075194 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Analysis of Aircraft Weapon Systems Cost Growth and Implementation of Acquisition Reform Initiatives Using a Hybrid Adjusted Cost Growth Model
Phillips, Richard A.; Mar. 2004; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423099; AFIT/GCA/ENV/04M-08; No Copyright; Avail: CASI; A06, Hardcopy

This thesis examined cost growth in Department of Defense (DoD) aircraft weapon systems from 1991 to 2001 using Selected Acquisition Report (SAR) data with a hybrid adjusted cost growth (ACG) model. In addition, an analysis of acquisition reform initiatives during the treatment period was conducted to determine if reform efforts affected aircraft weapon system cost growth. A "pre-reform" (1 January 1991-31 December 1996) period and a "post reform" (1 January 1997-31 December 2001) period were subjectively developed to compare the mean annual ACG during each period for statistical differences. The hybrid ACG model outlined in this thesis may aid program managers and other interested parties in determining weapon systems cost growth, and the conclusion drawn from analyzing current acquisition initiatives may assist DoD leadership in assessing reform effectiveness on reducing cost growth. This research effort analyzed 78 SARs for 13 aircraft weapon systems that reported a Milestone II baseline during the treatment period. ACG calculations revealed that aircraft systems from 1 January 1991 to 31 December 2001 averaged a 40 percent cost growth annually. The acquisition reform analysis included 43 SARs from 11 programs during the pre-reform period and 35 SARs from 7 programs in the post-reform period. A small sample t-test was used to compare the annual means of the two periods. The t-test revealed that there was no significant difference between the annual average ACG for the pre-reform and post-reform periods. The 13 aircraft systems reviewed in this study are as follows: B-1B (Lancer), C130-J (Hercules), C-17 (Globemaster III), KC- 135R (Stratotanker), AV-8B (Harrier) AV-8B (Harrier remanufacture), F-14D (Tomcat), F-16 (Fighting Falcon), F-22 (Raptor), FA-18 E/F (Super Hornet), FA-18 (Hornet), T-6A (JPATS), and the T-45-TS (Goshawk). The thesis methodology, results, and suggestions for future research are provided. (15 tables, 8 figures, 40 refs.)
DTIC
Cost Analysis; Costs; Defense Program; Mathematical Models; Procurement; Weapon Systems

20040075509 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis and Forecasting of U.S. Navy Operating and Support (O&S) Costs for Rotary Aircraft
Wilkes, Christopher J.; Mar. 23, 2004; 192 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423140; AFIT/GCA/ENV/04M-11; No Copyright; Avail: CASI; A09, Hardcopy

This research explores forecasting techniques to estimate the Cost per Flying Hour (CPFH) for Navy rotary aircraft. Three separate forecasting techniques were evaluated to better predict the CPFH for better estimating and budgeting by the U.S. Navy. The process begins by empirically analyzing Operating & Support cost categories for each helicopter. Trends were examined in CPFH. For forecasting purposes, actual CPFH figures were compiled from 1997 to 2003 for the CH-46D, the CH-53D, the MH-53E, the SH-60F, the UH-1N, and the UH-3H helicopters. The forecasting techniques explored were the 3-year moving average, the single exponential smoothing method, and Holt's linear method. These forecasting techniques were used to forecast for FY03 in evaluating the best methodology to forecast the CPFH for FY04. By comparing both the budgeted and forecasted figures for FY00 to FY02 to the actual CPFH figures in the same years, CPFH was more accurately forecasted. Actual, budgeted, and forecasted CPFH were compared for FY03. Holt's linear method was deemed the best forecasting method for 67 percent of the time series analyzed. The analysis was based on summary statistics and calculations. Finally, FY04 CPFH was forecasted for each helicopter using the chosen forecasting method.
DTIC
Cost Estimates; Economics; Estimates; Forecasting; Helicopters; Military Aircraft; Navy; Operating Costs

20040075510 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis and Forecasting of Air Force Operating and Support Cost for Rotary Aircraft
Laubacher, Matthew E.; Mar. 23, 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423137; AFIT/GCA/ENV/04M-05; No Copyright; Avail: CASI; A06, Hardcopy

This research explores forecasting techniques to estimate the Cost per Flying Hour (CPFH) for Air Force Helicopters. Specifically, this research evaluates three separate forecasting techniques to predict the CPFH for better estimating and budgeting by the U.S. Air Force. It starts by empirically analyzing the Operating and Support cost by CAIG categories for each helicopter. For forecasting purposes, the actual CPFH figures were compiled from FY96 to FY03 for a total of eight MAJCOMs flying the MH-53J/M, the HH-60G, or the UH-1N helicopters. The research explores the use of a 3-year moving average, the single exponential smoothing method, and Holt's linear method. These forecasting techniques were used to forecast for FY02 in evaluating the best methodology to forecast the CPFH for FYO4. By comparing both the budgeted and forecasted figures for FY00 to FY02 to the actual CPFH figures in the same years, the forecasting methods were able to more accurately predict the actual CPFH for all of the MAJCOMs that achieved a budget variance of less than 20 percent. It was discovered that Holt's linear method was the best forecasting method for 75 percent of the time series analyzed since they contained positive trends. Finally, these techniques were employed to provide the best possible forecast of the CPFH for FY04. (35 tables, 30 figures, 22 refs.)
DTIC
Cost Estimates; Economics; Estimates; Forecasting; Helicopters; Operating Costs

20040075511 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis and Forecasting of Army Operating and Support Cost for Rotary Aircraft
Hawkins, John C.; Mar. 23, 2004; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423135; AFIT/GCA/ENV/04M-03; No Copyright; Avail: CASI; A07, Hardcopy

This research explores forecasting techniques to estimate the Cost per Flying Hour (CPFH) for Army Helicopters. Specifically, three separate forecasting techniques were evaluated to better predict the CPFH for better estimating and budgeting by the U.S. Army. For forecasting purposes, actual CPFH figures were compiled from 1995 to 2003 for all MACOMs flying the AH-64A, the CH-47D, and the UH-60A helicopters. The number of MACOMs was then reduced to the top three with regard to total CPFH expenditure. The use of a 3-year moving average, the single exponential smoothing method, and Holt's linear method were explored for each helicopter's data. These forecasting techniques were used to forecast for FY03 in evaluating the best methodology to forecast the CPFH for FY04. By comparing both the budgeted and forecasted figures for FY00 to FY02 to the actual CPFH figures in the same years, an accurate CPFH forecast for all of the MACOMs was possible. When data became available, a comparison of the actual, budgeted, and forecasted CPFH for FY03 was performed. Holt's linear method was discovered to be the best forecasting method for 78 percent of the time series analyzed since they contained positive trends. Finally, the best forecast provided for FY04 was calculated with the chosen forecasting method. (36 tables, 46 figures, 24 refs.)
DTIC
Cost Estimates; Economics; Estimates; Forecasting; Helicopters; Operating Costs

20040075530 NASA Langley Research Center, Hampton, VA, USA

The Acoustic Analogy: A Powerful Tool in Aeroacoustics with Emphasis on Jet Noise Prediction

Farassat, F.; Doty, Michael J.; Hunter, Craig A.; May 07, 2004; 16 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

Contract(s)/Grant(s): 23-781-10-12-01

Report No.(s): AIAA Paper 2004-2872; No Copyright; Avail: CASI; A03, Hardcopy

The acoustic analogy introduced by Lighthill to study jet noise is now over 50 years old. In the present paper, Lighthill s Acoustic Analogy is revisited together with a brief evaluation of the state-of-the-art of the subject and an exploration of the possibility of further improvements in jet noise prediction from analytical methods, computational fluid dynamics (CFD) predictions, and measurement techniques. Experimental Particle Image Velocimetry (PIV) data is used both to evaluate turbulent statistics from Reynolds-averaged Navier-Stokes (RANS) CFD and to propose correlation models for the Lighthill stress tensor. The NASA Langley Jet3D code is used to study the effect of these models on jet noise prediction. From the analytical investigation, a retarded time correction is shown that improves, by approximately 8 dB, the over-prediction of aft-arc jet noise by Jet3D. In experimental investigation, the PIV data agree well with the CFD mean flow predictions, with room for improvement in Reynolds stress predictions. Initial modifications, suggested by the PIV data, to the form of the Jet3D correlation model showed no noticeable improvements in jet noise prediction.

Author

Jet Aircraft Noise; Noise Prediction; Aeroacoustics; Prediction Analysis Techniques

20040075541 NASA Langley Research Center, Hampton, VA, USA

Reductions in Multi-Component Jet Noise by Water Injection

Norum, Thomas D.; [2004]; 25 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

Contract(s)/Grant(s): 23-706-25-02-03

Report No.(s): AIAA Paper 2004-2976; No Copyright; Avail: CASI; A03, Hardcopy

An experimental investigation was performed in the NASA Langley Low Speed Aeroacoustics Wind Tunnel to determine the extent of jet exhaust noise reduction that can be obtained using water injection in a hot jet environment. The effects of water parameters such as mass flow rate, injection location, and spray patterns on suppression of dominant noise sources in both subsonic and supersonic jets were determined, and extrapolations to full-scale engine noise reduction were made. Water jets and sprays were injected in to the shear layers of cold and hot circular jets operating at both subsonic and supersonic exhaust conditions. Use of convergent-divergent and convergent nozzles (2.7in. D) allowed for simulations of all major jet noise sources. The experimental results show that water injection clearly disrupts shock noise sources within the jet plume, with large reductions in radiated shock noise. There are smaller reductions in jet mixing noise, resulting in only a small decrease in effective perceived noise level when projections are made to full scale. The fact that the measured noise reduction in the direction upstream of the nozzle was consistently larger than in the noisier downstream direction contributed to keeping effective perceived noise reductions small. Variations in the operation of the water injection system clearly show that injection at the nozzle exit rather than further downstream is required for the largest noise reduction. Noise reduction increased with water pressure as well as with its mass flow, although the type of injector had little effect.

Author

Water Injection; Aerodynamic Noise; Jet Aircraft Noise; Jet Exhaust; Noise Reduction; Aeroacoustics

20040075547 NASA Langley Research Center, Hampton, VA, USA

Damage Detection in Rotorcraft Composite Structures Using Thermography and Laser-Based Ultrasound

Anastasi, Robert F.; Zalameda, Joseph N.; Madaras, Eric I.; 2004; 7 pp.; In English; SEM X International Congress and Exposition on Experimental and Applied Mechanics, June 2004, Costa Mesa, CA, USA

Contract(s)/Grant(s): DAAH10-02-2-0001; No Copyright; Avail: CASI; A02, Hardcopy

New rotorcraft structural composite designs incorporate lower structural weight, reduced manufacturing complexity, and improved threat protection. These new structural concepts require nondestructive evaluation inspection technologies that can potentially be field-portable and able to inspect complex geometries for damage or structural defects. Two candidate technologies were considered: Thermography and Laser-Based Ultrasound (Laser UT). Thermography and Laser UT have the advantage of being non-contact inspection methods, with Thermography being a full-field imaging method and Laser UT a point scanning technique. These techniques were used to inspect composite samples that contained both embedded flaws and

impact damage of various size and shape. Results showed that the inspection techniques were able to detect both embedded and impact damage with varying degrees of success.
Author
Ultrasonics; Thermography; Nondestructive Tests; Composite Structures; Structural Design; Impact Damage

20040075556 NASA Langley Research Center, Hampton, VA, USA
Effects of Bifurcations on Aft-Fan Engine Nacelle Noise
Nark, Douglas M.; Farassat, Fereidoun; Pope, D. Stuart; Vatsa, Veer N.; May 07, 2004; 14 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 781-30-14
Report No.(s): AIAA Paper 2004-2988; No Copyright; Avail: CASI; A03, Hardcopy

Aft-fan engine nacelle noise is a significant factor in the increasingly important issue of aircraft community noise. The ability to predict such noise within complex duct geometries is a valuable tool in studying possible noise attenuation methods. A recent example of code development for such predictions is the ducted fan noise propagation and radiation code CDUCT-LaRC. This work focuses on predicting the effects of geometry changes (i.e. bifurcations, pylons) on aft fan noise propagation. Beginning with simplified geometries, calculations show that bifurcations lead to scattering of acoustic energy into higher order modes. In addition, when circumferential mode number and the number of bifurcations are properly commensurate, bifurcations increase the relative importance of the plane wave mode near the exhaust plane of the bypass duct. This is particularly evident when the bypass duct surfaces include acoustic treatment. Calculations involving more complex geometries further illustrate that bifurcations and pylons clearly affect modal content, in both propagation and radiation calculations. Additionally, results show that consideration of acoustic radiation results may provide further insight into acoustic treatment effectiveness for situations in which modal decomposition may not be straightforward. The ability of CDUCT-LaRC to handle complex (non-axisymmetric) multi-block geometries, as well as axially and circumferentially segmented liners, allows investigation into the effects of geometric elements (bifurcations, pylons).
Author
Ducted Fans; Acoustic Emission; Aerodynamic Noise; Aircraft Noise; Sound Waves; Noise Pollution; Engine Noise

20040075560 NASA Langley Research Center, Hampton, VA, USA
A Summary of DOD-Sponsored Research Performed at NASA Langley's Impact Dynamics Research Facility
Jackson, Karen E.; Boitnott, Richard L.; Fasanella, Edwin L.; Jones, Lisa E.; Lyle, Karen H.; 2004; 13 pp.; In English; AHS international 60th Annual Forum and Technology Display, 7-10 Jun. 2004, Baltimore, MD, USA
Contract(s)/Grant(s): 728-30-80; No Copyright; Avail: CASI; A03, Hardcopy

The Impact Dynamics Research Facility (IDRF) is a 240-ft.-high gantry structure located at NASA Langley Research Center in Hampton, Virginia. The IDRF was originally built in the early 1960's for use as a Lunar Landing Research Facility. As such, the facility was configured to simulate the reduced gravitational environment of the Moon, allowing the Apollo astronauts to practice lunar landings under realistic conditions. In 1985, the IDRF was designated a National Historic Landmark based on its significant contributions to the Apollo Moon Landing Program. In the early 1970's the facility was converted into its current configuration as a full-scale crash test facility for light aircraft and rotorcraft. Since that time, the IDRF has been used to perform a wide variety of impact tests on full-scale aircraft, airframe components, and space vehicles in support of the General Aviation (GA) aircraft industry, the U.S. Department of Defense (DOD), the rotorcraft industry, and the NASA Space program. The objectives of this paper are twofold: to describe the IDRF facility and its unique capabilities for conducting structural impact testing, and to summarize the impact tests performed at the IDRF in support of the DOD. These tests cover a time period of roughly 2 1/2 decades, beginning in 1975 with the full-scale crash test of a CH-47 Chinook helicopter, and ending in 1999 with the external fuel system qualification test of a UH-60 Black Hawk helicopter. NASA officially closed the IDRF in September 2003; consequently, it is important to document the past contributions made in improved human survivability and impact tolerance through DOD-sponsored research performed at the IDRF.
Author
NASA Space Programs; Research Facilities; Impact Tests; General Aviation Aircraft; Crashworthiness; Defense Program

20040075561 NASA Dryden Flight Research Center, Edwards, CA, USA
Strain-Gage Loads Calibration Parametric Study
Lokos, William A.; Stauf, Rick; 2004; 28 pp.; In English; 24th ICAS Congress, 29 Aug. - 3 Sep. 2004, Yokohama, Japan; No Copyright; Avail: CASI; A03, Hardcopy

This paper documents a parametric study of various aircraft wing-load test features that affect the quality of the resultant derived shear, bending-moment, and torque strain-gage load equations. The effect of the following on derived strain-gage equation accuracy are compared: single-point loading compared with distributed loading, variation in applied test load magnitude, number of applied load cases, and wing-box-only compared with control-surface loading. The subject of this study is an extensive wing-load calibration test of the Active Aeroelastic Wing F/A-18 airplane. Selected subsets of the available test data were used to derive load equations using the linear regression method. Results show the benefit of distributed loading and the diminishing-return benefits of test load magnitudes and number of load cases. The use of independent check cases as a quality metric for the derived load equations is shown to overcome blind extrapolating beyond the load data used to derive the load equations.
Author
Aeroelasticity; Bending Moments; Load Tests; Wing Loading

20040075664 NASA Marshall Space Flight Center, Huntsville, AL, USA
Mechanical Design of a Performance Test Rig for the Turbine Air-Flow Task (TAFT)
Forbes, John C.; Xenofos, George D.; Farrow, John L.; Tyler, Tom; Williams, Robert; Sargent, Scott; Moharos, Jozsef; [2004]; 8 pp.; In English; 52nd Joint-Army-Navy-NASA-Air Force Meeting, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

To support development of the Boeing-Rocketdyne RS84 rocket engine, a full-flow, reaction turbine geometry was integrated into the NASA-MSFC turbine air-flow test facility. A mechanical design was generated which minimized the amount of new hardware while incorporating all test and instrumentation requirements. This paper provides details of the mechanical design for this Turbine Air-Flow Task (TAFT) test rig. The mechanical design process utilized for this task included the following basic stages: Conceptual Design. Preliminary Design. Detailed Design. Baseline of Design (including Configuration Control and Drawing Revision). Fabrication. Assembly. During the design process, many lessons were learned that should benefit future test rig design projects. Of primary importance are well-defined requirements early in the design process, a thorough detailed design package, and effective communication with both the customer and the fabrication contractors.
Author
Design Analysis; Performance Tests; Fabrication; Rocket Engines

20040075734 NASA Ames Research Center, Moffett Field, CA, USA
Canard Rotor Wing Conversion Test
Acree, C. W., Jr.; Madden, John F.; Research and Technology 1997; September 1998, pp. 39-40; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The canard rotor wing (CRWj design was initi- ated by McDonnell Douglas Helicopter Systems (now Boeing) for high-speed, vertical takeoff and landing unmanned air vehicles. The teetering, reaction-drive rotor has a symmetric airfoil, allowing it to be stopped and started in flight with good dynamic performance. Conversion from rotary-wing to fixed- wing flight and vice versa at high speeds i s the greatest technical challenge of the CRW. A test of a half-scale model in the Ames 7- by IO-Foot Wind Tunnel (first figure) demonstrated full conversions of the bare rotor at airspeeds up to 150 knots. Rotor loads were benign throughout conversion.The rotor is driven by high-pressure air ejected through tip nozzles, which eliminates the need for the usual transmission. The flight vehicle will use turbofan engines to supply high-pressure air to the rotor. In the wind tunnel test, the Ames high-pressure air supply system was used to simulate the engine exhaust.
Derived from text
Rotors; Flight Characteristics

20040075747 NASA Ames Research Center, Moffett Field, CA, USA
Surface Flow Visualization on a Hovering Tiltrotor Blade
Yamauchi, Gloria K.; Wadcock, Alan J.; Heineck, James T.; Research and Technology 1997; September 1998, pp. 28; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Fluorescent mini-tufts were used to visualize the flow behavior on the upper surface of the blade of a full-scale, hovering XV-15 tiltrotor installed in the Ames 80- by 120-Foot Wind Tunnel. The objectives of the test were to determine whether the flow direction could be deduced from the tuft motion and whether this visualization technique could be practically implemented for forward flight. A dual camera/strobe system was used to acquire inboard and outboard images of approximately 2500 tufts on the upper surface of one blade. The tufts were approximately 0.625 inch in length; tuft diameters

of 0.002 and 0.006 inch were used. Tuft images were acquired for a range of thrust conditions up to and including stall.
Derived from text
Flow Visualization; Tilt Rotor Aircraft; Hovering

20040075754 NASA Ames Research Center, Moffett Field, CA, USA
Control/Display Integration Issues for STOVL Aircraft
Franklin, James A.; Research and Technology 1997; September 1998, pp. 43; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

As a member of the Joint Strike Fighter program team, Ames Research Center is participating in technology development for short takeoff and vertical landing (STOVL) fighter aircraft. NASA's role in the program is to develop design guidelines for integrated flight/propulsion controls, to support technology development for a demonstrator aircraft, and to provide consultation on integrated control design to industry participants. The choices of control response types and of pilot/vehicle interface strongly influence the operational capability for STOVL aircraft. Design criteria are being developed for response characteristics for integrated control systems that have the potential to significantly reduce pilot workload in STOVL operations. As part of NASA's effort, a simulation model was developed of a lift-fan configuration that represents a prospective STOVL design. This simulation has recently been used to conduct STOVL
Derived from text
Flight Characteristics; Stovl Aircraft; V/Stol Aircraft; Controllability; Flight Control; In-Flight Simulation; Aircraft Models

20040075761 NASA Ames Research Center, Moffett Field, CA, USA
Conflict Prediction and Resolution Technology Field Test
McNally, Dave; Bach, Ralph; Chan, William; Research and Technology 1997; September 1998, pp. 4-5; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Center/TRACON (Terminal Radar Approach Control) Automation System (CTAS) conflict-prediction capability, developed for the Descent Advisor function, was recently expanded and improved. The new CTAS conflict-prediction function processes all flight phases (climb, cruise, descent). A trial planning function was added to help the user confirm that a conflict-resolution trajectory is conflict-free before issuing a clearance to an aircraft. It was desirable to field test the conflict-prediction function stand-alone before re-integration with the Descent Advisor and other planned technologies for user-preferred trajectories. For field test purposes, the conflict-prediction and conflict-resolution functions were incorporated into a stand-alone tool that displays conflict information and helps the controller quickly build and check a trial plan route using turn vector, direct route, altitude, or speed changes.
Derived from text
Automatic Control; Radar Approach Control; Terminal Guidance; Controllers; Display Devices

20040075763 NASA Ames Research Center, Moffett Field, CA, USA
Wake Visualization of a Full-Scale Tiltrotor in Hover
Lau, Benton H.; Wadcock, Alan J.; Heineck, James T.; Research and Technology 1997; September 1998, pp. 29-30; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this program were to measure the tip-vortex trajectory of a full-scale, hovering tiltrotor and to compare the vortex trajectory of the baseline rotor with that of the subwing rotor (first figure). The subwing, which is mounted at the blade tip, can split the strong concentrated tip vortex into two weaker vortices, and weakening the vortex can reduce the blade-vortex interaction noise. TWO sets of subwings with different incidence angles were tested in this program.
Derived from text
Wakes; Tilt Rotor Aircraft; Blade-Vortex Interaction

20040075774 NASA Ames Research Center, Moffett Field, CA, USA
On-Blade Control of Rotor Blade Vibration
Fulton, Mark V.; Ormiston, Robert A.; Research and Technology 1997; September 1998, pp. 34-35; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

High levels of vibration in rotorcraft fuselages cause various problems, including structural fatigue, pilot fatigue, reduced rotorcraft readiness, and increased costs of development and maintenance. Current helicopters typically employ passive vibration isolation and absorption to reduce fuselage vibration. However, these passive devices are heavy and have various other limitations. Past attempts to further reduce vibration have used active techniques such as higher harmonic control of the

swashplate and individual blade control by means of active pitch links at the root of each blade. Modern "smart" materials provide an opportunity for on-blade active control, possibly for reduced weight and power. A small-scale, two-bladed rotor with on-blade control surfaces (elevons) was previously designed, fabricated, and tested in hover. The objective of the current project was to test this active rotor in a wind tunnel to determine the effectiveness of the elevon in changing vibratory blade moments in forward flight.
Derived from text
Vibration; Rotary Wing Aircraft; Active Control; Harmonic Control; Helicopters; Control Surfaces

20040075778 NASA Ames Research Center, Moffett Field, CA, USA
Skin-Friction Measurements on a Rotor in Hover
Wadcock, Alan J.; Yamauchi, Gloria K.; Research and Technology 1997; September 1998, pp. 31; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A means of acquiring skin-friction measurements on a fixed wing using an oil-flow interferometric technique was developed at Ames in the early 1990s. As long as flow conditions are steady, as they are in hover, this technique can be applied to rotary wings also. During the March 1997 hover test of a full-scale XV-15 tiltrotor in the Ames 80- by 120-Foot Wind Tunnel, this technique was used for the first time to provide detailed skin-friction measurements on a rotor over a wide range of thrust conditions.
Derived from text
Flow Visualization; Skin Friction; Tilt Rotor Aircraft

20040075786 NASA Ames Research Center, Moffett Field, CA, USA
X-36 Tailless Fighter Agility Research Aircraft
Sumich, Mark; Bailey, Rodney O.; Research and Technology 1997; September 1998, pp. 65-66; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The X-36 Tailless Fighter Agility Research Aircraft is a remotely piloted aircraft that was developed to demonstrate that a tailless aircraft, whose aerodynamic and systems configurations are driven by low- observables considerations, often referred to as stealth, can achieve the maneuverability and agility of current-class fighters without the directional stabilization and control power provided by vertical tails. The 28% scale X-36 is about 18 feet long, 10 feet wide, and 3 feet high. It weighs 1250 pounds fully fueled. The aircraft is powered by a Williams International F-112 turbofan engine which produces about700 pounds of thrust. Ames Research Center in conjunction with the Boeing Phantom Works. The X-36 Project i s an example of a better, cheaper, faster development philosophy, called rapid prototyping, that uses computer-aided design and manufacturing methods to create technologically advanced aircraft on a very short schedule and limited budget.
Author
X-36 Aircraft; Computer Aided Design; Rapid Prototyping

20040075816 NASA Ames Research Center, Moffett Field, CA, USA
Advanced Methods for Testing Rotor Performance
Caradonna, Francis X.; Research and Technology 1997; September 1998, pp. 40-41; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A principal advantage of rotorcraft is their ability to hover, and the efficiency with which they can hover is fundamental to helicopter productivity. It is surprising, therefore, that the ability to predict hover efficiency (and thus design optimum rotors) is limited. This is because the rotor flow field is so sensitive to the rotor wake that there are large analytical errors. This same wake sensitivity also causes large experimental errors. (If a perfect prediction capability existed, there would be no way to know it, because of experimental error.) Therefore, the attainment of greater rotor analysis capability is a twofold problem of improving both computational and experimental accuracy. This effort is directed at the experimental part of the problem.
Derived from text
Rotary Wing Aircraft; Rotors; Accuracy; Flow Distribution

20040075823 NASA Ames Research Center, Moffett Field, CA, USA
Boundary-Layer Receptivity
Dietz, Anthony J.; Research and Technology 1997; September 1998, pp. 47-49; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Accurate prediction of boundary-layer transition is crucial to the solution of a wide range of fluid dynamics problems,

from the design of low-drag airfoils to the estimation of reentry heat loads. In many flows, transition begins with a receptivity process, in which boundary-layer instabilities are excited by disturbances in the free stream. Understanding of this process has come a long way in recent years. A particular Ames contribution has been in the area of receptivity to vortical disturbances.
Derived from text
Boundary Layer Transition; Vortices; Stability; Airfoils

20040076975 Defence Science and Technology Organisation, Fishermans Bend, Australia
Review of Improved Methods for Analysing Load Attraction and Thermal Effects in Bonded Composite Repair Design
Harman, A. B.; Walker, K. F.; December 2003; 51 pp.; In English
Report No.(s): DSTO-TR-1546; DODA-AR-013-020; Copyright; Avail: Other Sources

Adhesive bonded repairs to aircraft involving metallic and composite structures have proven to be an effective, efficient means of repair and life extension. The simplified closed form equations used by the RAAF in an Engineering Standard (DEF(AUST)9005) have proven to be effective and conservative. Recent work, however, has identified improved equations to account for load attraction into the stiffened repaired area, and evaluate the thermally induced stresses in the repaired structure and the patch. The improved equations were compared with the current methods, using the repair to a 2024T851 aluminium alloy F-111 lower wing skin with a boron epoxy repair patch, bonded with FM-73 film adhesive. The improved methods will reduce the unnecessary conservatism inherent in DEF(AUST)9005 and therefore allow some repairs to proceed where they may otherwise have been rejected. Repairs will also be designed to operate more efficiently.
Author
Adhesive Bonding; Aircraft Maintenance; Composite Structures; Epoxy Resins

20040077049 NASA Ames Research Center, Moffett Field, CA, USA
Single-Point and Multi-Point Aerodynamic Shape Optimization of a High Speed Civil Transport
Cliff, Susan; Research and Technology 1999; December 2000, pp. 41-43; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The focus of this work was to develop and apply high-fidelity numerical design optimization techniques to the aerodynamic design of High Speed Civil Transport (HSCT) configurations for the purpose of substantially improving their aerodynamic performance, in an effort to develop, an economically feasible concept. It was sponsored by the High Speed Research (HSR) program in direct support of Goal 2, Objective 6: 'Reduce the travel time to the Far East and Europe by 50% within 20 years, ...' A direct consequence of this effort was the rapid acceleration of the development of high-fidelity aerodynamic design optimization methods within NASA and industry, applicable to the entire spectrum of flight vehicles. Such methods represent the next generation of design tools and hence directly support Goal 2, Objective 8: 'Provide next-generation design tools ....'
Author
Aerodynamic Configurations; Supersonic Transports; Shape Optimization; Aircraft Design

20040077067 NASA Ames Research Center, Moffett Field, CA, USA
V-22 Osprey Shipboard Interactional Aerodynamics Investigation
Long, Kurt; Zilliac, Greg; Research and Technology 1999; December 2000, pp. 69-70; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The U.S. Navy is currently conducting an extensive land-based and shipboard flight test program to evaluate the V-22 Osprey tilt-rotor aircraft. During shipboard tests aboard USS SAIPAN (LHA 21, V-22 test pilots experienced a roll anomaly while descending from hover. This anomaly consisted of uncommanded roll oscillation of approximately a 90-degree amplitude. Postflight analysis revealed that the roll was consistent with factors that might include an aberration in the aircraft s flight control systems logic, or air-load asymmetries caused by vehicle/ship interactional aerodynamics. Based on related ongoing shipboard air-wake measurement efforts at the Fluid Mechanics Lab (FML), the Navy requested FML support in investigating possible aerodynamic causes for the incident.
Derived from text
V-22 Aircraft; Aberration; Flight Control; Interactional Aerodynamics; Postflight Analysis

20040077098 NASA Ames Research Center, Moffett Field, CA, USA
Improved Rotorcraft Airfoil Designs Using Genetic Algorithms
Fanjoy, David W.; Crossley, William A.; Lyrintzis, Anastasios; Kottapalli, Sesi; Research and Technology 1999; December 2000, pp. 45-46; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Genetic algorithms (GAS) are an optimal search technique based on evolutionary programming techniques that mimic Darwin s idea o i natural selection. Ongoing research has demonstrated that CAS are useful tools in aerospace design. Recent research has centered on using CA-based-methods tor airfoil design. A practical problem ot rotorcraft industry origin that involved the vertical tail (NACA 63-418 airfoil section) of a current Army helicopter was considered. The vertical tail was experiencing buffeting within its normal flight envelope, and excessive flow separation at moderate angles of attack was a suspected cause. The objective of this effort was to design a new GA-based vertical tail airfoil section that maintained attached flow. The associated shape-design problem was as follows: minimize airfoil drag while retaining the thickness, lift, and moment of the NACA 63-418 airfoil. An additional constraint ensured that the new airfoil design retained attached flow at three flight conditions (at angles of attack of -2, 4, and 12 degrees, and at a Mach number of 0.06). A simplified aerodynamic analysis, the panel method, was to be used to keep computational expense low. GA-based airfoil (figure 1) featured a maximum thickness location that was farther forward; it also had a more complex camber distribution. Results showed that the new CA-based airfoil exhibited similar lift, a smaller pitching moment, and less flow separation than the NACA 63-418. Figure 2 shows that at an angle of attack of 12 degrees, the separation location improvement for the new GA-based airfoil was 18% of the chord. Further analysis using two more advanced codes (Ames ARC2D and the Massachusetts Institute of Technology's XFOIL) confirmed the above improvement (however, the Compared to the NACA 63-418 airfoil, the new three codes predicted different improvement levels). To summarize, it is believed that the present GA-based procedure can be used for solving rotorcraft-related problems of a practical nature.
Derived from text
Airfoils; Genetic Algorithms; Rotary Wing Aircraft; Aircraft Design; Panel Method (Fluid Dynamics)

20040077101 NASA Ames Research Center, Moffett Field, CA, USA
Wind Tunnel Testing with Fast Time-Response PSP
Schairer, Edward; Bell, James; Research and Technology 1999; December 2000, pp. 64-65; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Although proven successful for steady pressure measurements, extension of the pressure-sensitive paint (PSP) technique to unsteady flows, especially for rotorcraft, is considered quite difficult. This is partly because of the complex chemistry of a pressure-sensitive paint which has both fast time- response (greater than 1 kilohertz (kHz) as opposed to a typical PSP time response of 1 hertz (Hz)) and a self-referencing capability (often provided by adding a second pressure-insensitive luminescent dye to produce a biluminophore paint). Also, there is the problem of developing a camera coupled to a flash illumination system that is fast enough to stop the motion of the rotor model. Unsteady PSP would allow full pressure measurements on helicopter rotors, which would be of great benefit because rotors are extremely difficult to instrument with conventional pressure sensors.
Derived from text
Wind Tunnel Tests; Time Functions; Rotary Wings; Pressure Sensitive Paints; Pressure Measurement

20040077149 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of Advanced Rotorcraft Configurations
Johnson, Wayne; Research and Technology 1999; December 2000, pp. 16-17; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Advanced rotorcraft configurations are being investigated with the objectives of identifying vehicles that are larger, quieter, and faster than current-generation rotorcraft. A large rotorcraft, carrying perhaps 150 passengers, could do much to alleviate airport capacity limitations, and a quiet rotorcraft is essential for community acceptance of the benefits of VTOL operations. A fast, long-range, long-endurance rotorcraft, notably the tilt-rotor configuration, will improve rotorcraft economics through productivity increases. A major part of the investigation of advanced rotorcraft configurations consists of conducting comprehensive analyses of vehicle behavior for the purpose of assessing vehicle potential and feasibility, as well as to establish the analytical models required to support the vehicle development. The analytical work of FY99 included applications to tilt-rotor aircraft. Tilt Rotor Aeroacoustic Model (TRAM) wind tunnel measurements are being compared with calculations performed by using the comprehensive analysis tool (Comprehensive Analytical Model of Rotorcraft Aerodynamics and Dynamics (CAMRAD 11)). The objective is to establish the wing and wake aerodynamic models that are required for tilt-rotor analysis and design. The TRAM test in the German-Dutch Wind Tunnel (DNW) produced extensive measurements. This is the first test to encompass air loads, performance, and structural load measurements on tilt rotors, as well as acoustic and flow visualization data. The correlation of measurements and calculations includes helicopter-mode

operation (performance, air loads, and blade structural loads), hover (performance and air loads), and airplane-mode operation (performance).
Derived from text
Helicopter Performance; Rotor Aerodynamics; Wind Tunnel Tests; Aerodynamic Configurations

20040077156 NASA Ames Research Center, Moffett Field, CA, USA
Tilt-Rotor Noise Reduction Study
Norman, Thomas R.; Research and Technology 1999; December 2000, pp. 39-40; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The successful introduction of the civil tilt rotor into the national airspace system relies heavily on its community acceptance. In particular, a tilt rotor with reduced noise emissions is critical. Various approaches are being considered to address this problem. One such approach, the application of remotely adjustable on-blade control elements to rotor blades, is receiving considerable attention. This research effort is an attempt to better define the on-blade requirements and ultimately to identify a feasible design implementation. The objective of this effort, performed by Continuum Dynamics, Inc. under an SBIR (Small Business Innovation Research) Phase I contract, was to determine a mix of on-blade control-surface deflection or in-flight twist change to produce significant payload and range enhancement and blade vortex interaction (BVI) noise reduction for a representative civil tilt rotor.
Derived from text
Tilt Rotor Aircraft; Noise Reduction; Blade-Vortex Interaction; Aerodynamic Noise; Blade Slap Noise

20040077157 NASA Ames Research Center, Moffett Field, CA, USA
Isolated Tilt-Rotor Aeroacoustics
Yamauchi, Gloria; Young, Larry; Booth, Earl; Research and Technology 1999; December 2000, pp. 40; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

As part of the Short Haul Civil Tiltrotor (SHCT) project, an element of the Aviation Systems Capacity program, a test of an isolated tilt rotor was conducted in the Duits-Nederlandse Windtunnel (DNW) open-jet test section in April-May 1998. The model was the isolated configuration of the Tilt-Rotor Aeroacoustic Model (TRAM) and consists of a 0.25-scale V-22 right-hand rotor and nacelle. Aeroacoustic data and rotor wake measurements were acquired for a range of conditions in which blade-vortex interaction (BVI) occurs. The test was led by NASA Ames Research Center in partnership with the U.S. Army, NASA Langley, and the Boeing Company. Unlike conventional helicopter rotor blades, proprotor blades are highly twisted and can generate negative loading over a large area of the rotor disk. The negative loading causes multiple vortices (of opposite sign) to be shed, thereby increasing the complexity of the wake. Hence, modeling tilt-rotor wakes and predicting tilt-rotor aeroacoustics are very challenging tasks.
Derived from text
Tilt Rotor Aircraft; V-22 Aircraft; Blade-Vortex Interaction; Rotary Wings; Aeroacoustics; Vortices; Test Chambers

20040077158 NASA Ames Research Center, Moffett Field, CA, USA
Rotorcraft Uninhabited Aerial Vehicle (RUAV) System Identification, Modeling, and Flight Control System Development
Tischler, Mark B.; Cicolani, Luigi S.; Colbourne, Jason D.; Frost, Chad R.; Research and Technology 1999; December 2000, pp. 30-31; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

A new challenge to industry and the government alike is the trend toward highly compressed schedules for rotorcraft uninhabited aerial vehicle (RUAV) development and system fielding. Current RUAV proposals and development programs are on 6- to 9-month schedules, in contrast to the 6- to 10-year schedules common to most recent piloted rotorcraft systems. This year, the Army/NASA Rotorcraft Division launched a new initiative: Control and Simulation Technologies for Autonomous Rotorcraft (COSTAR) which seeks to develop key enabling technologies for the control and simulation of RUAVs. The COSTAR initiative refines technologies originally developed for manned rotorcraft for application to the RUAV problem, and seeks to increase technology integration sufficiently to realize the desired reduction in design cycle time. Key elements of COSTAR include accurate flight-mechanics modeling using system identification (CIFER@), control system design optimization for multiple objectives (CONDUIT), and real-time workstation-based simulation (RIPTIDE). COSTAR technologies are central to three ongoing cooperative projects, in which university and industry RUAV developers have teamed

with the Army/NASA Rotorcraft Division s Flight Control Technology Group. The three cooperative projects are discussed in this paper.
Derived from text
Control Systems Design; Flight Control; Rotary Wing Aircraft; Control Simulation; Flight Mechanics; System Identification; Aircraft Models; Pilotless Aircraft

20040077177 NASA Ames Research Center, Moffett Field, CA, USA
Prediction of Rotorcraft Pitch-Link Loads
Kottapalli, Sesi; Research and Technology 1999; December 2000, pp. 18; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The pitch links of rotor blades are essential hardware that provide direct control to rotorcraft. The pitch-link loads undergo large changes in magnitude as a result of flight conditions that range from those of relatively benign level flight to those associated with severe, complex maneuvers. In the present study, a "complex" maneuver was defined as one that involved simultaneous non-zero aircraft angle of bank (associated with turns) and aircraft pitch rate (associated with a pull-up or a push-over). Also, since a typical rotor blade pitch link operates in a highly dynamic environment, the pitch-link loads obtained from flight tests have associated with them a greater degree of uncertainty. Analytical prediction of pitch-link loads is thus difficult, and methods that provide accurate results are highly desirable. The objectives were (1) to obtain physical insights into the nature of complex maneuvers and (2) to apply neural networks to efficiently characterize maneuver-related rotorcraft blade pitch-link loads. The NASA/Army UH-60A Airloads Program database was used.
Derived from text
Aerodynamic Loads; Rotary Wing Aircraft; Flight Tests; Flight Conditions

20040077178 NASA Ames Research Center, Moffett Field, CA, USA
Efficient Computational Fluid Dynamics for Rotorcraft Analysis
Caradonna, Frank; Research and Technology 1999; December 2000, pp. 15; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Airflows over rotorcraft are far more complex and more difficult to predict than those that occur on fixed-wing aircraft. The inability to predict many of these flows is a direct or indirect contributor to the cost, duration, and risk of the rotorcraft development process. For this reason, the application of computational fluid dynamics (CFD) is an important and growing part of the rotorcraft research process. However, rotorcraft aerodynamics is difficult for CFD because the limiting physical problems of rotorcraft differ from those of fixed-wing aircraft for which CFD was originally developed. An example of such a flow is the wake that is shed by the rotor. Such wakes are visible in the contrails of high-altitude airliners. The primary difference with rotorcraft is that because of its rotary motion, a rotor never gets far from its shed wake. This adjacent wake strongly determines the performance and acoustics of a rotor. The ability to predict this wake with the required accuracy has been shown to require far greater computational resources (with conventional methods) than is practical for engineering analysis. The objective of this work is to develop new CFD wake-computation methods that are accurate and practical for everyday use. .
Derived from text
Computational Fluid Dynamics; Rotary Wing Aircraft; Rotor Aerodynamics; Aircraft Configurations; Air Flow

20040077181 NASA Ames Research Center, Moffett Field, CA, USA
Three-Component Velocity Measurements in the Wake of a Rotor in Hover
Wadcock, Alan J.; Yamauchi, Gloria K.; Heineck, James T.; Research and Technology 1999; December 2000, pp. 25; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Improved rotorcraft aeroacoustic and performance analyses are highly dependent on the accurate modeling of the rotor wake structure, in particular, the strength and size of the blade-tip vortex. Particle image velocimetry (PIV) can provide these structural wake measurements very efficiently. The present investigation represents the first three-component PIV measurements acquired in a rotor wake by NASA. The objective was to acquire three-component velocity fields in the wake of a hovering, two-bladed, untwisted rotor and determine the vortex size and strength as a function of wake age. A 7.5-foot-diameter rotor with a constant chord of 7.5 inches was selected for the study. The rotor was operated at a tip speed of 342 feet per second with the rotor thrusting downward (wake up) to minimize recirculation; 500 PIV stereo image pairs were acquired for each wake age, which ranged from 0 to 270 degrees.
Derived from text
Hovering; Wakes; Velocity Measurement; Rotary Wing Aircraft; Aeroacoustics

20040077183 NASA Ames Research Center, Moffett Field, CA, USA

A Computational Tool for Rotor Design

Strawn, Roger; Research and Technology 1999; December 2000, pp. 53; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Helicopter and tilt-rotor blades produce complex vortical flow fields that interact with the nacelles, wings, fuselage, and the ground. Rotorcraft designers need an efficient computational tool that can model these vortical flow fields and accurately predict the aerodynamic performance of rotary-wing vehicles. The purpose of this project is to develop a computational tool with which to model the complex flow fields around rotors and bodies. In an industry design environment, turnaround time must be reduced to a level at which design cycles can be conducted within schedule and cost. Therefore, the computational tool must be efficient and easy to use. With Ames funding, Sukra Helitek Inc. developed a software tool called Rot3DC, which simulates the flow field around rotary-wing vehicles. The method employs a graphical user interface to model either isolated rotors or rotor and fuselage problems, including ground interference. Rot3DC solves the Navier-Stokes equations on unstructured grids with a simple, but effective, momentum-source representation for the rotor blades. This momentum-source rotor-blade model allows for highly efficient solutions of rotor flow fields. A sample aerodynamic solution from the Rot3DC code for a V-22 tilt-rotor landing on the deck of an aircraft carrier is shown. This figure demonstrates the complicated interactions between the rotor downwash, the wings of the V-22, and the deck of the ship. Despite these complex flow-field features, the Rot3DC code can model these solutions in a matter of hours on a high-end personal computer. This rapid turnaround and simplified problem setup make Rot3DC well-suited for helicopter design applications. Indeed, the Boeing Company has licensed Rot3DC and is using it to model the Comanche helicopter and V-22 tilt rotor. Sukra Helitek Inc. plans to upgrade the Rot3DC computer code to include a higher-fidelity unsteady rotor model and solution-adaptive grids for improved modeling of rotor wakes. These modifications should improve the overall analytical accuracy while retainiiig the ease of use and rapid turnaround of the original Rot3DC software package.

Derived from text

Rotary Wing Aircraft; Software Development Tools; Aircraft Models; Rotor Blades (Turbomachinery); Helicopter Design

20040077188 NASA Ames Research Center, Moffett Field, CA, USA

Analysis of On-Blade Control

Fulton, Mark V.; Research and Technology 1999; December 2000, pp. 36-37; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Because high levels of helicopter vibration are bothersome to pilots, passengers, and on-board equipment, efforts are under way to develop improved active rotor concepts for vibration control. In an effort to explore the benefits of on-blade controls, a small-scale active rotor was previously tested in the Army/NASA 7- by 10-Foot Wind Tunnel. The rotor shown contained one elevon (or control surface) per blade which was actuated by piezoceramic bimorph actuators to reduce vibratory blade loads. Previous reports have described the test in detail along with preliminary 2GCHAS (Second Generation Comprehensive Helicopter Analysis System) calculations used for data correlation and for explaining the observed aeroelastic phenomenon. More recently, CAMRAD II (Comprehensive Analytical Model of Rotorcraft Aerodynamics and Dynamics) calculations were made to study several model features, including tip loss and elevon dynamics, and to allow further forward flight vibratory loads comparisons. In all cases, the control consisted of elevon deflection, and the response consisted of blade root bending and torsion moments. In hover, the predictions captured the basic aeroelastic effects evident in the data, including elevon reversal and aeroelastic resonant peaks. For some cases, however, the magnitude of the predictions significantly differed from the experimental measurements.

Derived from text

Rotor Aerodynamics; Wind Tunnels; Control Surfaces; Rotor Blades (Turbomachinery); Rotary Wing Aircraft

20040077189 NASA Ames Research Center, Moffett Field, CA, USA

An Electromagnetic Actuator for Helicopter Rotor Active Control

Wellman, Brent; Ormiston, Robert A.; Research and Technology 1999; December 2000, pp. 55; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

There is considerable interest in the potential of active rotor control as a means of improving rotorcraft loads, vibration, noise, and performance by using various approaches including individual blade control, on-blade controls, and active twist. Smart materials and actuators figure prominently in many of these approaches, but at present this technology is limited with respect to actuation force and displacement capability, as well as maturity level of the underlying technologies. Aeroflightdynamics Directorate (AFDD) investigated alternative technologies for individual blade control surface actuation and solicited proposals under the Small Business Innovative Research (SBIR) program. The Heliflap is an electromagnetic

actuator and trailing-edge control surface developed for helicopter rotor active-control applications. It is a rugged, compact system with no external linkages and no moving parts except the flap itself. It has excellent force, deflection, and frequency characteristics, as well as good power and thermal dissipation characteristics. The flap amplitude and frequency are controlled by modulation of the electrical current to the actuators. The net installed weight for the non- optimized prototype is 9.6 pounds. The design and development of the Heliflap has been completed including bench testing and preliminary whirl testing on a full-scale OH-58 helicopter rotor at rotor speeds up to 81% of normal operations and at low collective pitch settings. Test results compare favorably with design predictions from the Heliflap analytical model. Bench testing demonstrated 35.6 foot-pounds static torque for 100 amperes, k8-degree deflections, and operation from 0-37 hertz. Whirl testing of the 6- by 24-inch prototype at 81% nominal rotor speed demonstrated plus or minus 8 degree deflections at 0-37 hertz (4.4 times per rotor revolution) requiring a total average electrical power of 220 watts. The actuator appears to be well suited for active control for rotor vibration reduction and may have significant potential for application to rotor primary flight control as well.
Derived from text
Actuators; Electromagnets; Oh-58 Helicopter; Rotary Wing Aircraft; Active Control

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*.

20040075781 NASA Ames Research Center, Moffett Field, CA, USA
Clutter-Rejection for Obstacle Detection in Radar Data
Barniv, Yair; Research and Technology 1997; September 1998, pp. 79-80; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Because of its needle-like nose, shaped for supersonic flight, and the high angle of attack used during takeoff and landing, the High-speed Civil Transport (HSCT) has no forward window. The HSCT would have to rely on synthetic vision for detecting infringing airborne obstacles, and "seeing" the runway during landing and takeoff. The sensor of choice for all-weather operations is an airborne radar. However, there are two problems inherent in utilizing conventional radars for vision: (1) although they excel in resolving range, their angular resolution is rather poor, and (2) ground clutter may be confused with targets of interest, especially when looking down during landing.
Derived from text
Airborne Radar; Clutter; Radar Data; Radar Detection; Flight; High Speed

20040077172 NASA Ames Research Center, Moffett Field, CA, USA
Human Factors Field Evaluation of Cockpit Display of Traffic Information (CDTI)
Ashford, Rose; Battiste, Vernol; Research and Technology 1999; December 2000, pp. 29-30; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Cockpit Display of Traffic Information (CDTI) is a major departure from traditional ground-based air traffic control and will markedly improve air traffic safety and efficiency, as well as facilitate modernization of the National Airspace System. A prototype CDTI was installed on 12 aircraft (8 Boeing 727's and 4 DC-9's) belonging to the member airlines of the Cargo Airline Association. This initial CDTI displays proximate aircraft relative to their own-ship, assisting flight crews in sighting and identifying traffic 'out the window.' NASA provided a human factors evaluation of the CDTI to demonstrate whether it would be safe and effective tor these initial visual applications, and to provide preliminary results supporting future CDTI applications involving aircraft that are sharing separation responsibility.
Author
Display Devices; Aircraft Instruments; Pilot Support Systems; Human Factors Engineering

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*.

20040074383 NASA Glenn Research Center, Cleveland, OH, USA
Detailed Microstructural Characterization of the Disk Alloy ME3
Gabb, Timothy P.; Garg, Anita; Ellis, David L.; O'Connor, Kenneth M.; May 2004; 44 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 714-30-05
Report No.(s): NASA/TM-2004-213066; E-14533; No Copyright; Avail: CASI; A03, Hardcopy

The advanced powder metallurgy disk alloy ME3 was designed using statistical screening and optimization of composition and processing variables in the NASA/General Electric/Pratt & Whitney HSR/EPM disk program to have extended durability for large disks at maximum temperatures of 600 to 700 C. Scaled-up disks of this alloy were then produced at the conclusion of that program to demonstrate these properties in realistic disk shapes. The objective of the present study was to assess the microstructural characteristics of these ME3 disks at two consistent locations, in order to enable estimation of the variations in microstructure across each disk and across several disks of this advanced alloy. Scaled-up disks processed in the HSR/EPM Compressor/Turbine Disk program had been sectioned, machined into specimens, and tested in tensile, creep, fatigue, and fatigue crack growth tests by NASA Glenn Research Center, in cooperation with General Electric Engine Company and Pratt & Whitney Aircraft Engines. For this study, microstructures of grip sections from tensile specimens in the bore and rim were evaluated from these disks. The major and minor phases were identified and quantified using transmission electron microscopy (TEM). Particular attention was directed to the .' precipitates, which along with grain size can predominantly control the mechanical properties of superalloy disks.
Author
Microstructure; Mechanical Properties; Heat Resistant Alloys; Turbines; Tensile Creep; Powder Metallurgy; Crack Propagation

20040075606 NASA Marshall Space Flight Center, Huntsville, AL, USA
Systems Modeling of a Hypothetical SSME Channel-Wall Nozzle
Greene, William D.; Thames, Mignon P.; Polsgrove, Robert H.; September 1, 2003; 2 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

A future upgrade to the Space Shuttle Main Engine (SSME) may be the replacement of the current regenerative cooled tube-wall nozzle with a nozzle using a regeneratively-cooled channel-wall design. The current tube-wall design represents the only major piece of SSME hardware that has not been dramatically updated throughout thc long history of the engine. There are a number of advantages to a channel-wall design including the promise of faster and lower cost fabrication and greater reliability in the field. The technical obstacles in the path of making this happen are many, particularly in the realms of metallurgy and manufacturing techniques. However, one technical area that can and should be addressed in the near term as part of the development of detailed component requirements is a systems type model of the fluid flow and heat transfer processes to which the new design will be exposed. This paper presents the results of an effort to develop a mathematical model of the internal flow for a generic channel-wall nozzle functioning as a direct replacement for the current tube-wall nozzle with a minimum of systems-level changes. Comparisons will be made to mathematical modeling results for the current tube-wall design and the results of various geometrical trade studies will be presented. It is the intent of this work to examine the feasibility of the concept of a direct replacement component with minimum systems-!eve impacts and to highlight potential areas of concern requiring further work in the future.
Author
Mathematical Models; Nozzle Design; Walls; Internal Flow

20040075609 NASA Marshall Space Flight Center, Huntsville, AL, USA
Mechanical Design of a Performance Test Rig for the Turbine Air-Flow Task (TAFT)
Xenofos, George; Forbes, John; Farrow, John; Williams, Robert; Tyler, Tom; Sargent, Scott; Moharos, Jozsef; September 04, 2003; 2 pp.; In English; JANNAF 52nd JP Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

To support development of the Boeing-Rocketdyne RS84 rocket engine, a fill-flow, reaction turbine geometry was

integrated into the NASA-MSFC turbine air-flow test facility. A mechanical design was generated which minimized the amount of new hardware while incorporating all test and instrUmentation requirements. This paper provides details of the mechanical design for this Turbine Air-Flow Task (TAFT) test rig. The mechanical design process utilized for this task included the following basic stages: Conceptual Design. Preliminary Design. Detailed Design. Baseline of Design (including Configuration Control and Drawing Revision). Fabrication. Assembly. During the design process, many lessons were learned that should benefit future test rig design projects. Of primary importance are well-defined requirements early in the design process, a thorough detailed design package, and effective communication with both the customer and the fabrication contractors. The test rig provided steady and unsteady pressure data necessary to validate the computational fluid dynamics (CFD) code. The rig also helped characterize the turbine blade loading conditions. Test and CFD analysis results are to be presented in another JANNAF paper.
Author
Mechanical Engineering; Design Analysis; Performance Tests; Turbines; Flow Geometry

20040075686 NASA Marshall Space Flight Center, Huntsville, AL, USA
VPS GRCop-84 Liner Development Efforts
Elam, Sandra K.; Holmes, Richard; McKechnie, Tim; Hickman, Robert; Pickens, Tim; August 07, 2003; 2 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-12 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NGLT 721-26-5Q; No Copyright; Avail: Other Sources; Abstract Only

For the past several years, NASA's Marshall Space Flight Center (MSFC) has been working with Plasma Processes, Inc. (PPI) to fabricate combustion chamber liners using the Vacuum Plasma Spray (VPS) process. Multiple liners of a variety of shapes and sizes have been created. Each liner has been fabricated with GRCop-84 (a copper alloy with chromium and niobium) and a functional gradient coating (FGC) on the hot wall. While the VPS process offers versatility and a reduced fabrication schedule, the material system created with VPS allows the liners to operate at higher temperatures, with maximum blanch resistance and improved cycle life. A subscal unit (5K lbf thrust class) is being cycle tested in a LOX/Hydrogen thrust chamber assembly at MSFC. To date, over 75 hot-fire tests have been accumulated on this article. Tests include conditions normally detrimental to conventional materials, yet the VPS GRCop-84 liner has yet to show any signs of degradation. A larger chamber (15K lbf thrust class) has also been fabricated and is being prepared for hot-fire testing at MSFC near the end of 2003. Linear liners have been successfully created to further demonstrate the versatility of the process. Finally, scale up issues for the VPS process are being tackled with efforts to fabricate a full size, engine class liner. Specifically, a liner for the SSME's Main Combustion Chamber (MCC) has recently been attempted. The SSME size was chosen for convenience, since its design was readily available and its size was sufficient to tackle specific issues. Efforts to fabricate these large liners have already provided valuable lessons for using this process for engine programs. The material quality for these large units is being evaluated with destructive analysis and these results will be available by the end of 2003.
Author
Fabrication; Combustion Chambers; Linings; Chromium; Coating

20040077187 NASA Ames Research Center, Moffett Field, CA, USA
A Numerical and Experimental Study of Wind Turbine Unsteady Aerodynamics
Duque, Earl; Kufeld, Robert; Research and Technology 1999; December 2000, pp. 35-36; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Accurate, reliable, and robust numerical predictions of the power required to turn the main rotor blades of a rotorcraft remain a challenge to the industry. Although various numerical methods do exist and have been used in the design of many different aircraft, there still remain some questions regarding the prediction of the maximum power required. Many of the existing theories do not work well in this flight regime. One possible flaw i s our lack of understanding of how a rotor blade stalls along the inboard radial locations. To address this lack of understanding, NASA has formed a collaborative effort with the Department of Energy s (DOE) National Renewable Energy Laboratory (NREL) to investigate the unsteady aerodynamics of a horizontal axis wind turbine (HAWT). The main purpose o i this project is to gain a better understand- ing of a wind turbine s unsteady aerodynamics. By improving our understanding of this machine s aerodynamic environment, we simultaneously improve our capability to properly model rotorcraft rotor blades. computational fluid dynamics (CFD) methods to simulate the wind turbine. Solutions based on the Reynolds-averaged Navier-Stokes equations have been obtained as illustrated in figure 1. Concurrently, In this effort, researchers use advanced rotorcraft NREL has installed and will test their Unsteady Aerodynamics Experiment in NASA's 80- by 120- Foot Wind Tunnel. This test is the largest and most comprehensive wind tunnel test of an HAWT in the world. It will provide extensive unsteady data regarding, for example, pressure, air loads, and dynamic blade response. The information gathered from the experimental data, combined with the

knowledge obtained through the computations, forms the nucleus for the development of more accurate semi-empirical rotor design methods. In addition, the knowledge gained through this collaborative program will have a major effect on the understanding of other rotary flow fields such as those of tilt rotors and helicopters. This collaborative effort directly addresses aerodynamic issues relevant to both rotorcraft and wind turbines. By utilizing scientific resources from both NREL and NASA, we have been able to advance our understanding of the aerodynamic behavior of rotor blades to the benefit of both industries. Derived from text

Aerodynamic Characteristics; Wind Turbines; Unsteady Aerodynamics; Computational Fluid Dynamics; Rotary Wing Aircraft; Reynolds Equation; Numerical Analysis; Navier-Stokes Equation

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*.

20040074342 Lockheed Martin Corp., Hampton, VA, USA

B-737 Linear Autoland Simulink Model

Belcastro, Celeste, Technical Monitor; Hogge, Edward F.; May 2004; 123 pp.; In English

Contract(s)/Grant(s): NAS1-00135; WU 23-728-30-10

Report No.(s): NASA/CR-2004-213021; No Copyright; Avail: CASI; A06, Hardcopy

The Linear Autoland Simulink model was created to be a modular test environment for testing of control system components in commercial aircraft. The input variables, physical laws, and referenced frames used are summarized. The state space theory underlying the model is surveyed and the location of the control actuators described. The equations used to realize the Dryden gust model to simulate winds and gusts are derived. A description of the pseudo-random number generation method used in the wind gust model is included. The longitudinal autopilot, lateral autopilot, automatic throttle autopilot, engine model and automatic trim devices are considered as subsystems. The experience in converting the Airlabs FORTRAN aircraft control system simulation to a graphical simulation tool (Matlab/Simulink) is described.

Author

Simulation; Aircraft Control; Automatic Landing Control; Automatic Pilots; Environmental Control; Performance Tests

20040074452 Massachusetts Inst. of Tech., Cambridge, MA, USA

Autonomous Guidance of Agile Small-scale Rotorcraft

Mettler, Bernard; Feron, Eric; June 04, 2004; 22 pp.; In English

Contract(s)/Grant(s): NAG2-1552; No Copyright; Avail: CASI; A03, Hardcopy

This report describes a guidance system for agile vehicles based on a hybrid closed-loop model of the vehicle dynamics. The hybrid model represents the vehicle dynamics through a combination of linear-time-invariant control modes and pre-programmed, finite-duration maneuvers. This particular hybrid structure can be realized through a control system that combines trim controllers and a maneuvering control logic. The former enable precise trajectory tracking, and the latter enables trajectories at the edge of the vehicle capabilities. The closed-loop model is much simpler than the full vehicle equations of motion, yet it can capture a broad range of dynamic behaviors. It also supports a consistent link between the physical layer and the decision-making layer. The trajectory generation was formulated as an optimization problem using mixed-integer-linear-programming. The optimization is solved in a receding horizon fashion. Several techniques to improve the computational tractability were investigate. Simulation experiments using NASA Ames 'R-50 model show that this approach fully exploits the vehicle's agility.

Author

Control Systems Design; Rotary Wing Aircraft; Controllers; Sequential Control; Hybrid Structures; Feedback Control

20040075706 NASA Ames Research Center, Moffett Field, CA, USA

Characterization of Dynamic Stall on the UH-60A

Bousnan, William G.; Research and Technology 1997; September 1998, pp. 32-33; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Under severe loading conditions dynamic stall will occur intermittently on a helicopter rotor blade as it makes one revolution of 360 degrees. When dynamic stall does occur, a vortex is shed from the leading edge of the blade; this vortex is translated back along the upper surface of the blade, and then leaves the trailing edge. The shedding of the dynamic-stall

vortex in these conditions twists the rotor blade and causes extremely high loads in the helicopter s control system. Indeed, the size and strength of the components in the control system are generally determined by these dynamic-stall loads. Unfortunately, analytical models are unable to compute the dynamic-stall loads because of the nonlinear nature of the aerodynamic loading. A first step in the development of improved analytical models for helicopter design is an accurate characterization of dynamic stall as it occurs in flight as determined by experimental measurements.
Derived from text
Aerodynamic Stalling; Helicopter Control; Helicopter Design; Leading Edges; Trailing Edges; Aerodynamic Loads

20040075729 NASA Ames Research Center, Moffett Field, CA, USA
Dynamical Behavior of Networks and Cellular Automata
Stargle, Jeffrey; Colombano, Silvano; Liang, Shoudan; Research and Technology 1997; September 1998, pp. 99; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A novel data processing algorithm, which addresses the inverse problem of deducing internal network structure from behavior, as represented by time-series data on signals at one or more output nodes, has been developed. Data analysis techniques, based on information theory and Bayesian change-point determination methods originally developed for astrophysical systems) are being applied to this reverse engineering of biological systems, as well as to automatic genetic sequence decoding.
Derived from text
Automata Theory; Information Theory; Data Processing; Algorithms; Reverse Engineering

20040075740 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of Civil Helicopter Accidents
Hart, Sandra G.; Research and Technology 1997; September 1998, pp. 10-11; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

NASA formed the Aviation Safety Program in mid-1 997 to respond to the ambitious safety challenge posed by President Clinton. To guide the development of a safety investment strategy for the helicopter element of this program, a team of experts, drawn from helicopter manufacturers, operators, and governmental agencies, was formed and tasked with analyzing representative fatal helicopter accidents to identify prevention opportunities. The 34 accidents analyzed included a range of vehicle makes and models, missions, flight phases, types of operation, and accident characteristics. Using information contained in the official National Transportation Safety Board accident dockets, the team developed a sense of what happened (the chain of Events), identified issues or problems that might have existed with the aircraft, maintainers, environment, pilot actions, and air traffic control, and the quality of the information in the report itself (the Problems), and hypothesized what might have prevented an accident entirely or at least mitigated its severity (Solutions).
Derived from text
Aircraft Accidents; Aircraft Safety; Flight Safety; Helicopters

20040075762 NASA Ames Research Center, Moffett Field, CA, USA
Flight Mechanics of Helicopter Sling-Load Systems
Cicolani, Luigi; Tischler, Mark; McCoy, Allen; Tucker, George; Research and Technology 1997; September 1998, pp. 36-38; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

An important consideration in the design of helicopter rotor blades is the stability of the isolated rotor and the coupled rotor-body system. Once disturbed, unstable linear systems grow in response without bound until a failure occurs. Therefore, the helicopter design engineer would like an analytical tool that would accurately calculate the stability of these systems. The present work provides an experimental database that is needed to validate these analytical tools. The database, when complete, will include two rotor-blade configurations tested in hover and forward flight. This year's accomplishments include the fabrication and structural testing of the second rotor-blade configuration.
Derived from text
Helicopter Design; Rotor Blades (Turbomachinery); Aerodynamic Configurations; Rotor Body Interactions; Stability

20040075773 NASA Ames Research Center, Moffett Field, CA, USA
Modeling UH-60A Control System Stiffness
Kufeld, Robert; Research and Technology 1997; September 1998, pp. 33; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this work was to focus on improving the control system model of the UH-GOA helicopter and thus improve the prediction of its dynamic stall characteristics. The recent flight testing of the UH-GOA at Ames Research Center provided a wealth of data on observations of the dynamic stall phenomenon; the data are ideally suited for comparison with calculations from comprehensive rotorcraft analyses. In addition, current models of the LIH-6OA control system stiffness were based on an analytical estimate and never verified.
Derived from text
Flight Tests; Aerodynamic Stalling; Helicopters

20040075779 NASA Ames Research Center, Moffett Field, CA, USA
Aeroelastic Stability Testing
Maier, Thomas; Sharpe, David; Ormiston, Robert A.; Research and Technology 1997; September 1998, pp. 36; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

An important consideration in the design of helicopter rotor blades is the stability of the isolated rotor and the coupled rotor-body system. Once disturbed, unstable linear systems grow in response without bound until a failure occurs. Therefore, the helicopter design engineer would like an analytical tool that would accurately calculate the stability of these systems. The present work provides an experimental database that is needed to validate these analytical tools. The database, when complete, will include two rotor-blade configurations tested in hover and forward flight. This year s accomplishments include the fabrication and structural testing of the second rotor-blade configuration.
Derived from text
Rotor Blades (Turbomachinery); Rotor Body Interactions; Stability; Aerodynamic Configurations; Stability Tests; Helicopter Design; Airframes

20040077185 NASA Ames Research Center, Moffett Field, CA, USA
Distortion and Elevated Growth of Instabilities by Vortices Induced by Free-Stream Nonuniformity
Watmuff, Johnathan H.; Research and Technology 1999; December 2000, pp. 71-72; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this effort is to study the interaction between streamwise vorticity and Tollmien- Schlichting (TS) waves in an effort to gain new insights into the physical processes responsible for bypass transition. Transition by means of amplification and nonlinear breakdown of initially small-amplitude TS waves is only observed for low free-stream turbulence (FST) levels. "Bypass" of TS instability mechanisms has been hypothesized for higher FST levels. However, recent observations demonstrate that TS waves still play an active role at moderate FST levels. Elevated FST levels also appear to be associated with streamwise vorticity within the laver that originates at the leading edge. Therefore, the influence of streamwise vortices on TS waves may provide new insights into bypass transition, which has remained a mystery since the 1930s.
Derived from text
Vortices; Amplification; Leading Edges; Nonuniformity

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20040075737 NASA Ames Research Center, Moffett Field, CA, USA
T-NASA Taxi Test at Atlanta Airport
Foyle, David C.; Andre, Anthony; Hooey, Becky; McCann, Robert; Research and Technology 1997; September 1998, pp. 8-9; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Terminal Area Productivity Program/Low- Visibility Landing and Surface Operations element is developing cockpit technologies to enable safe and efficient surface operations in Category IIIB (300-700-feet runway visual range) visibility conditions. Ames Research Center is developing an integrated display system, the T-NASA (Taxiway Navigation and Situation Awareness) system, consist- ing of conformal symbology on a head-up display (HUD; see first figure), an electronic moving map (EMM; second figure), and three-dimensional (3-D) audio alerts for impending traffic incursions. The T-NASA Taxi HUD uses scene-linked symbology projected on glass overlaying the forward scene to present taxi route information, situational

awareness information, and ground speed. The EMM depicts the cleared taxi route on the airport surface, as well as real-time information about own-ship position, other airport traffic, and hold-short locations. The 3-D Audio Ground Collision Avoidance System (GCAS) presents spatially localized auditory traffic and navigation warnings. A joint flight test was conducted at Atlanta's Hartsfield International Airport to evaluate Ames Research Center s HUD and EMM components of the T-NASA system. Langley Research Center conducted the integration of T-NASA into NASA s 757 aircraft, and the Federal Aviation Administration developed the airport surveillance and data-link technologies.
Author
Air Traffic; Airports; Collision Avoidance; Productivity; Situational Awareness

20040075738 NASA Ames Research Center, Moffett Field, CA, USA
Simulation Motion Requirements in Coordinated Maneuvers
Schroeder, Jeffrey A.; Chung, William W. Y.; Laforce, Soren; Research and Technology 1997; September 1998, pp. 11; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

If a pilot does not feel a lateral acceleration during a roll maneuver, the maneuver is said to be coordinated. During these maneuvers, the ball on the cockpit turn-and-slip indicator is centered. To accurately represent these coordinated maneuvers in a flight simulator, the motion platform must translate laterally when it rolls. However, most simulators do not have enough lateral displacement available to maintain coordination. As a result, the pilot feels an inappropriate, or false, lateral acceleration in the simulator. This study examined the effect of this false simulator cue. In addition, the effort suggested a criterion for simulator manufacturers and users that can be used to select the required size of future simulators. In the study, pilots flew a helicopter model in the world's largest displacement flight simulator, which is located at Ames Research Center. The large displacement of this unique simulator allowed coordinated maneuvers to be flown as a baseline. Subsequent reductions in the commanded roll and lateral simulator displacements allowed the examination of the false cueing effects. Measures of pilot-vehicle performance and pilot workload quantified the effect of these reductions in displacement.
Author (revised)
Flight Simulators; Roll; Helicopters; Aircraft Maneuvers

20040075745 NASA Ames Research Center, Moffett Field, CA, USA
Daily Use of the Traffic Management Advisor
Swenson, Harry N.; Engelland, Shawn; Hoang, Ty; Research and Technology 1997; September 1998, pp. 26-27; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The growth of commercial air travel and the "hub-and-spoke" operations used by many air carriers have put a severe strain on the Nation's air traffic capacity. This strain is safely, but many times inefficiently, absorbed by routine airborne and ground delays of aircraft. These delays cost the traveling public several billion dollars per year. The Center/TRACON (Terminal Radar Approach Control) Automation System (CTAS) is a joint NASA/Federal Aviation Administration (FAA) program that has its goal the development of decision-support automation tools to efficiently reduce delays while maintaining a safe and reasonable level of controller workload.
Derived from text
Air Traffic; Automatic Control; Controllers; Radar Approach Control

20040077065 NASA Ames Research Center, Moffett Field, CA, USA
Human-Centered Computing at Mission Control
ONeill, John; Wales, Roxana; Research and Technology 1999; December 2000, pp. 160; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames researchers are studying how mission operations (ops) are conducted at Johnson Space Center Mission Control with the goal of improving the information technology support, practices, and facilities in which mission operations are conducted. This work has led to the development of "ops assistants," tools specifically designed to support the work of flight controllers in Mission Control.
Derived from text
Flight Control; Information Systems

20040077179 NASA Ames Research Center, Moffett Field, CA, USA
Large-Rotor Research Program
Norman, Thomas R.; Shinoda, Patrick M.; Jacklin, Stephen A.; Research and Technology 1999; December 2000, pp. 21-22; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

As part of its Rotorcraft Program, NASA is committed to providing the experimental data necessary to (1) validate newly developed predictive capabilities and (2) provide physical insight into those areas where accurate predictive capability does not yet exist. To make the acquisition of these data possible for large-scale rotor systems, NASA and the U.S. Army have developed a new wind tunnel test stand, the Large Rotor Test Apparatus (LRTA). The LRTA is designed for testing moderate-to-large helicopter blades and tilt rotors up to 50,000 pounds of thrust and 6,000 horsepower and provides unique capabilities that will support both industry and government rotorcraft test programs. During the past year, two major milestones were reached in the development of the LRTA. The first was the successful calibration of the LRTA rotor balance, following fabrication and assembly of the LRTA rotor balance calibration facility. This calibration effort demonstrated the capability of the LRTA balance design to measure rotor hub loads to better than 0.5% full-scale. This level of load measurement accuracy is critical to the successful wind tunnel testing of large rotor systems. The second milestone reached in FY99 was the design, fabrication, and integration of a state-of-the-art digital rotor-control console for use with the LRTA. This new console provides the digital commands and feedback controls necessary to safely 'fly' a rotor system in the wind tunnel.

Derived from text

Test Stands; Rotary Wings

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*.

20040075060 Air Force Research Lab., Edwards AFB, CA

Powder-Based Work at Edwards AFB

Hoffman, Wesley P.; Apr. 29, 2004; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2306

Report No.(s): AD-A422888; No Copyright; Avail: CASI; A03, Hardcopy

Areas of interest are bulk nanophase aluminum parts for aerospace and astronautics applications and metallic coatings for microtubecomponents. Nanocrystalline materials are defined as polycrystalline materials with crystallites that have manometer rather than micron dimensions. In contrast to conventional course-grained materials, the number of atoms in the grain boundaries can equal or exceed those in the crystal lattice sites. They are materials with superior properties which include: increased strength (for aluminum it increases from 29 ksi to 115 ksi) while maintaining ductility (5%).

DTIC

Aluminum; Metal Coatings; Polycrystals; Powder (Particles)

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20040075687 NASA Marshall Space Flight Center, Huntsville, AL, USA

MSFC Nuclear Propulsion Materials Development

Rogers, J. R.; Cook, B.; [2004]; 1 pp.; In English; Tri-Lateral Alliance Collaborative Technical Forum, 4-6 May 2004, Chattanooga, TN, USA; No Copyright; Avail: Other Sources; Abstract Only

Nuclear propulsion systems for spacecraft applications present numerous technical challenges for propulsion systems. They have been the focus of a recent NRA. Challenges inclue: a nuclear reactor subsystem to produce thermal energy; a power conversion subsystem to convert the thermal energy into electrical energy; a propulsion subsystem that utilizes Hall effect thrusters; thruster technologies and high temperature materials to support subsystems. The MSFC Electrostatic Levitation

(ESL) Facility provides an ideal platform for the study of high temperature and reactive materials. An overview of the facility and its capabilities will be presented.
Author
Nuclear Propulsion; Research Facilities

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*.

20040074989 Lawrence Livermore National Lab., Livermore, CA
LLNL Inductrack Progress Report - February 99 through November 99
Louann, T.; Mar. 08, 2000; In English
Report No.(s): DE2004-15006007; UCRL-CR-138459; No Copyright; Avail: National Technical Information Service (NTIS)

The report consists of a collection of monthly progress reports for the time frame February 1999- November 1999, for the 'Inductrack' project at Lawrence Livermore National Laboratory (LLNL). Short summaries of progress, along with financials, and personnel involved are included in each progress report.
NTIS
Levitation; Personnel; Magnetic Induction

20040075180 Panametrics, Inc., Waltham, MA
Design Develop Test and Deliver a Protoflight Medium-to-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package
Belue, Jeffrey E.; Hanser, Frederick A.; Morel, Paul R.; Mar. 11, 2004; 24 pp.; In English
Contract(s)/Grant(s): F19628-95-C-0196; Proj-2822
Report No.(s): AD-A423079; AFRL-VS-HA-TR-2004-1035; No Copyright; Avail: CASI; A03, Hardcopy

An electron spectrometer has been designed to measure electron flux in the range of 3 to 30 MeV. A breadboard unit was designed and tested, using a solid state detector telescope for geometric factor definition and a Cerenkov radiator/PMT for energy measurement. The measured response to electrons was very broad, so the Cerenkov radiator was redesigned as a larger volume with larger PMTs to improve the energy resolution. The modified Cerenkov radiator/PMT assembly was tested, and a protoflight unit is being fabricated. The protoflight electron spectrometer was originally scheduled to be integrated to the Small Onboard Environmental Diagnostic Sensors (SOBEDS) Package, but this has been canceled. The protoflight is mostly complete, except for the spacecraft electrical interface design, which was on hold until a spacecraft interface was specified. The protoflight sensor is in a configuration where it can be modified for a future flight, using any likely spacecraft interface.
DTIC
Electron Counters; Electron Spectroscopy; High Energy Electrons; Spectrometers

20040075516 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Reusable Space Vehicle Baseline Conceptual Vehicle
Maynard, Dennis R.; Pettit, Patricia; Mar. 2004; 166 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422942; AFIT/GLM/ENS/04-12; No Copyright; Avail: CASI; A08, Hardcopy

Modeling efforts for future space operation vehicles at the USA Air Force Research Labs Air Vehicles Directorate have been focused towards the in flight mission. To better serve the research and development effort, a simulation of the ground operations is required allowing for trade-offs within turnaround operations and between the components that drive those procedures. However, before a simulation can be developed a conceptual model must be generated to guide the model building process. This research provides a baseline conceptual model for reusable space vehicles based on the space shuttle as the only operational vehicle of its kind. The model is built utilizing the Integrated Definition (IDEF) methodology, specifically IDEF3. IDEF3 is focused towards process-viewpoint diagramming and layout. The model is developed using the hierarchical development capabilities of the IDEF3 methodology and is broken into modules allowing for greater reuse and usability. This model captures the scheduled maintenance performed to turnaround the space shuttle for the next launch but does not contain every activity. The idea was to capture the baseline activities that may be found in future Reusable Space Vehicles and provide

a description of what happens at Kennedy Space Center when preparing the space shuttle for the next launch.
DTIC
Reusable Spacecraft; Support Systems; Models

20040075735 NASA Ames Research Center, Moffett Field, CA, USA
Aerothermal Analysis of the X-34 Vehicle
Green, Mike; Prabhu, Dinesh; Palmer, Grant; Loomis, Mark P.; Venkatapathy, Ethiraj; Kontinos, Dean; Henline, William; Polsky, Susan; Papadopoulos, Periklis; Davies, Carol B.; Research and Technology 1997; September 1998, pp. 84-86; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The X-34 vehicle will provide the first flight demonstration under NASA's Reusable Launch Vehicle (RLV) program of a fully reusable launch vehicle. Under a fixed-price contract with NASA, Orbital Sciences Corporation (OSC) i s to provide a Mach 8 suborbital RLV technology demonstrator. The vehicle i s 18.3 meters in length, has a wingspan of 8.4 meters, and is powered by a single LOX-kerosene engine. The X-34 i s carried below an L-101 1 aircraft to an altitude in excess of 9 kilometers, where the vehicles separate, the X-34 engine starts, and the X-34 vehicle continues along its flight trajectory. The first flight is scheduled for 1999. Under a cooperative agreement with OSC, Ames Research Center was given the responsibility for designing, analyzing, and fabricating the thermal protection system (TPS) of the X-34 nosecap, wing leading edges, and rudder leading edge. Temperature, pressure, and heating rates on the surface of the X-34 were computed at six points along the X I 004701 Mach 8.5 no-bounce trajectory. The work focused on the nosecap, wingstrake leading edges, and the rudder leading edge. These areas are protected from the thermal environments experienced during flight by silicone-impregnated reusable ceramic ablator tiles.
Derived from text
X-34 Reusable Launch Vehicle; Thermal Protection; Aerothermodynamics

20040075736 NASA Ames Research Center, Moffett Field, CA, USA
Sharp Leading Edges for Hypervelocity Vehicles
Salute, Joan S.; Kolodziej, Paul; Bull, Jeffrey D.; Research and Technology 1997; September 1998, pp. 87-88; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Recent research shows that ultra-high temperature ceramics (UHTCs) may enable sharp leading edges to be used on space vehicles. Sharp leading edges (51 centimeter) could enable an entire new design space for hypervelocity vehicles with decreased drag, increased cross-range capability, and reduced cost-to-orbit. These factors, combined with results from ground-based testing and analysis, led to the implementation of the first UHTC flight demonstration. The objective of this flight was to validate the nonablating pertormance of a UHTC sharp leading edge by comparing flight data Lvith theorized material performance data. Implementation of the UHTC flight demonstration was a joint effort by Ames Research Center, Sandia National Laboratories, and the U.S. Air Force.
Derived from text
Sharp Leading Edges; Reentry Vehicles

20040077100 NASA Ames Research Center, Moffett Field, CA, USA
Ballistic Range Tests Verify Stability of a Loaf-Shaped Entry Vehicle
Gage, Peter; Allen, Gary; Park, Chul; Brown, Jeff; Wercinski, Paul; Tam, Tim; Research and Technology 1999; December 2000, pp. 79-80; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

An entry vehicle whose shape resembles that of a loaf of bread has been proposed for missions to be flown as secondary payloads on the Ariane V launch vehicle. This shape conforms well within the volume available inside the Ariane structure for auxiliary payloads, and provides a much more efficient and larger internal packaging capability for the given launch-vehicle constraints than the conventional sphere-cone geometry (such as that of the Mars-Pathfinder entry vehicle). Because aerodynamic stability for this new class of vehicles must be evaluated, initial ballistic range testing was conducted to assess the supersonic behavior of loaf-shape vehicles. A shadowgraph image of the ballistic range model flying at supersonic speeds is presented.
Derived from text
Ballistic Ranges; Stability; Rotary Wing Aircraft; Aerodynamic Stability; Ariane 5 Launch Vehicle

16
SPACE TRANSPORTATION AND SAFETY

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

20040075041 NASA Langley Research Center, Hampton, VA, USA

A Summary of the Space Shuttle Columbia Tragedy and the Use of LS Dyna in the Accident Investigation and Return to Flight Efforts

Melis, Matthew; Carney, Kelly; Gabrys, Jonathan; Fasanella, Edwin L.; Lyle, Karen H.; [2004]; 8 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA

Contract(s)/Grant(s): 23-376-70-30; No Copyright; Avail: CASI; A02, Hardcopy

On February 1, 2003, the Space Shuttle Columbia broke apart during reentry resulting in loss of 7 crewmembers and craft. For the next several months an extensive investigation of the accident ensued involving a nationwide team of experts from NASA, industry, and academia, spanning dozens of technical disciplines. The Columbia Accident Investigation Board (CAIB), a group of experts assembled to conduct an investigation independent of NASA concluded in August, 2003 that the cause of the loss of Columbia and its crew was a breach in the left wing leading edge Reinforced Carbon-Carbon (RCC) thermal protection system initiated by the impact of thermal insulating foam that had separated from the orbiters external fuel tank 81 seconds into the missions launch. During reentry, this breach allowed superheated air to penetrate behind the leading edge and erode the aluminum structure of left wing which ultimately led to the breakup of the orbiter. In order to gain a better understanding the foam impact on the orbiters RCC wing leading edge, a multi-center team of NASA and Boeing impact experts was formed to characterize the foam and RCC materials for impact analysis using LS Dyna. Dyna predictions were validated with sub-component and full scale tests. LS Dyna proved to be a valuable asset in supporting both the Columbia Accident Investigation and NASA s return to flight efforts. This paper summarizes Columbia Accident and the nearly seven month long investigation that followed. The use of LS-DYNA in this effort is highlighted. Contributions to the investigation and return to flight efforts of the multicenter team consisting of members from NASA Glenn, NASA Langley, and Boeing Philadelphia are introduced and covered in detail in papers to follow in these proceedings.

Author

Accident Investigation; Thermal Insulation; Thermal Protection; Full Scale Tests; Columbia (Orbiter); Prediction Analysis Techniques

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20040076912 NASA Marshall Space Flight Center, Huntsville, AL, USA

Spaceflight Operations Services Grid (SOSG) Project

Bradford, Robert; Lisotta, Anthony; 2004; 21 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: CASI; A03, Hardcopy

The motivation, goals, and objectives of the Space Operations Services Grid Project (SOSG) are covered in this viewgraph presentation. The goals and objectives of SOSG include: 1) Developing a grid-enabled prototype providing Space-based ground operations end user services through a collaborative effort between NASA, academia, and industry to assess the technical and cost feasibility of implementation of Grid technologies in the Space Operations arena; 2) Provide to space operations organizations and processes, through a single secure portal(s), access to all the information technology (Grid and Web based) services necessary for program/project development, operations and the ultimate creation of new processes, information and knowledge.

CASI

Communication Networks; Spacecraft Communication; Ground Support Systems

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20040075650 NASA, Washington, DC, USA
Space Shuttle: The Renewed Promise
McAleer, Neil; [1989]; 25 pp.; In English
Report No.(s): NASA-PAM-521; No Copyright; Avail: CASI; A03, Hardcopy

NASA celebrated its 30th anniversary in 1988, two days after the Space Shuttle soared into space once more. When Congress approved the creation of the National Aeronautics and Space Administration in 1958, the USA had successfully launched only four small satellites and no American astronaut had yet flown in space. In the three decades since, four generations of manned spacecraft have been built and flown, twelve men have walked on the Moon, more than 100 Americans have flown and worked in space, and communications satellites and other Space-Age technologies have transformed life on planet Earth. When NASA's Golden Anniversary is celebrated in 2008, it is likely that men and women will be permanently living and working in space. There may be a base on the Moon, and a manned mission to Mars may only be years away. If a brief history of the first half-century of the Space Age is written for that event, it will show clearly how the exploration of space has altered the course of human history and allowed us to take a better hold of our destiny on and off planet Earth.
Derived from text
NASA Programs; Space Exploration; Space Shuttles

20040075655 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
NASA IKONOS Radiometric Characterization
Pagnutti, Mary; Frisbee, Troy; Zanoni, Vicki; Blonski, Slawek; Daehler, Erik; Grant, Brennan; Holekamp, Kara; Ryan, Robert; Sellers, Richard; Smith, Charles, et al.; March 25, 2002; 32 pp.; In English; High Spatial Resolution Commercial Imagery Workshop-IKONOS, 22 Mar. 2002, Reston, VA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-03-00021-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this program: Perform radiometric vicarious calibrations of IKQNOS imagery and compare with Space Imaging calibration coefficients The approach taken: utilize multiple well-characterized sites which are widely used by the NASA science community for radiometric characterization of airborne and spaceborne sensors; and to Perform independent characterizations with independent teams. Each team has slightly different measurement techniques and data processing methods.
Derived from text
Radiosondes; Satellite Imagery

20040077040 NASA Langley Research Center, Hampton, VA, USA
Cloud-Aerosol LIDAR and Infrared Pathfinder Satellite Observation (CALIPSO) Spacecraft: Independent Technical Assessment
Gilbrech, Richard J.; McManamen, John P.; Wilson, Timmy R.; Robinson, Frank; Schoren, William R.; June 2004; 75 pp.; In English
Contract(s)/Grant(s): WU 104-08-00
Report No.(s): NASA/TM-2004-213231/VERSION-0.01; NESC-RP-04-01/03-001-E-Version-0.01; L-18363/VERSION-0.01; No Copyright; Avail: CASI; A04, Hardcopy

CALIPSO is a joint science mission between the CNES, LaRC and GSFC. It was selected as an Earth System Science Pathfinder satellite mission in December 1998 to address the role of clouds and aerosols in the Earth's radiation budget. The spacecraft includes a NASA light detecting and ranging (LIDAR) instrument, a NASA wide-field camera and a CNES imaging infrared radiometer. The scope of this effort was a review of the Proteus propulsion bus design and an assessment of the potential for personnel exposure to hydrazine propellant.
Author
Propulsion; Hydrazines; Propellants; Earth Radiation Budget; Earth Sciences; Aerosols

20040077094 NASA Ames Research Center, Moffett Field, CA, USA

Application of Rotary-wing Technologies to Planetary Science Missions

Young, Larry A.; Research and Technology 1999; December 2000, pp. 78-79; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The next few years promise a unique convergence of NASA aeronautics and space programs. NASA planetary science missions are becoming increasingly more sophisticated and this will ultimately culminate, in part, in the development of planetary aerial vehicles (PAVs). Early work in this area has principally focused on conceptual design of fixed-wing aircraft configurations for Martian exploration. However, autonomous vertical-lift vehicles- and rotary-wing technologies in general-hold considerable potential for supporting planetary science and exploration missions. and Titan, vertical-lift vehicles (using rotors as the means of propulsion) could potentially be developed and flown to support robotic science missions to these two planets and Saturn's moon. For missions to Jupiter, Saturn, Uranus, and Neptune, vertical-lift capability is not required for PAVs supporting scientific investigations of the gas-giant planets. However, rotary-wing technologies, such as aeromechanics for PAV propeller design, could still be applicable for vehicles developed for these planets.

Derived from text

Rotary Wings; Vehicles; Aircraft Design

20040077103 NASA Ames Research Center, Moffett Field, CA, USA

Web-Based Analyses for Vehicle Engineering

Wright, Michael; Gage, Peter; Prabhu, Dinesh; Papadopoulos, Periklis; Olejniczak, Joe; Olynick, Dave; Research and Technology 1999; December 2000, pp. 82-83; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The preliminary design of an aerospace vehicle is a complex task, one that requires the collaborative effort of a group of engineers using many different engineering analysis software packages. During the early stages, the design goes through frequent changes from the original baseline, each change requiring parametric modifications to the computational models. Typically, no single person is proficient in the use of all of the required software, which means that the resident experts in each software package are tasked to spend considerable time making small, repetitive changes to the baseline models. In this project we seek to automate this process by building a Hypertext Markup Language (HTML) based user interface called WAVE (web-based analyses for vehicle engineering) which ties a subset of the capabilities of a set of engineering analysis tools into a straightforward uniform package that can be used by a design engineer who is not familiar with the details of the analysis software. parameterized models of the vehicle systems and environment, and then determine the best solution procedure for the given task. A customized interface is then built for the vehicle within WAVE that ties all of the analytical tools together. During the design process, the end user is presented with a subset of the capabilities of the original analysis software, consisting of only those parameters that have been chosen to vary during preliminary design.

Author

Aerospace Vehicles; Design Analysis; Software Engineering

20040077104 NASA Ames Research Center, Moffett Field, CA, USA

Aerodynamic Shape Optimization of the X-37 Configuration for Improved Stability and Performance

Cliff, Susan; Research and Technology 1999; December 2000, pp. 84-85; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this work was to apply numerical shape optimizations to the X-37 in order to improve its longitudinal stability and performance during descent. Wind tunnel test results for this vehicle, which were designed by Boeing at Seal Beach, California, showed longitudinal instability at Mach numbers between 0.6 and 1.5 and at moderate to high angles of attack. The instability was attributed to flow separation from the wing and tails. As part of the X-3 7 development program, Ames was requested to assist in refining this configuration through the use of numerical-optimization techniques developed under the High Speed Research Program.

Author

X-37 Vehicle; Shape Optimization; Flow Characteristics

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20040074348 Missouri Univ., Rolla, MO, USA

Development of a Self-calibrating Dissolved Oxygen Microsensor Array for the Monitoring and Control of Plant Growth in a Space Environment

Kim, Chang-Soo; Brown, Christopher S.; Nagle, H. Troy; 2004; 64 pp.; In English

Contract(s)/Grant(s): NAG9-1423; NRA-01-OBPR-01; No Copyright; Avail: CASI; A04, Hardcopy

Plant experiments in space will require active nutrient delivery concepts in which water and nutrients are replenished on a continuous basis for long-term growth. The goal of this study is to develop a novel microsensor array to provide information on the dissolved oxygen environment in the plant root zone for the optimum control of plant cultivation systems in the space environment. Control of water and oxygen is limited by the current state-of-the-art in sensor technology. Two capabilities of the new microsensor array were tested. First, a novel in situ self-diagnosis/self-calibration capability for the microsensor was explored by dynamically controlling the oxygen microenvironment in close proximity to an amperometric dissolved oxygen microsensors. A pair of integrated electrochemical actuator electrodes provided the microenvironments based on water electrolysis. Miniaturized thin film dissolved oxygen microsensors on a flexible polyimide (Kapton(Registered Trademark)? substrate were fabricated and their performances were tested. Secondly, measurements of dissolved oxygen in two representative plant growth systems were made, which had not been performed previously due to lack of proper sensing technology. The responses of the oxygen microsensor array on a flexible polymer substrate properly reflected the oxygen contents on the surface of a porous tube nutrient delivery system and within a particulate substrate system. Additionally, we demonstrated the feasibility of using a 4-point thin film microprobe for water contents measurements for both plant growth systems. mechanical flexibility, and self-diagnosis. The proposed technology is anticipated to provide a reliable sensor feedback plant growth nutrient delivery systems in both terrestrial environment and the microgravity environment during long term space missions. The unique features of the sensor include small size and volume, multiple-point sensing,

Author

Aerospace Environments; Vegetation Growth; Plant Roots; Moisture Content; Microinstrumentation; Dissolved Gases; Calibrating; Sensors

20
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*.

20040074518 Lawrence Livermore National Lab., Livermore, CA

Coal-Fired Power Plant with Zero Atmospheric Emissions

Martinez-Frias, J.; Aceves, S. M.; Smith, J. R.; Brandt, H.; May 27, 2003; In English

Report No.(s): DE2004-15005879; UCRL-JC-153441; No Copyright; Avail: National Technical Information Service (NTIS)

This paper presents the thermodynamic analysis of a coal-based zero-atmospheric emissions electric power plant. The approach involves an oxygen-blown coal gasification unit. The resulting synthetic gas (syngas) is combusted with oxygen in a gas generator to produce the working fluid for the turbines. The combustion produces a gas mixture composed almost entirely of steam and carbon dioxide. These gases drive multiple turbines to produce electricity. The turbine discharge gases pass to a condenser where water is captured. A stream of carbon dioxide then results that can be used for enhanced oil recovery, or for sequestration.

NTIS

Carbon Dioxide; Thermodynamics; Synthesis Gas

20040075603 Alabama Univ., Huntsville, AL, USA

Combustion Instability Analysis and the Effects of Drop Size on Acoustic Driving Rocket Flow

Harper, Brent, Technical Monitor; Ellison, L. Renea; Moser, Marlow D.; May 13, 2004; 6 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA

Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A02, Hardcopy

High frequency combustion instability, the most destructive kind, is generally solved on a per engine basis. The instability often is the result of compounding acoustic oscillations, usually from the propellant combustion itself. To counteract the instability the chamber geometry can be changed and/or the method of propellant injection can be altered. This experiment will alter the chamber dimensions slightly; using a cylindrical shape of constant diameter and the length will be varied from six to twelve inches in three-inch increments. The main flowfield will be the products of a high OF hydrogen/oxygen flow. The liquid fuel will be injected into this flowfield using a modulated injector. It will allow for varied droplet size, feed rate, spray pattern, and location for the mixture within the chamber. The response will be deduced from the chamber pressure oscillations.

Author

Combustion Stability; Drop Size; Rocket Flight

20040075665 NASA Marshall Space Flight Center, Huntsville, AL, USA

Transient Simulation of the Integrated Powerhead Demonstrator (IPD) Rocket Engine

Guidos, Mike; Seymour, Dave; September 1, 2003; 2 pp.; In English; JANNAF 52nd Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

The IPD rocket engine is the product of a joint Air Force/NASA program to demonstrate the concept of a full-flow staged combustion power cycle. In this type of rocket engine cycle, both the entire fuel flow and the entire oxidizer flow are combusted in one of two pre-bumers and used to drive two turbopumps, thus utilizing the flow work of the total propellant flow. The basis of the IPD engine program relies on integrating newly developed and pre-existing hardware to demonstrate the component and material technologies to make this concept feasible, while simultaneously saving development time and costs. To provide insight to the project team and contractors during engine development and test phases, the engine system was modeled at MSFC using the Rocket Engine Transient Simulation (ROCETS) software to analyze system performance and determine component integration issues. The ROCETS software is used extensively a MSFC to perform steady-state power-balances and transient simulations of thermodynamic power and general fluid systems. The software is favored for its capability to solve large systems of non-linear equations, its librarie of fluid properties and flow devices, its flexibility to modify existing code to improve the physics-derived approximations of real fluid thermodynamic behavior, and the ability to add unique system constraints. The purpose of this paper is to present the methodology used to model the IPD engine system, detail the pitfalls encountered with the software, and explain the approximations made to more accurately represent engine component and fluid behavior. Engine system performance output from the model will be presented and explained in comparison with real fluid and component behavior.

Author

Rocket Engines; Computerized Simulation; Turbine Pumps; Performance Prediction; Fuel Flow

20040075674 Purdue Univ., West Lafayette, IN, USA, Alabama Univ., Huntsville, AL, USA

Computational Simulation of Acoustic Modes in Rocket Combustors

Harper, Brent, Technical Monitor; Merkle, C. L.; Sankaran, V.; Ellis, M.; May 13, 2004; 9 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA

Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A02, Hardcopy

A combination of computational fluid dynamic analysis and analytical solutions is being used to characterize the dominant modes in liquid rocket engines in conjunction with laboratory experiments. The analytical solutions are based on simplified geometries and flow conditions and are used for careful validation of the numerical formulation. The validated computational model is then extended to realistic geometries and flow conditions to test the effects of various parameters on chamber modes, to guide and interpret companion laboratory experiments in simplified combustors, and to scale the measurements to engine operating conditions. In turn, the experiments are used to validate and improve the model. The present paper gives an overview of the numerical and analytical techniques along with comparisons illustrating the accuracy of the computations as a function of grid resolution. A representative parametric study of the effect of combustor mean flow Mach number and combustor aspect ratio on the chamber modes is then presented for both transverse and longitudinal modes. The results show that higher mean flow Mach numbers drive the modes to lower frequencies. Estimates of transverse wave mechanics in a high aspect ratio

combustor are then contrasted with longitudinal modes in a long and narrow combustor to provide understanding of potential experimental simulations.
Author
Acoustic Properties; Combustion Chambers; Computational Fluid Dynamics; Simulation; Combustion Stability; Liquid Propellant Rocket Engines

20040075679 Alabama Univ., Huntsville, AL, USA
The Rocket Engine Advancement Program 2 (REAP2)
Harper, Brent, Technical Monitor; Hawk, Clark W.; May 10, 2004; 5 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A01, Hardcopy

The Rocket Engine Advancement Program (REAP) 2 program is being conducted by a university propulsion consortium consisting of the University of Alabama in Huntsville, Penn State University, Purdue University, Tuskegee University and Auburn University. It has been created to bring their combined skills to bear on liquid rocket combustion stability and thrust chamber cooling. The research team involves well established and known researchers in the propulsion community. The cure team provides the knowledge base, research skills, and commitment to achieve an immediate and continuing impact on present and future propulsion issues. through integrated research teams composed of analysts, diagnosticians, and experimentalists working together in an integrated multi-disciplinary program. This paper provides an overview of the program, its objectives and technical approaches. Research on combustion instability and thrust chamber cooling are being accomplished
Author
Propulsion; Rocket Engines; University Program

20040075690 NASA Marshall Space Flight Center, Huntsville, AL, USA
Outbrief - Long Life Rocket Engine Panel
Quinn, Jason Eugene; 2004; 11 pp.; In English; JANNAF Meeting, 19 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

This white paper is an overview of the JANNAF Long Life Rocket Engine (LLRE) Panel results from the last several years of activity. The LLRE Panel has met over the last several years in order to develop an approach for the development of long life rocket engines. Membership for this panel was drawn from a diverse set of the groups currently working on rocket engines (Le. government labs, both large and small companies and university members). The LLRE Panel was formed in order to determine the best way to enable the design of rocket engine systems that have life capability greater than 500 cycles while meeting or exceeding current performance levels (Specific Impulse and Thrust/Weight) with a 1/1,OOO,OOO likelihood of vehicle loss due to rocket system failure. After several meetings and much independent work the panel reached a consensus opinion that the primary issues preventing LLRE are a lack of: physics based life prediction, combined loads prediction, understanding of material microphysics, cost effective system level testing. and the inclusion of fabrication process effects into physics based models. With the expected level of funding devoted to LLRE development, the panel recommended that fundamental research efforts focused on these five areas be emphasized.
Author
Rocket Engines; Specific Impulse; Life (Durability); Cost Effectiveness

20040075886 Pennsylvania State Univ., University Park, PA, USA
Performance and Stability Characteristics of a Uni-Element Swirl Injector for Oxygen-Rich Stage Combustion Cycles
Pal, S.; Kalitan, D.; Woodward, R. D.; Santoro, R. J.; May 13, 2004; 11 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A03, Hardcopy

A uni-element liquid propellant combustion performance and instability study for liquid RP-1 and hot oxygen-rich pre-burner products was conducted, at a chamber pressure of about 1000 psi. using flush and recessed swirl injectors. High-frequency pressure transducer measurements were analyzed to yield the characteristic frequencies which were compared to expected frequencies of the chamber. Modes, which were discovered to be present within the main chamber included, the first longitudinal, detected at approximately 1950 Hz, and the second longitudinal mode at approximately 3800 Hz. An additional first longitudinal quarter wave mode was measured at a frequency of approximately 23000 Hz for the recessed swirl

injector configuration. The characteristic instabilities resulting from these experiments were relatively weak averaging 0.2% to 0.3% of the chamber pressure.
Author
Injectors; Rp-1 Rocket Propellants; Combustion Stability; Propellant Combustion

20040075889 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA's In-Space Propulsion Technology Program: Overview and Status
Johnson, Les; Alexander, Leslie; Baggett, Randy; Bonometti, Joe; Herrmann, Melody; James, Bonnie; Montgomery, Sandy; [2004]; 10 pp.; In English; 52nd Joint Army-Navy-NASA-Air Force Propulsion Meeting, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

NASA's In-Space Propulsion Technology Program is investing in technologies that have the potential to revolutionize the robotic exploration of deep space. For robotic exploration and science missions, increased efficiencies of future propulsion systems are critical to reduce overall life-cycle costs and, in some cases, enable missions previously considered impossible. Continued reliance on conventional chemical propulsion alone will not enable the robust exploration of deep space - the maximum theoretical efficiencies have almost been reached and they are insufficient to meet needs for many ambitious science missions currently being considered. The In-Space Propulsion Technology Program s technology portfolio includes many advanced propulsion systems. From the next generation ion propulsion system operating in the 5 - 10 kW range, to advanced cryogenic propulsion, substantial advances in spacecraft propulsion performance are anticipated. Some of the most promising technologies for achieving these goals use the environment of space itself for energy and propulsion and are generically called, 'propellantless' because they do not require onboard fuel to achieve thrust. Propellantless propulsion technologies include scientific innovations such as solar sails, electrodynamic and momentum transfer tethers, aeroassist, and aerocapture. This paper will provide an overview of both propellantless and propellant-based advanced propulsion technologies, and NASA s plans for advancing them as part of the $60M per year In-Space Propulsion Technology Program.
Author
Spacecraft Propulsion; Aerocapture; Solar Electric Propulsion; Solar Sails; Ion Engines; Solar Thermal Propulsion; Tetherlines

20040075903 Lawrence Livermore National Lab., Livermore, CA
Pressure Measurements in a PBX 9501 Gauged Acceptor when Impacted by a Steel Plate that is Accelerated by a Thermally Cooked off PBX 9501 Charge
Forbes, J. W.; Garcia, F.; Urtiew, P. A.; Vandersall, K. S.; Greenwood, D. W.; Mar. 11, 2002; 16 pp.; In English
Report No.(s): DE2004-15006877; UCRL-JC-145652; No Copyright; Avail: Department of Energy Information Bridge

Measuring the violence of a thermal explosion of a cased explosive is important for evaluating safety issues of explosive devices in fires. A sympathetic initiation scenario was studied here where a 9.0 cm diameter by 2.5 cm thick disc of PBX 9501 donor charge encased in a 304 stainless steel assembly was heated on top and bottom flat surfaces until it thermally exploded. The initial heating rate at the metal/explosive interface was 5 C per minute until it reaches 170 C; then this temperature is held for 35 minutes to allow temperature equilibration to within a few degrees throughout the explosive. The heating resumed at a rate of 1 C per minute until the PBX 9501 donor thermally exploded. A PBX 9501 acceptor charge with carbon resistor and manganin foil pressure gauges inserted at various depths was placed at a 10 cm standoff distance from the donor charge's top steel cover plate. Piezoelectric arrival time pins were placed in front of the acceptor surface to measure the velocity and shape of the impacting plate. The stainless steel cover plate of the donor charge had a nominal velocity of 0.55(+-) 0.04 mm/(micro)s upon impact and was non-symmetrically warped. The impact of the tilted curved plate induced a three-dimensional compression wave into the acceptor. The rise times of the pressure waves were nominally 1.5(micro)s with the closest carbon resistor gauges giving peak pressure of 10 kb that decayed to 3 kb for a wave run distance of 2. 4 cm.
NTIS
Acceptor Materials; Radiochemistry; Nuclear Chemistry; Combustion

20040076885 NASA Marshall Space Flight Center, Huntsville, AL, USA
Liquid-Metal-Fed Pulsed Electromagnetic Thrusters For In-Space Propulsion
Markusic, T. E.; [2004]; 11 pp.; In English; JANNAF Conference, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

We describe three pulsed electromagnetic thruster concepts, which span four orders of magnitude in power processing capability (100 W to >100 kW), for in-space propulsion applications. The primary motivation for using a pulsed system

is to is to enable high (instantaneous) power operation, which provides high acceleration efficiency, while using considerably less (continuous) power from the spacecraft power system. Unfortunately, conventional pulsed thrusters require failure-prone electrical switches and gas-puff valves. The series of thrusters described here directly address this problem, through the use of liquid metal propellant, by either eliminating both components or providing less taxing operational requirements, thus yielding a path toward both efficient and reliable pulsed electromagnetic thrusters. The emphasis of this paper is to conceptually describe each of the thruster concepts; however, initial test results with gallium propellant in one thruster geometry are presented. These tests reveal that a greater understanding of gallium material compatibility, contamination, and wetting behavior will be necessary before a completely functional thruster can be developed. Initial experimental results aimed at providing insight into these issues are presented.
Author
Electromagnetic Propulsion; Spacecraft Propulsion; Liquid Metals; Metal Propellants

20040076914 NASA Marshall Space Flight Center, Huntsville, AL, USA
Plasma Propulsion Research at NASA Marshall Space Flight Center
Sheehy, Jeffrey A.; 2004; 1 pp.; In English; JANNAF Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

The Propulsion Research Center at NASA Marshall Space Flight Center is pursuing a range of research efforts aimed at identifying and developing new technologies for primary spacecraft propulsion. Efficient high-power electric propulsion (Ep) thrusters are a particular area of emphasis; these would enable the relatively rapid transit of large payloads about the solar system for unmanned or manned science and exploration. Such a mission would make heavy demands on the propulsion system, which may be required to run reliably for several years at a specific impulse approaching 10,OOO s with an efficiency of turning electrical power into jet power of at least 70%. The transit time to a destination scales approximately inversely with the cube root of the specific power, which is the ratio of jet power to power-plant mass. Consequently, reducing a trip time by half requires roughly an eight-fold increase in specific power. Given a renewed NASA commitment to space nuclear power, developing efficient EP thrusters with high jet power (> 100 kW) would seem to provide the most direct means of significantly increasing the specific power and hence reducing trip times. In particular, electromagnetic devices, with their high inherent thrust densities, should be better suited to high power applications than thrusters which depend exclusively on electrostatic forces for propellant acceleration.
Derived from text
Plasma Propulsion; Electric Propulsion; Spacecraft Propulsion; Electrostatics; Specific Impulse

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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*.

20040074474 Lockheed Martin Corp., Syracuse, NY, USA
Effect of Substrate Orientation on Phase Separation in Epitaxial GaInAsSb
Wang, C. A.; Calawa, D. R.; Vineis, C. J.; Apr. 2001; 22 pp.; In English
Report No.(s): DE2004-822095; LM-01K032; No Copyright; Avail: Department of Energy Information Bridge

The effect of substrate misorientation on phase separation in Ga(sub 1-x)In(sub x)As(sub y)Sb(sub 1-y) nominally lattice-matched to GaSb is reported. The layers were grown at 575 C by organometallic vapor phase epitaxy on vicinal (001) GaSb substrates, miscut 2(sup o)(yields) (-111)A, (1-11)B, or (101). Ga(sub 1-x)In(sub x)As(sub y)Sb(sub 1-y) (x(approx) 0.1, y(approx) 0.09) layers, which have 300-K photoluminescence (PL) peak emission at(approx)2. 1(micro)m, grow step-bunched and exhibit minimal phase separation. The full width at half maximum of 4-K PL spectra is slightly smaller at 7 meV for layers grown on substrates miscut toward (1-11)B compared to 9 meV for layers grown on substrates miscut toward (-1-11)A and (101). Ga(sub 1-x)In(sub x)As(sub y)Sb(sub 1-y) layers with higher alloy composition (0.16(le) x(le) 0. 19, 0.14(ge) y(le) 0.17), which have 300-K PL peak emission at(approx)2.4(micro)m, have significant phase separation. These layers are characterized by increased lattice constant variations and epitaxial tilt, broad PL spectra with significant band tailing, and strong contrast modulation in transmission electron microscopy. The degree of decomposition depends on substrate miscut direction: Ga(sub 1-x)In(sub x)As(sub y)Sb(sub 1-y) layers grown on (001) 2(sup o)(yields) (1-11)B substrates are more homogeneous than those grown on (001) 2(sup o)(yields) (-1-11)A and (001) 2(sup o)(yields) (101) substrates. The results are

attributed to the smaller adatom diffusion length on substrates miscut toward (1-11)B.
NTIS
Electron Microscopy; Substrates; Alloys; Vapor Phase Epitaxy

20040075033 Georgia Tech Research Inst., Atlanta, GA, USA
Rapid Measurements of Aerosol Ionic Composition and 3-10 nm Particle Size Distributions On The NASA P3 To Better Quantify Processes Affecting Aerosols Advected From East Asia
Weber, Rodney J.; May 2004; 3 pp.; In English
Contract(s)/Grant(s): NCC1-411; No Copyright; Avail: CASI; A01, Hardcopy

The Particle Into Liquid Sample (PILS) was deployed on the NASA P3 for airborne measurements of fine particle ionic chemical composition. The data have been quality assured and reside in the NASA data archive. We have analyzed our data to characterize the sources and atmospheric processing of fine aerosol particles advected from the region during the experiments. Fine particle water-soluble potassium was found to serve as a useful aerosol tracer for biomass smoke. Ratios of PILS potassium to sulfate are used as a means of estimating the percent contribution of biomass burning to fine particle mass in mixed plumes advecting from Asia. The high correlations between K+ and NO3(sup -) and NH4(sup +)' indicated that biomass burning was a significant source of these aerosol compounds in the region. It is noteworthy that the air mass containing the highest concentrations of fine particles recorded in all of ACE-Asia and TRACE-P appeared to be advecting from the Bejing/Tientsin urban region and also had the highest K(+), NO3(sup -) and NH4(sup +) concentrations of both studies. Based on K+/SO4(sup 2-) ratio's, we estimated that the plume was composed of approx. 60% biomass burning emissions, possibly from the use of bio-fuels in the urban regions.
Derived from text
Aerosols; Ion Concentration; Size Distribution; Biomass Burning

20040075090 Baylor Coll. of Medicine, Houston, TX
Atomic Crystal Structure of an Organophosphorus Acid Anhydrolase
Quiocho, Florante A.; Nickitenko, Alexei; May 9, 2004; 4 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0015
Report No.(s): AD-A422943; ARO-41939.1-CH; No Copyright; Avail: CASI; A01, Hardcopy

The major aim is to determine the three- dimensional atomic structure of an organophosphorus acid anhydrolase (OPAA) by x ray crystallography. This structure is a prerequisite for remodeling the active site, in collaboration with scientists at ECBC and Geo-Centers, Inc. in order to enhance catalytic activity towards fluorinated U-type and other extremely toxic chemical warfare (CW) nerve agents. A decontamination system based on the remodeled OPAA not only provides rapid removal of CW agents, but is also enviromnentally safe and noncorrosive in nature. After overcoming the major difficulty in crystallizing OPAA, we have now determined by MAD and SAD techniques and refined the crystal structure of OPAA to 2.5 A resolution. The structure analysis of OPAA with the bound enzyme inhibitor MIPAFOX (N,N'- di-isopropylphosphorodiamidic fluoride) is in progress.
DTIC
Atomic Structure; Crystal Structure; Organic Phosphorus Compounds

20040075093 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Deviation of Time-Resolved Luminescence Dynamics in MWIR Semiconductor Materials from Carrier Recombination Theory Predictions
Johnson, Peter M.; Mar. 12, 2004; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422950; AFIT/GEO/ENP/04-2; No Copyright; Avail: CASI; A05, Hardcopy

Time resolved luminescence spectroscopy was used to characterize luminescence decay curves for a bulk InAs sample and an InAsSb type-I quantum-well sample over the first 3ns following excitation. The luminescence decay curves were then converted to carrier densities and used to find recombination coefficients that provided the least-squared- error solution of the rate equation describing carrier recombination. Recombination coefficients describing Shockley Read-Hall (A(sub SRH)) radiative (B(sub rad)) and Anger (C(sub Aug)) recombination were determined at two different temperatures and four excitation powers, then analyzed for consistency and physical significance. For all of the resulting least squares fits a minimum of one recombination coefficient was negative. While this could be explained in terms of unconfined carriers in the quantum structure the lack of a trend in the parameters with excitation power indicates that this has not the sole contributing factor. No explanation for this behavior could be formulated for the bulk InAs sample. As an alternative approach luminescence decay

curves were directly analyzed to evaluate the possibility that the anomalous behavior was an artifact of the initial luminescence- to- carrier density mapping. Again the least squares fit resulted in negative coefficients. Furthermore when the parameters were constrained to be positive the best fit was significantly worse than the unconstrained case. This indicated that negative parameters were not simply an artifact of noise in the data.
DTIC
Luminescence; Semiconductors (Materials)

20040075121 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Ammonia IR Absorbance Measurements with an Equilibrium Vapor Cell
Field, Paul E.; Combs, Roger J.; Knapp, Robert B.; Feb. 2004; 329 pp.; In English
Contract(s)/Grant(s): DAAD05-99-T-1052
Report No.(s): AD-A422992; ECBC-TR-377; No Copyright; Avail: CASI; A15, Hardcopy

Infrared (IR) absorbance spectra were acquired for 18 ammonia vapor pressures. The vapor pressures were generated with 15 gravimetrically prepared aqueous solutions and three commercial aqueous solutions using a dynamic method I.E., EQUILIBRIUM VAPOR CELL (EVC). Background IR spectra were obtained using the vapor pressure of distilled water. The IR absorbance (A) measurements were analyzed by computing ammonia vapor mole fractions (Y) or partial pressures (P) as a function of solution mole fractions (X). The Y versus A furnished a superior data fit over P versus A for the prepared and two commercial solutions. The linear regions of these data fits allowed prediction of Y and P for the third commercial 5% VN ammonia solution. Eight times zero filling of IR interferogram data allowed a more accurate determination of the ammonia spectral band peak positions. The zero filled results were compared to the results with no zero filling. Program listings, analysis results, and IR absorbance spectra were tabulated in an extensive set of appendixes. Titration of two prepared aqueous ammonia solutions demonstrated the reliability of gravimetric solution preparation, as well as showing that storage of an aqueous ammonia solution for a period exceeding 2 years had no significant effect on ammonia concentration.
DTIC
Ammonia; Chemical Equilibrium; Infrared Instruments; Vapor Pressure; Vapors

20040075126 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Effect of Equivalence Ratio and G-Loading on In- Situ Measurements of Chemiluminescence in an Ultra Compact Combustor
Armstrong, Jason M.; Mar. 2004; 117 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422997; AFIT/GAE/ENY/04-M01; No Copyright; Avail: CASI; A06, Hardcopy

Using a spectrometer and high temperature fiber optics the relative intensities of the near-infrared, visible, and ultraviolet radiation emitted from the C2*, CH*, and OH* radicals were measured at eight discrete locations within the Ultra Compact Combustor test rig. Blackbody radiation in the near infrared also was observed. The tests were conducted at various g-loadings and overall equivalence ratios and with various air hole configurations. These measurements were compared to determine the effect of these changes on the radiation emitted. Local C2* intensities were used to estimate the flame location within the combustor and the local CH*/OH* ratio was used as a gauge of the local equivalence ratio within the cavity. Results indicate that the highest ratios of CH*/OH* occur in the outer radius of the cavity where the high g-loads transport the colder unreacted fuel and air. The highest C2* ratios also occur in the outer radius. A correlation between cavity equivalence ratio and C2*/OH* was determined for these experiments as well. Fuel droplet size characterization also was conducted using a laser diffraction particle size analyzer. The same pressure atomizer used in the Ultra Compact Combustor test rig was used. Fuel flow conditions simulated the same fuel flow conditions as the test rig. Experiments indicated poor atomization at the lower overall fuel-to-air ratio test conditions since the fuel flow pressure is relatively low at these conditions. Combustion efficiencies also were some of the lowest efficiencies measured for these test conditions, which is indicative of poor fuel atomization. All experiments were completed in the Air Force Research Laboratory's Atmospheric Combustion Research Facility at Wright-Patterson AFB. This research supports compact common core initiatives of the Versatile, Affordable, Advanced Turbine Engine (VAATE) program. (15 tables, 71 figures, 21 refs.)
DTIC
Atomizing; Chemiluminescence; Combustion Chambers; Equivalence; Fuel Sprays; Fuel-Air Ratio; Hydroxyl Radicals; In Situ Measurement; Jet Engine Fuels; Radicals

20040075190 Boeing Phantom Works, Seattle, WA

Development of an Enhanced Durability Corrosion Protecting Self-Priming Topcoat

Osborne, Joseph H.; May 2004; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-C-0108

Report No.(s): AD-A423094; No Copyright; Avail: CASI; A02, Hardcopy

Monthly report of progress in developing an enhanced self priming topcoat using high performance urethane resins and advanced concepts in nonchromate corrosion protection. The goal of the program is to develop a coating that meets and exceeds the requirements of TT-P-2756 and exceeds the performance of the existing topcoat material qualified to the specification.

DTIC

Corrosion; Corrosion Prevention; Durability; Protective Coatings

20040075232 Georgia Univ., Athens, GA

Effects of Biological and Photochemical Degradation on the Optical Properties of CDOM Exported to Coastal Marine Environments

Moran, Mary A.; Zepp, R. G.; Sheldon, W. S.; Koopmans, D.; Apr. 30, 2004; 5 pp.; In English

Contract(s)/Grant(s): N00014-98-1-0530

Report No.(s): AD-A423173; No Copyright; Avail: CASI; A01, Hardcopy

Dissolved organic matter (DOM) exported from rivers and intertidal marshes to coastal oceans typically contains high concentrations of light-absorbing molecules that can interfere with remote sensing of ocean color. This project quantitatively assessed the ability of coastal ocean bacteria to degrade and produce CDOM and investigated the synergistic interactions between bacterial degradation and photochemical processes in transforming CDOM in seawater and altering its optical properties. Optical properties (absorption spectra, EEMs), photoreactivity and biological lability of CDOM formed during the bacterial degradation of selected vascular plants and algae was used to asses the relative importance of terrestrial and marine organic matter as sources of CDOM.

DTIC

Biodegradation; Coasts; Marine Environments; Optical Properties; Organic Materials; Photochemical Reactions

20040075555 Georgia Inst. of Tech., Atlanta, GA, USA

Intercomparisons of Airborne Measurements of Aerosol Ionic Chemical Composition during TRACE-P and ACE-Asia

Ma, Y.; Weber, R. J.; Maxwell-Meier, K.; Orsini, D. A.; Lee, Y.-N.; Huebert, B. J.; Howell, S. G.; Bertram, T.; Talbot, R. W., et al.; August 25, 2003; 47 pp.; In English

Contract(s)/Grant(s): NCC1-411; NSF ATM-00-80471; NSF ATM-00-02698; No Copyright; Avail: CASI; A03, Hardcopy

As part of the two field studies, Transport and Chemical Evolution over the Pacific (TRACE-P), and the Asian Aerosol Characterization Experiment (ACEAsia), the inorganic chemical composition of tropospheric aerosols was measured over the western Pacific from three separate aircraft using various methods. Comparisons are made between the rapid online techniques of the Particle Into Liquid Sampler (PILS) for measurement of a suite of fine particle ionic compounds and a mist chamber (MC/IC) measurement of fine sulfate, and the longer time-integrated filter and multi-orifice impactor (MOI) measurements. Comparisons between identical PILS on two separate aircraft flying in formation showed that they were highly correlated (e.g., sulfate r(sup 2) of 0.95), but were systematically different by 10 +/- 5% (linear regression slope and 95% confidence bounds), and had generally higher concentrations on the aircraft with a low turbulence inlet and shorter inlet-to-instrument transmission tubing. Comparisons of PILS and mist chamber measurements of fine sulfate on two different aircraft during formation flying had an 3 of 0.78 and a relative difference of 39% +/- 5%. MOI ionic data integrated to the PILS upper measurement size of 1.3 pm sampling from separate inlets on the same aircraft showed that for sulfate, PILS and MOI were within 14% +/- 6% and correlated with an r(sup 2) of 0.87. Most ionic compounds were within f 30%, which is in the range of differences reported between PILS and integrated samplers from ground-based comparisons. In many cases, direct intercomparison between the various instruments is difficult due to differences in upper-size detection limits. However, for this study, the results suggest that the fine particle mass composition measured from aircraft agree to within 30-40%.

Author

Aerosols; Chemical Composition; Troposphere; Particle Mass; Airborne Equipment; Chemical Evolution

20040075693 BAE Systems, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Particles Growing in Solutions: Depletion Forces and Instability of Homogeneous Particle Distribution

Chernov, A. A.; 2004; 1 pp.; In English; International Symposium on Physical Sciences, 24-27 May 2004, Toronto, Canada; No Copyright; Avail: Other Sources; Abstract Only

Crystallites, droplets and amorphous precipitates growing from supersaturated solution are surrounded by zones, which are depleted with respect to the molecules they are built of. If two such particles of colloidal size are separated by a distance comparable to their diameters, then the depletion within the gap between particles is deeper than that at the outer portion of the particles. This will cause depletion attraction between the particles should appear. It may cause particle coagulation and decay of the originally homogeneous particle distribution into a system of clouds within which the particle number density is higher, separated by the region of the lower number density. Stability criterion, Q = 4 pi R(exp 3)c/3 >> 1, was analytically found along with typical particle density distribution wavevector q = (Q/I)(exp 1/2)(a/R)(exp 1/4). Here, R and a are the particle and molecular radii, respectively, c is the average molecular number density in solution and I is the squared diffusion length covered by a molecule during a typical time characterizing decay of molecular concentration in solution due to consumption of the molecules by the growing particles.
Author
Solutions; Crystallites; Crystal Growth

20040075730 NASA Ames Research Center, Moffett Field, CA, USA
Prebiotic Synthesis of Activated Amino Acids
Weber, Arthur L.; Research and Technology 1997; September 1998, pp. 100; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

About four billion years ago chemical processes occurring on the primitive Earth yielded molecules that had the ability to make copies of themselves (i.e., replicate). These rudimentary replicating molecules eventually developed into today s life that uses both protein and DNA molecules for replication. Since the DNA of today s life is too complex to have been chemically made on the primitive Earth, the first replicating systems may have been composed solely of small proteins, called peptides. Peptides are good candidates for the first replicating molecules because they are constructed from very simple building blocks-activated amino acid molecules that could have been made by chemical processes on the primitive Earth.
Derived from text
Amino Acids; Chemical Reactions; Proteins; Deoxyribonucleic Acid

20040075809 NASA Ames Research Center, Moffett Field, CA, USA
Nitrogen Dissociation in Earth's Lower Thermosphere
Huo, Winifred M.; Dateo, Christopher E.; Research and Technology 1997; September 1998, pp. 106-107; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The reaction of nitrogen atoms (N) with oxygen (02) is important in the formation of nitric oxide (NO) in Earth's lower thermosphere. This reaction i s particularly sensitive to the internal state of the N atom. The reaction proceeds very slowly if the N atoms are in their ground electronic state (4S), but becomes much faster for electronically excited N atoms (2D or 2P). Thus the amount of NO in the lower thermosphere is dependent on the population of excited state N atoms. Employing current models of the lower thermosphere, a change in the population of N 2D from 60 percent of the total N atom population to 50 percent results in an 80 percent decrease in the NO density. Given this uncertainty in the current models, a better understanding of the N atom population distributions is necessary. Nitrogen atoms in the lower thermosphere are produced by electron impact dissociation of N2 and the dissociative recombination of N2+. Laboratory measurement of electron impact dissociation of the ground state N2 molecule found that equal amounts of 2D and 4S nitrogen atoms were produced. This distribution of N atoms gives less 2D than is used in the model, resulting in an even larger discrepancy between the measured and modeled NO density. To help resolve this discrepancy, large-scale quantum chemical calculations on the dissociation pathways of N2 have been carried out.
Author
Earth Atmosphere; Thermosphere; Gas Dissociation; Thermal Dissociation

20040075839 Ames Lab., IA, USA, Iowa State Univ. of Science and Technology, Ames, IA, USA, Brookhaven National Lab., Upton, NY, USA
Nd-Fe-Al, A Spin Glass Transition in a Collection of Superparamagnetic Clusters
McCallum, R. W.; Kramer, M. J.; Dennis, K. W.; Lewis, L. H.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006570; BNL-71067-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

In the Nd-Fe-A1 system, compositions in the range of Nd(sub 60)Fe(sub 30)Al(sub 10) have been reported to be ferromagnetic bulk metallic glasses with high coercivities. Careful examination of both the microstructure and magnetic properties of these materials shows this to be true only in the most general sense. The materials are shown to be

nanocomposites, in the strictest sense, with characteristic structural length scales on the order of 1.2 nm. Magnetically, the materials are also composites exhibiting a number of magnetic transitions as a function of temperature. The temperature dependence of the magnetic properties will be discussed in terms of strongly-interacting superparamagnetic clusters residing in a paramagnetic matrix.
NTIS
Magnetic Properties; Neodymium Alloys

20040077129 NASA Ames Research Center, Moffett Field, CA, USA
Minimizing Infrared Stray Light on SOFIA
Meyer, Allan W.; Smith, Sheldon M.; Koerber, Chris T.; Research and Technology 1999; December 2000, pp. 112-113; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is now being designed and developed, with first light expected in late 2002. This report briefly describes recent efforts at Ames Research Center to evaluate some of the infrared properties of the SOFIA telescope surfaces, and also some of the surface treatments that may be used in focal-plane infrared sensors.
Derived from text
Sofia (Airborne Observatory); Surface Treatment; Materials Selection; Spacecraft Construction Materials

24
COMPOSITE MATERIALS

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

20040075214 California Univ., Los Angeles, CA
Physical, Chemical, and Mechanical Bonding Concept/Mechanisms for Joining Steel and Composite Sections
Gupta, Vijay; Apr. 22, 2004; 44 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0680
Report No.(s): AD-A423133; No Copyright; Avail: CASI; A03, Hardcopy

Silane-based chemistries on stainless steel substrates have been investigated to develop reliable stainless steel/E-glass composite sections. A chemistry has been uncovered that leads to a joint stronger than one of the substrate (composite). Effects of moisture and seawater on the fracture energies of the joints were also determined. Silane layers have been found that control the fracture path through the multilayer joint assembly in a way that improves the long- term fracture reliability by a factor of 5 over regular non- silane joint chemistries. The degrading effect of seawater was dramatic and the use of silane was not as effective as that against moisture attack. The intrinsic fracture energy of the joint was also measured by carrying out experiments at cryogenic temperatures, which can be used as a local failure criterion in design simulations of large structures. The intrinsic-to-total toughness relationship was experimentally obtained for the steel/composite joint, which provides the necessary scaling law for designing joints in large-scale structures based on the lab data. The dynamic tensile strengths of various interfaces in the joint were also measured.
DTIC
Bonding; Chemical Bonds; Composite Materials; Steels

20040075249 Army Cold Regions Research and Engineering Lab., Hanover, NH
Representative Sampling for Energetic Compounds at an Antitank Firing Range
Jenkins, Thomas F.; Ranney, Thomas A.; Hewitt, Alan D.; Walsh, Marianne E.; Bjella, Kevin L.; Apr. 2004; 66 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423212; ERDC/CRREL-TR-04-7; No Copyright; Avail: CASI; A04, Hardcopy

Field sampling experiments were conducted at the CFB-Valcartier Arnhem antitank rocket range to investigate various sampling schemes that would yield representative soil samples at firing points and impact areas of antitank ranges. Three sampling strategies were evaluated. Between the firing point and the target, 10-m x 10-m grids were established and 30-increment composite soil samples were collected. In two of these grids, one near the firing point and one at the target, other grids were divided into 100 1-m x 1-m minigrids. Within each minigrid a discrete and a 10-increment composite soil sample were collected and analyzed for energetic compounds. In the target area, an alternative strategy was also evaluated using concentric halos around the target. Each halo was subdivided into increasing numbers of segments at increasing distances from the targets. Multi-increment composite samples were collected within each halo segment. Behind the firing line, nine line

(linear) composites were collected at various distances from 0 to 25 m from the firing line. Results from the 100 1-m x 1-m minigrids near the firing line and the target demonstrated that the distribution of analyte concentrations in the discrete samples was non-Gaussian and the range of concentrations varied over two orders of magnitude. The distributions of data for multi-increment composite samples with various numbers of increments were simulated by averaging the concentration estimates from randomly selected discrete samples. For the firing line area, the distribution of NG computed composites exhibits increased normality as the number of increments is increased and the resulting tolerance range declined substantially. This was also true for HMX in the target area. Recommendations are made for appropriate sampling strategies to collect representative surface soil sample for antitank rocket ranges.
DTIC
Composite Materials; Explosives; Sampling

20040075545 NASA Langley Research Center, Hampton, VA, USA
Effects of Elastic Edge Restraints and Initial Prestress on the Buckling Response of Compression-Loaded Composite Panels
Hilburger, Mark W.; Nemeth, Michael P.; Riddick, Jaret C.; Thornburgh, Robert P.; [2004]; 29 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-55-TC
Report No.(s): AIAA Paper 2004-1713; No Copyright; Avail: CASI; A03, Hardcopy

A parametric study of the effects of test-fixture-induced initial prestress and elastic edge restraints on the prebuckling and buckling responses of a compression-loaded, quasi-isotropic curved panel is presented. The numerical results were obtained by using a geometrically nonlinear finite element analysis code with high-fidelity models. The results presented show that a wide range of prebuckling and buckling behavior can be obtained by varying parameters that represent circumferential loaded-edge restraint and rotational unloaded-edge restraint provided by a test fixture and that represent the mismatch in specimen and test-fixture radii of curvature. For a certain range of parameters, the panels exhibit substantial nonlinear prebuckling deformations that yield buckling loads nearly twice the corresponding buckling load predicted by a traditional linear bifurcation buckling analysis for shallow curved panels. In contrast, the results show another range of parameters exist for which the nonlinear prebuckling deformations either do not exist or are relatively benign, and the panels exhibit buckling loads that are nearly equal to the corresponding linear bifurcation buckling load. Overall, the results should also be of particular interest to scientists, engineers, and designers involved in simulating flight-hardware boundary conditions in structural verification and certification tests, involved in validating structural analysis tools, and interested in tailoring buckling performance.
Author
Buckling; Composite Structures; Curved Panels; Structural Analysis; Panels

20040075685 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Strength and Compatible Aluminum Alloy for Hydrogen-Peroxide Fuel Tanks
Lee, Jonathan A.; [2004]; 1 pp.; In English; 52nd JANNAF Propulsion Meeting/1st Liquid Propulsion Subcommittee, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper describes the development of a new high strength and Hydrogen Peroxide (HP) propellant compatible aluminum alloy for NASA Hyper-X vehicle's fuel tanks and structures. The tensile strength of the new alloy is more than 3 times stronger than the conventional 5254 alloy while it still maintains HP compatibility similar to 5254 (Class 1 category). The alloy development strategy consists of selecting certain rare earth and transition metals, with unique electrochemical properties, that will not act as catalysts to decompose liquid HP at the atomic level. Such elements will added to the aluminum alloy and the mixture will be cast and rolled into thin sheet metals. Test coupons are machined from sheet metals for HP long-term exposure testing and mechanical properties testing. In addition, the ability to weld the new alloy using Friction Stir Welding has also been explored. Currently, aluminum alloy 5254 is the state-of-the-art material for HP storage, but its yield strength is very low (420 ksi) and may not be suitable for the development of light-weight fuel tanks for Hyper-X vehicles. The new high strength and HP compatible alloy could represent an enabling material technology for NASA's Hyper-X vehicles, where flight weight reduction is a critical requirement. These X-planes are currently under studied as air-breathing hypersonic research vehicles featuring a lifting body configuration with a Rocket Based Combined Cycle (RBCC) engine system.
Author
High Strength; Compatibility; Aluminum Alloys; Hydrogen Peroxide; Fuel Tanks; Product Development

20040075689 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Application of Metal Matrix Composite Materials in Propulsion System Valves

Laszar, John; Shah, Sandeep; Kashalikar, Uday; Rozenoyer, Boris; August 29, 2003; 1 pp.; In English; JANNAF 52nd JP Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

Metal Matrix Composite (MMC) materials have been developed and used in many applications to reduce the weight of components where weight and deflection are the driving design requirement. MMC materials are being developed for use in some propulsion system components, such as turbo-pumps and thrust chambers. However, to date, no propulsion system valves have been developed that take advantage of the materials unique properties. The stiffness of MMC's could help keep valves light or improve life where deflection is the design constraint (such as seal and bearing locations). The low CTE of the materials might allow the designer to reduce tolerances and clearances producing better performance and lighter weight valves. Using unique manufacturing processes allow parts to be plated/coated for longer life and allow joining either by welding or threading/bolting. Additionally, casting of multi part pre-forms to form a single part can lead to designs that would be hard or impossible to manufacture with other methods. Therefore, NASA's Marshall Space Flight Center (MSFC) has developed and tested a prototype propulsion system valve that utilizes these materials to demonstrate these advantages. Through design and testing, this effort will determine the best use of these materials in valves designed to achieve the goal of a highly reliable and lightweight propulsion system. This paper is a continuation of the paper, The Application of Metal Matrix Composite Materials In Propulsion System Valves, presented at the JANNAF Conference held in April, 2002. Fabrication techniques employed, valve development, and valve test results will be discussed in this paper.

Author

Metal Matrix Composites; Composite Materials; Propulsion; Valves

20040075849 Oak Ridge National Lab., TN, USA

Durability-Based Design Criteria for a Quasi-Isotropic Carbon-Fiber Automotive Composite

Corum, J. M.; Battiste, R. L.; Deng, S.; Ruggles-Wrenn, M. B.; Weitsman, Y. J.; Mar. 2002; In English

Report No.(s): DE2003-814041; ORNL-TM-2002/39; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

Fiber Composites; Life (Durability); Automobiles

20040075877 Lawrence Livermore National Lab., Livermore, CA

Micromechanics of Transformation Superplasticity in Ti-6Al-4V/TiB(w) Composites

Schuh, C.; Dunand, D. C.; Oct. 16, 2001; 16 pp.; In English

Report No.(s): DE2004-15006873; UCRL-JC-145879; No Copyright; Avail: Department of Energy Information Bridge

Transformation superplasticity is a deformation mechanism induced by thermally-cycling a polymorphic material through the phase transformation range while simultaneously applying an external biasing stress. Unlike microstructural superplasticity, which requires a fine, equiaxed grain structure, this mechanism can be applied to coarse-grained alloys and composites. In this article, we review our research on transformation superplasticity of Ti-6Al-4V/TiB-whisker reinforced composites, during thermal cycling through the titanium(alpha)/(beta) transformation range. The composites exhibit Newtonian flow and superplastic extension under these conditions. We describe the constitutive behavior of composites containing 0, 5 and 10 vol% reinforcing whiskers, and consider the effects of load transfer from matrix to whisker on superplastic deformation using existing rheological models. Additionally, strain hardening due to gradual whisker alignment is observed, and rationalized in terms of increased load transfer for aligned whiskers.

NTIS

Micromechanics; Composite Materials; Phase Transformations; Superplasticity; Thermal Cycling Tests

20040077043 Utah Univ., Salt Lake City, UT, USA

Novel Microstructures for Polymer-Liquid Crystal Composite Materials

Magda, Jules J.; [2004]; 5 pp.; In English

Contract(s)/Grant(s): NAG8-1665; No Copyright; Avail: CASI; A01, Hardcopy

There are a number of interface-dominated composite materials that contain a liquid crystalline (LC) phase in intimate contact with an isotropic phase. For example, polymer- dispersed liquid crystals, used in the fabrication of windows with switchable transparency, consist of micron size LC droplets dispersed in an isotropic polymer matrix. Many other types of liquid crystal composite materials can be envisioned that might have outstanding optical properties that could be exploited in novel chemical sensors, optical switches, and computer displays. This research project was based on the premise that many

of these potentially useful LC composite materials can only be fabricated under microgravity conditions where gravity driven flows are absent. In the ground-based research described below, we have focused on a new class of LC composites that we call thermotropic- lyotropic liquid crystal systems (TLLCs). TLLCs consist of nanosize droplets of water dispersed in an LC matrix, with surfactants at the interface that stabilize the structure. By varying the type of surfactant one can access almost an infinite variety of unusual LC composite microstructures. Due to the importance of the interface in these types of systems, we have also developed molecular simulation models for liquid crystals at interfaces, and made some of the first measurements of the interfacial tension between liquid crystals and water.
Author
Composite Materials; Liquid Crystals; Liquid Phases; Interfacial Tension; Surfactants; Microgravity

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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*.

20040073646 Johns Hopkins Univ., Baltimore, MD
Mechanical Properties of MEMS Materials
Sharpe, W. N., Jr.; Hemker, K. J.; Edwards, R. L.; Mar. 2004; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-2-0553; Proj-E117
Report No.(s): AD-A422530; AFRL-IF-RS-TR-2004-76; No Copyright; Avail: CASI; A04, Hardcopy

New techniques and procedures were developed to measure the mechanical properties of the thin-film structural materials used in microelectromechanical systems. Tensile stress-strain curves were measured for polysilicon, silicon nitride, silicon carbide, and electroplated nickel. For example, polysilicon has a Young's modulus of 160 GPa and a Poisson's ratio of 0.22. It is a linear brittle material with fracture strength as high as 3 GPa. The mechanical properties of electroplated nickel are found to be highly dependent on the manufacturing process. Preliminary tests were conducted on silicon germanium, aluminum-glass composites, and diamond (amorphous carbon). Tests on specimens with stress concentrations show a definite size effect, i.e.,increase in fracture strength with decrease in size of highly stressed region, that is explained with Weibull statistics. Scanning and transmission electron microscopy studies of these materials relate the microstructure to the mechanical behavior. X-ray and atomic force microscopy studies show texture and surface roughness to be important features. Methods were developed to test polysilicon up to 600 deg C, and it is seen to be ductile and subject to creep at these temperatures. The coefficient of thermal expansion of polysilicon is larger than predicted from single crystal data. New axial fatigue tests at 6 kHz show polysilicon to behave much like a metal with decreased loading leading to increased life. Creep and fatigue tests were also conducted on nickel.
DTIC
Mechanical Properties; Microelectromechanical Systems

20040074525 Lawrence Livermore National Lab., Livermore, CA
Simulations of Shock-Induced Mixing and Combustion of an Acetylene Cloud in a Chamber
Bell, J. B.; Day, M. S.; Beckner, V. E.; Kuhl, A. L.; Neuwald, P.; Feb. 06, 2001; In English
Report No.(s): DE2004-15005775; UCRL-JC-142374; No Copyright; Avail: National Technical Information Service (NTIS)

In this paper we present numerical simulations of the interaction of a blast wave with an acetylene bubble in a closed chamber. We model the system using the inviscid Euler equations for a mixture of ideal gases. The formulation specifies the thermodynamic behavior of the system using a Chemkin interface and includes the capability to model combustion as the ambient air mixes with the acetylene. The simulations are performed using a three-dimensional adaptive mesh refinement algorithm based on a second-order Godunov integration scheme. Simulations are compared with experimental measurements for the same configuration.
NTIS
Clouds; Explosions; Acetylene

20040074526 Lawrence Livermore National Lab., Livermore, CA
Inverse Problem in Explosion and Combustion
Oppenheim, A. K.; Sum, T. H.; Feb. 05, 2001; In English
Report No.(s): DE2004-15005774; UCRL-JC-142373; No Copyright; Avail: National Technical Information Service (NTIS)

The principal task of our studies is to provide a rational interpretation of the thermodynamic and fluid dynamic events taking place in a closed vessel upon detonation of an explosive charge and subsequent turbulent combustion of its products, acting as fuel for an exothermic reaction with air. Under such circumstances, the latter has been compressed by a reverberating shock front of the blast wave generated by the explosion. The paper presents the chemical and thermodynamic background and its numerical results, deduced for this purpose from mass spectroscopic data and pressure records, acquired upon explosion of a 0.8 kg charge of TNT in a 17 m(sup 3) chamber filled with air--a diagnostic analysis identified by the title. The evolution of the flow field and its structure are presented in a companion paper.
NTIS
Explosions; Spectroscopy; Shock Waves; Flow Distribution; Thermodynamics

20040075013 Lawrence Livermore National Lab., Livermore, CA
Computational Biology a Strategic Intitative LDRD
Barsky, D.; Colvin, M.; Feb. 07, 2002; In English
Report No.(s): DE2004-15006108; UCRL-ID-147129; No Copyright; Avail: National Technical Information Service (NTIS)
The goal of this Strategic Initiative LDRD project was to establish at LLNL a new core capability in computational biology, combining laboratory strengths in high performance computing, molecular biology, and computational chemistry and physics. As described in this report, this project has been very successful in achieving this goal. This success is demonstrated by the large number of referred publications, invited talks, and follow-on research grants that have resulted from this project. Additionally, this project has helped build connections to internal and external collaborators and funding agencies that will be critical to the long-term vitality of LLNL programs in computational biology. Most importantly, this project has helped establish on-going research groups in the Biology and Biotechnology Research Program, the Physics and Applied Technology Directorate, and the Computation Directorate.
NTIS
Biotechnology; Computational Chemistry; Molecular Biology

20040075084 Spectral Sciences, Inc., Burlington, MA
Theoretical Studies of High Energy Oxygen Atom Chemistry
Braunstein, M.; Duff, J.; Shroll, R.; Bernstein, L.; Adler-Golden, S.; Apr. 13, 2004; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-03-C-0015; Proj-BMSB
Report No.(s): AD-A422935; No Copyright; Avail: CASI; A03, Hardcopy
Ab-initio Modeling of the Following Reactions: O + H2 yields OH + H; O + h2O yields O + H2O* or OH** + OH*; O + HCl yields O = HCl* or Cl + OH*
DTIC
Oxygen; Oxygen Atoms; Reaction Kinetics

20040075136 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Analysis of the Effects of Low Energy Electron Radiation of Al(sub x) Ga(sub 1-x)N/GaN Modulation-Doped Field-Effect Transistors
Sattler, James M.; Mar. 2004; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423014; AFIT/GE/ENP/04-02; No Copyright; Avail: CASI; A07, Hardcopy
The effects of radiation on AlxGa1-xN/GaN MODFETs is an area of increasing interest to the USAF as these devices become developed and integrated in satellite-based systems Irradiation is also a valuable tool for analyzing the quantum- level characteristics and properties that are responsible for device operation AlxGa1-xN/GaN MODFETs were fabricated and irradiated at liquid nitrogen temperatures by 0,45-1,2MeV electrons up to doses of 6*10(exp 16) e/ cm2. Following irradiation, low temperature I-V measurements were recorded providing dose-dependent measurements Temperature-dependent I- V measurements were also made during room temperature annealing following irradiation I-V measurements indicate radiation-induced changes occur in these devices creating increased gate and drain currents These increased currents are only maintained at low temperatures (T < 300 K), It is believed that the increase in gate current is caused by an increase in the electron trap concentration of the AlxGa1- xN/GaN layer, This increase in trap concentration directly increases the trap-assisted tunneling current resulting in the observed increase in gate current The mechanism causing the increase in drain current is unknown, Several theories explaining this increase are presented along with the additional research necessary to

illuminate the correct theory, This is the first experiment involving electron radiation of AlxGa1-xN/GaN MODFETs.
DTIC
Aluminum Nitrides; Doped Crystals; Electron Irradiation; Electron Radiation; Field Effect Transistors; Gallium Nitrides; Modulation; Radiation Effects

20040075146 Ohio State Univ., Columbus, OH
Studies of Anomalous Shock Wave Propagation and Dispersion in Weakly Ionized Plasma
Adamovich, I. V.; Lempert, W. R.; Subramaniam, V. V.; Rich, J. W.; Jan. 2001; 168 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-99-1-0023
Report No.(s): AD-A423025; 736784; No Copyright; Avail: CASI; A08, Hardcopy

The effects of weak ionization on the strength of shock waves in supersonic gas flows were studied in an experimental program. Claims that weak ionization can substantially reduce shock wave strength, independently of any plasma heating effects, were evaluated. Experiments were conducted in both shock tubes and in supersonic, steady flow, plasma wind- tunnels. Temperatures and ionization levels in the flows were measured. It was demonstrated that shocks can be weakened by creating an electric discharge in the flow, but this effect is purely a consequence of the Joule heating of the plasma. Without heating, ionization alone does not weaken the shock.
DTIC
Ionization; Plasmas (Physics); Shock Wave Propagation; Shock Waves; Wave Propagation

20040075168 Air Force Research Lab., Edwards AFB, CA
Experimental and Theoretical Study of 1.5-Diamino- 4-H-Tetrazolium Perchlorate
Drake, Greg; Hawkings, Tommy; Hall, Leslie; Boatz, Jerry; Vij, Ashwani; Jan. 2004; 29 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A423054; AFRL-PR-ED-TP-2004-119; No Copyright; Avail: CASI; A03, Hardcopy

The synthesis and characterization of 1 ,5-diamino- 1,2,3 ,4-tetrazolium perchlorate were carried out. Experimental evidence strongly supports the protonation of a nitrogen atom of the tetrazole ring, including the structure observed in a single crystal x-ray diffraction study of the title compound. Quantum chemical calculations were performed at the CCSD(T)/6-311G(2df,p)//MP2/ 6-311G(d,p) level of theory to determine the relative energies of all possible N- protonated structures of the 1,5.-diamino- 1,2,3,4-tetrazole ring. The predicted geometry of the most stable isomer compares favorably with the experimentally observed structure.
DTIC
Perchlorates; Synthesis (Chemistry); Tetrazoles

20040075171 State Univ. of New York, Stony Brook, NY
Crested Tunnel Barriers for Fast Scalable Nonvolatile Memories
Likharev, Konstantin K.; Ma, Tso-Ping; Mar. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0386; Proj-2305
Report No.(s): AD-A423060; AFRL-SR-AR-TR-04-0249; No Copyright; Avail: CASI; A02, Hardcopy

The main goal of Stony Brook work will be to move as fast as possible toward the demonstration of first practical crested barriers based on a combination of plasma- grown A1203 layers with either thermally-grown aluminum oxide or silicon dioxide (see Fig. 7 and its discussion above). Listed below are the most urgent steps we plan to make in this direction: 1) Ways to combine plasma-formed (Cr19-type) layers with thermally-oxidized (Cr05-type) layers will be explored. One possible way is to deposit a thin (-2-nm) aluminum layer on the thermally-grown oxide, and plasma-oxidize it thoroughly. If this way will not give a sufficiently smooth aluminum film (e.g., because of poor wetting), other methods of the second layer deposition will be studied. 2.) Effects of higher oxygen exposure and post-annealing on Cr30-type layers will be studied. Either of these procedure (or their combination) may lead to films combining high barrier of annealed Cr12 layers with larger thickness. 3) Rapid post-annealing at higher temperatures (up to 500tC 2) of Cr05-type films will be explored, in order to increase the barrier height even further, while sustaining the barrier homogeneity and reproducibility. 4) Chemical and physical structure of various aluminum oxide layers and their interfaces will be understood in more detail using such methods as high-resolution TEM, scanning TEM contrast imaging, and energy-loss spectroscopy, all available through our collaboration with Dr. Yimei Zhu of the Brookhaven National Laboratory (at no cost for the AFOSR).
DTIC
Computer Storage Devices; Semiconductor Devices

20040075189 Air Force Research Lab., Hanscom AFB, MA

Collisional Electron Detachment From NO- by Rare Gases

Ferguson, E. E.; Viggiano, A. A.; Gillery, C.; Rosmus, P.; Jan. 2004; 7 pp.; In English

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

Report No.(s): AD-A423092; AFRL-VS-HA-TR-2004-1096; No Copyright; Avail: CASI; A02, Hardcopy

A model is proposed to explain earlier measurements of electron detachment from NO- by He, Ne, and several diatomic and triatomic molecules. The measurements have been extended to include detachment by Ar with a rate constant of 2 x 10(exp -14) cu cm s(exp -1) at 500K. The previously puzzling inefficiencies are satisfactorily explained by a mechanism in which NO- (v = 0) is vibrationally excited to NO- (v = 1), followed by autodetachment. The data are analyzed with Landau-Teller theory alter invoking the principle of detailed balance. Ab initio - calculations of the NO- interactions potentials with He, Ne, and Ar have been made. Range parameters derived from Landau-Teller plots -and ab initio calculations are in the range expected although not in exact agreement. The ab initio potential attractive wells make clear why the necessary vibrational excitations in He and Ne collisions with NO- (and hence collisional detachment) are far more effective than in the case for Ar. This appears to be the first application of Landau-Teller theory to a negative ion.

DTIC

Detachment; Diatomic Molecules; Nitric Oxide; Rare Gases

20040075198 University of Southern California, Los Angeles, CA

The Molecular Basis of Humic Acid Reduction and its Role in Microbiologically Influenced Corrosion (MIC)

Mansfeld, Florian; May 15, 2004; 4 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0775

Report No.(s): AD-A423111; No Copyright; Avail: CASI; A01, Hardcopy

Based on the experimental values of the corrosion potential and the polarization resistance it was demonstrated that iron respiration can protect steel from corrosion. A new electrochemical model that explains the mechanism of this process has been developed. This mechanism is based on the assumption that iron-reducing biofilms reduce the rates of both the oxygen reduction and the metal dissolution reactions that are involved in the corrosion of iron and mild steel.

DTIC

Corrosion; Corrosion Resistance; Heterocyclic Compounds; Microbiology

20040075201 Air Force Research Lab., Hanscom AFB, MA

Acidity of a Nucleotide Base: Uracil

Miller, T. M.; Arnold, S. T.; Viggiano, A. A.; Miller, A. E.; Jan. 2004; 10 pp.; In English

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

Report No.(s): AD-A423114; AFRL-VS-HA-TR-2004-1095; No Copyright; Avail: CASI; A02, Hardcopy

Experiment and calculations are used to show that the gas-phase acidity of uracil is comparable to that of HCl. The gas-phase acidity of uracil (denoted here by U) was bracketed by proton-transfer measurements involving U and various reference acids (denoted here by A) of known gas-phase acidity. Rate constants for proton transfer from the reference acid A to the conjugate anion of uracil, (U-H)-, were measured in a selected ion flow tube at 298 K. Rate constants for proton transfer from U to ions (A-H)- were measured at 467 K in a flowing-afterglow Langmuir probe apparatus. Here, (U-H) or (A-H) indicates a U or A molecule which is missing an H atom, respectively. The result is (DeltaH acid(uracil)) = 333 +/- 5 kcal and DeltaG(uracil) = 326 +/- 5 kcal mol(-1) at 298 K, which agrees with earlier work. Thermal electron attachment to uracil was found to be too slow to permit measurement of a rate constant, consistent with the gas-phase acidity given above. 63 and G3(MP2) calculations are reported for uracil, and for the each of the (U-H) radicals and (U-H)- ions that result from H or H+ loss from each of the four hydrogen sites of U (on the N1, N3, CS, and C6 positions). From the calculated total energies we obtain the gas-phase acidity of uracil, the four U-H homolytic bond strengths, and the electron affinities of the four possible fragment radicals. We confirm earlier work that the most acidic site in uracil is at the N1 site; this site is where uracil becomes covalently bonded to a carbon of the ribose sugar in RNA. G3 calculations for the N1 site at 298 K give DeltaH acid(uracil) = 334.5 kcal mol(-1) and DeltaG acid(uracil) = 327.1 kcal mol at 298 K, in good agreement with the experiment. The weakest H-atom bond enthalpy (at the NI site) is calculated to be 101.8 kcal mol.

DTIC

Acetic Acid; Acidity; Bases (Chemical); Nucleotides; Uracil

20040075212 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Low Temperature Hall Measurements of Neutron Irradiated Silicon Carbide

Bonavita, Ange1o M.; Mar. 2004; 82 pp.; In English

Report No.(s): AD-A423131; AFIT/GNE/ENP/04-01; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this research was to search for evidence of low temperature annealing from neutron irradiated 4H-silicon carbide. No features suggesting annealing were found below a temperature of 340K. Temperature dependant Hall effect measurements were taken over a range of 100K to 340K recording resistivity, carrier densities, and mobility. Resistivity was noted to increase with irradiations, and carrier densities appeared to decrease, while mobility appeared minimally affected by neutron irradiation. This suggests the creation of active acceptor defects decreasing carrier concentrations. N-type samples measured were 5mm x 5mm square with Nickel contacts, and irradiated to 10(exp 10) and 10(exp 16) n-cm/cu cm of 1MeV equivalent neutron fluence. Suggestions for continuing research include using a probe station instead of wire connections to samples, use a large source current to minimize variance, and minimize cadmium shielding to reduce negative reactivity.
DTIC

Annealing; Hall Effect; Irradiation; Low Temperature; Neutron Irradiation; Neutrons; Silicon Carbides; Temperature Measurement

20040075218 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Characterization of Microbial Processes that Degrade Chlorinated Solvents in a Constructed Wetland Using Organic Acid and Inorganic Anion Concentration Profiles

Mar. 23, 2004; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423147; AFIT/GEM/ENV/04M-03; No Copyright; Avail: CASI; A06, Hardcopy

Chlorinated solvents have been used in industrial cleaning and degreasing processes in the USA since the early 1900s, and their induction into the environment increased significantly with the growth of industrial processes over the past century. PCE, TCE and their daughter products have been associated with a number of human health concerns and are currently the most common contaminants found in groundwater in the USA. Wetlands possess characteristics necessary for the complete degradation of chlorinated ethenes by microorganisms via anaerobic and aerobic regions that foster the necessary oxidation-reduction conditions. Organic acid and inorganic anion concentrations were evaluated in samples taken from a constructed wetland at Wright-Patterson Air Force Base, Ohio during the summer and fall of 2003. These analyses are indicative of redox conditions in the subsurface and suggest the occurrence of microbial activities that degrade chlorinated ethenes to innocuous end products. Organic acid concentrations decreased by 100% from July 2003 to fall 2003. Combined with data collected previously during the months of December and January, this suggested that changing seasons and temperature fluctuations have a significant influence on microbial metabolisms. Nitrate and sulfate reduction above stratum C indicated mildly reducing conditions in the lowest stratum that became more highly reducing in the upper two strata. Based on the changing analyst concentrations throughout the wetland cell over several seasons, it was evident that the appropriate subsurface conditions existed for the reductive dechlorination of chlorinated ethenes.
DTIC

Anions; Chemical Composition; Chlorination; Concentration (Composition); Microorganisms; Solvents; Wetlands

20040075775 NASA Ames Research Center, Moffett Field, CA, USA

Bonded Capillary Columns

Shen, Thomas; Chen, Jr-Lung; Research and Technology 1997; September 1998, pp. 126-127; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The sol gel process has been widely used in a variety of areas including high-performance chromatography, materials science, and nanotechnology applications. The sol gel technology has been applied for the in situ formation of stationary phases on fused-silica capillary columns. Experience suggests that the sol gel method will provide a better avenue for preparing analytical microcolumns for miniaturized instruments. These microcolumns have the potential to be used for fast and highly efficient separation and analysis of polar as well as nonpolar compounds in future planetary spacecraft missions that will focus on in situ or returned samples analysis. The sol gel process is not a well defined preparation procedure. Usually, it has to be modified according to the components involved. Therefore, studies of the effects of solvents were conducted, and some particular formulations were found to be excellent for the preparation of columns. In order to further advance the sol gel process for column preparation in a more definitive and effective way, a more systematic study will be carried out to further resolve this problem. Accordingly, several short (about 1 0-feet-long) gas chromatography (GC) columns have been prepared.

Some of these displayed desirable properties for analytical gas chromatography of small polar and nonpolar molecules Author

Sol-Gel Processes; Gas Chromatography; Nanotechnology

20040075843 General Accounting Office, Washington, DC

Homeland Security: DHS Needs a Strategy to Use DOE's Laboratories for Research on Nuclear, Biological, and Chemical Detection and Response Technologies

May 2004; 48 pp.; In English

Report No.(s): PB2004-105510; GAO-04-653; No Copyright; Avail: CASI; A03, Hardcopy

Success in the war against terrorism requires the USA to effectively research, develop, and deploy technologies to detect and respond to the use of nuclear, biological, and chemical weapons. The Homeland Security Act of 2002 gave the Department of Homeland Security (DHS) the ability to use laboratories owned by the Department of Energy (DOE) to conduct research and development (R&D) of these advanced technologies. GAO was asked to determine (1) whether DHS has completed a strategic R&D plan and coordinated its efforts with other federal agencies, (2) how DHS plans to use DOE's laboratories to carry out its R&D, and (3) what controls DHS is establishing to monitor projects at DOE's laboratories. NTIS

Terrorism; Research; Technologies; Biological Effects

20040075883 Oak Ridge National Lab., TN

Hydrofluoric Acid Corrosion Study of High-Alloy Materials

Osborne, P. E.; Icenhour, A. S.; Del Cul, G. D.; 2003; In English

Report No.(s): DE2003-814438; ORNL/TM-2002/165; No Copyright; Avail: National Technical Information Service (NTIS)

A corrosion study involving high-alloy materials and concentrated hydrofluoric acid (HF) was conducted in support of the Molten Salt Reactor Experiment Conversion Project (CP). The purpose of the test was to obtain a greater understanding of the corrosion rates of materials of construction currently used in the CP vs those of proposed replacement parts. Results of the study will help formulate a change-out schedule for CP parts. The CP will convert slightly less than 40 kg of (sup 233)U from a gas (UF(sub 6)) sorbed on sodium fluoride pellets to a more stable oxide (U(sub 3)O(sub 8)). One by-product of the conversion is the formation of concentrated HF.

NTIS

Alloys; Corrosion; Hydrofluoric Acid

20040076882 Institute of Gas Technology, Des Plaines, IL

Environmental Benign Mitigation of Microbiologically Influenced Corrosion(MIC). Quarterly Report, October-December 2002

Paterek, J. R.; Husmillo, G.; Trbovic, V.; Jan. 2003; In English

Report No.(s): DE2003-814909; No Copyright; Avail: National Technical Information Service (NTIS)

The overall program objective is to develop and evaluate environmental benign agents or products that are effective in the prevention, inhibition, and mitigation of microbially influenced corrosion (MIC) in the internal surfaces of metallic natural gas pipelines. The goal is one or more environmental benign, a.k.a. 'green' products that can be applied to maintain the structure and dependability of the natural gas infrastructure. The technical approach for this quarter were isolation and cultivation of MIC-causing microorganisms from corroded pipeline samples, optimizing parameters in the laboratory-scale corrosion test loop system and testing the effective concentrations of Capsicum sp. extracts to verify the extent of corrosion on metal coupons by batch culture method. A total of 22 strains from the group of heterotrophic, acid producing, denitrifying and sulfate reducing bacteria were isolated from the gas pipeline samples obtained from Northern Indiana Public Service Company in Trenton, Indiana. They were purified and will be sent out for identification. Bacterial strains of interest were used in antimicrobial screenings and test loop experiments. Parameters for the laboratory-scale test loop system such as gas and culture medium flow rate; temperature; inoculation period; and length of incubation were established. Batch culture corrosion study against Desulfovibrio vulgaris showed that one (S(sub 1)M) out of the four Capsicum sp. extracts tested was effective in controlling the corrosion rate in metal coupons by 33. 33% when compared to the untreated group.

NTIS

Gas Pipes; Pipelines; Natural Gas

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20040074476 Lockheed Martin Corp., Syracuse, NY, USA

Stress Corrosion Crack Growth Rate Testing and Analytical Electron Microscopy of Alloy 600 as a Function of Pourbaix Space and Microstructure

Lewis, N.; Attanasio, S. A.; Morton, D. S.; Young, G. A.; Oct. 2000; 52 pp.; In English

Report No.(s): DE2004-821947; LM-00K073; No Copyright; Avail: Department of Energy Information Bridge

Stress corrosion crack (SCC) growth rate tests and analytical electron microscopy (AEM) studies were performed over a broad range of environments and heat treatments of Alloy 600. This effort was conducted to correlate bulk environmental conditions such as pH and electrochemical potential (EcP) with the morphology of the SCC crack. Development of a library of AEM morphologies formed by SCC in different environments is an important step in identifying the conditions that lead to SCC in components. Additionally, AEM examination of stress corrosion cracks formed in different environments and microstructures lends insight into the mechanism(s) of stress corrosion cracking. Testing was conducted on compact tension specimens in three environments: a mildly acidic oxidizing environment containing sulfate ions, a caustic environment containing 10% NaOH, and hydrogenated near-neutral buffered water. Additionally, stress corrosion cracking testing of a smooth specimen was conducted in hydrogenated steam. The following heat treatments of Alloy 600 were examined: mill annealed at 980 C (near-neutral water), mill annealed at 1010 C (steam), sensitized (acid and caustic), and mill annealed+ healed to homogenize the grain boundary Cr concentration (caustic). Crack growth rate (CGR) testing showed that sensitized Alloy 600 tested in the mildly acidic, oxidizing environment containing sulfate ions produced the fastest cracking ((approx) 8. 8(micro)m/hr at 260 C), and AEM examination revealed evidence of sulfur segregation to the crack tip. The caustic environment produced slower cracking ((approx) 0.4(micro)m/hr at 307 C) in the mill annealed+ healed heat treatment but no observed cracking in the sensitized condition. In the caustic environment, fully oxidized carbides were present in the crack wake but not ahead of the crack tip. In near-neutral buffered water at 338 C, the CGR was a function of dissolved hydrogen in the water and exhibited a maximum (0. 17(micro)m/hr) near the transition between Ni and NiO stability. The cracks in near-neutral hydrogenated water exhibited Cr-rich spinels and NiO-type oxides but no significant oxidation of grain boundary carbides. No clear effect of dissolved hydrogen on the crack wake morphology was apparent. In hydrogenated steam testing of a smooth specimen (CGR estimated as(approx) 0. 7(micro)m/hr at 399 C), metallic nickel nodules were evident in both the crack wake and on the specimen surface. Oxide particles having a similar size and shape to the microstructural carbides were found in the crack wake, suggesting that these particles are carbides that were oxidized by contact with the steam. The present results show that different environments often produce unique crack tip morphologies that can be identified via AEM.

NTIS

Stress Corrosion Cracking; Crack Propagation; Alloys; Microstructure; Electron Microscopy

20040075014 Lawrence Livermore National Lab., Livermore, CA

Decontaimination of U-Metal Surface by an Oxidation Etching System

Stout, R. B.; Kansa, E. J.; Shaffer, R. J.; Weed, H. C.; Dec. 18, 2000; In English

Report No.(s): DE2004-15006076; UCRL-JC-141063; No Copyright; Avail: National Technical Information Service (NTIS)

A surface oxidation treatment is described to remove surface contamination from uranium (U) metal and/or hydrides of uranium and heavy metals (HM) from U-metal parts. In the case of heavy metal atomic contamination on a surface, and potentially several atomic layers beneath, the surface oxidation treatment combines both chemical and chemically driven mechanical processes. The chemical process is a controlled temperature-time oxidation process that creates a thin film of uranium oxide (UO(sub 2) and higher oxides) on the U-metal surface. The chemically driven mechanical process is strain induced by the volume increase as the U-metal surface transforms to a UO(sub 2) surface film.

NTIS

Decontamination; Metal Surfaces; Oxidation; Etching; Surface Treatment

20040075095 Air Force Inst. of Tech., Wright-Patterson AFB, OH

The Evaluation of the Damping Characteristics of a Hard Coating on Titanium

Blackwell, Christopher M.; Mar. 2004; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422952; AFIT/GAE/ENY/04-M03; No Copyright; Avail: CASI; A06, Hardcopy

Engine failures due to fatigue have cost the Air Force an estimated $400 million dollars per year over the past two decades

(Garrison, 2001). Damping treatments capable of reducing the internal stresses of fan and turbine blades to levels where fatigue is less likely to occur have the potential for reducing cost while enhancing reliability. This research evaluates the damping characteristics of magnesium aluminate spinel, MgO+Al2O3, (mag spinel) on titanium plates. The material and aspect ratio were chosen to approximate the low aspect ratio blades found in military gas turbine fans. The plates were tested with a cantilevered boundary condition, using electrodynamics shaker excitation. The effective test area of each specimen was 4-1/2 in. x 4-1/2 in. The nominal plate thickness was 1/8 in. Mag spinel was applied to both sides of the plate, at a thickness of .01 in., and damping tests were run at room temperature. The effect of the coating was evaluated at the 2nd bending mode (mode 3) and the chordwise bending mode (mode 4). A scanning laser vibrometer revealed the frequency and shape of each mode for the plates. Sine sweeps were used to characterize the damping of the coated and uncoated specimens for the modes tested. The coating increased damping nonlinearly for both modes tested. The test results are presented in this document.
DTIC
Aluminates; Coating; Damping; Fracture Mechanics; Magnesium Compounds; Titanium

20040075614 NASA Marshall Space Flight Center, Huntsville, AL, USA
Liquid-metal-fed Pulsed Plasma Thrusters for In-space Propulsion
Markusic, Thomas E.; [2004]; 1 pp.; In English; JANNAF Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

Liquid metal propellants may provide a path toward more reliable and efficient pulsed plasma thrusters (PPTs). Conceptual thruster designs which eliminate the need for high current switches and propellant metering valves are described. Propellant loading techniques are suggested that show promise to increase thruster propellant utilization, dynamic, and electrical efficiency. Calibration results from a compact, electromagnetically-pumped propellant feed system are presented. Results for lithium and gallium propellants show capability to meter propellant at flow rates up to 10 +/- 0.1 mg/s. Experiments investigating the initiation of arc discharges using liquid metal droplets are presented. High speed photography and laser interferometry provide spatially and temporally resolved information on the decomposition of liquid metal droplets , and the evolution of the accelerating current channel.
Author
Pulsed Plasma Thrusters; Metal Propellants; Liquid Metals; Electric Discharges; Lithium; Flow Velocity; Feed Systems

20040075899 Lawrence Livermore National Lab., Livermore, CA
High Temperature, High Strain Rate Extrusion of Ultrahigh-Carbon Steels
Lesuer, D. R.; Syn, C. K.; Sherby, O. D.; Aug. 23, 2000; 16 pp.; In English
Report No.(s): DE2004-15006357; UCRL-JC-137307; No Copyright; Avail: Department of Energy Information Bridge

It is shown that high rate extrusion is a viable production process for obtaining desirable microstructures and mechanical properties in ultrahigh carbon steels (UHCSs). The coefficient of friction for extrusion was determined for the UHCSs as well as five other materials and shown to be a function of stress--decreasing with increasing stress. The extruded UHCSs deform by a diffusion-controlled dislocation creep process. Stacking fault energies have been calculated from the extrusion data and observed to decrease with increasing concentrations of silicon, aluminum and chromium. Microstructures are either ultrafine pearlite when extruded above the eutectoid temperature or ultrafine spheroidite when extruded below the eutectoid temperature. The resulting strength--ductility properties are shown to be superior to those obtained in high-strength low alloy steels.
NTIS
Carbon Steels; Mechanical Properties; Extruding

20040075905 Oak Ridge National Lab., TN
Mapping Flow Localization Processes in Deformation of Irradiated Reactor Structural Alloys
Farrell, K.; Byun, T. S.; Hashimoto, N.; Jul. 2002; In English
Report No.(s): DE2003-814077; ORNL/TM-2002/66; No Copyright; Avail: National Technical Information Service (NTIS)

Metals that can sustain plastic deformation homogeneously throughout their bulk tend to be tough and malleable. Often, however, if a metal has been hardened it will no longer deform uniformly. Instead, the deformation occurs in narrow bands on a microscopic scale wherein stresses and strains become concentrated in localized zones. This strain localization degrades the mechanical properties of the metal by causing premature plastic instability failure or by inducing the formation of cracks. Irradiation with neutrons hardens a metal and makes it more prone to deformation by strain localization. Although this has been known since the earliest days of radiation damage studies, a full measure of the connection between neutron irradiation

hardening and strain localization is wanting, particularly in commercial alloys used in the construction of nuclear reactors. Therefore, the goal of this project is to systematically map the extent of involvement of strain localization processes in plastic deformation of three reactor alloys that have been neutron irradiated. The deformation processes are to be identified and related to changes in the tensile properties of the alloys as functions of neutron fluence (dose) and degree of plastic strain. The intent is to define the role of strain localization in radiation embrittlement phenomena. The three test materials are a tempered bainitic A533B steel, representing reactor pressure vessel steel, an annealed 316 stainless steel and annealed Zircaloy-4 representing reactor internal components.
NTIS
Deformation; Alloys; Mechanical Properties; Radiation Damage

20040076916 Austin Peay State Univ., Clarksville, TN, USA
Electrocomposite of Alumina in Nickel Matrix
Xiong-Skiba, Pei; Hulguin, Ryan; Engelhaupt, Darell; Ramsey, Brian; 2004; 1 pp.; In English; 205th Meeting of the Electrochemical Society, 9-13 May 2004, Antonio, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

Nickel/aluminum oxide composite was electroformed in a sulfamate bath with 50 g/L of 0.05-micron aluminum oxide powder. Different plating methods including direct current plating, periodic pulse plating, and periodic reverse pulse plating were used. With conventional direct current plating, the maximum particle inclusion in the nickel matrix remains about 2% (wt). However, much higher percentile particle inclusions were achieved when a specific pulse reversal plating technique was applied. The particle incorporation approaches theoretical maximum when the deposit thickness per cycle approaches the particle diameter size at lower duty cycle. The highest particle incorporation achieved is 23% (by weight). Conceptual models interpreting the dramatic differences in the results of these plating methods were also proposed.
Author
Electroforming; Aluminum Oxides; Nickel Oxides; Direct Current; Plating

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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*.

20040074335 NASA Glenn Research Center, Cleveland, OH, USA
Characterization of an Ultra-High Temperature Ceramic Composite
Levine, Stanley R.; Opila, Elizabeth J.; Robinson, Raymond C.; Lorincz, Jonathan A.; May 2004; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-794-40-4S
Report No.(s): NASA/TM-2004-213085; E-14563; Copyright; Avail: CASI; A03, Hardcopy

Ultra-high temperature ceramics (UHTC) are of interest for hypersonic vehicle leading edge applications. Monolithic UHTCs are of concern because of their low fracture toughness and brittle behavior. UHTC composites (UHTCC) are being investigated as a possible approach to overcome these deficiencies. In this study a small sample of a UHTCC was evaluated by limited mechanical property tests, furnace oxidation exposures, and oxidation exposures in a flowing environment generated by an oxy-acetylene torch. The composite was prepared from a carbon fiber perform using ceramic particulates and a pre-cerns about microcracking due to thermal expansion mismatch between the matrix and the carbon fiber reinforcements, and about the oxidation resistance of the HfB2-SiC coating layer and the composite constituents. However, positive performance in the torch test warrants further study of this concept.
Author
High Temperature; Ceramic Matrix Composites; Ceramics; Thermal Expansion; Performance Tests; Oxidation Resistance; Mechanical Properties; Carbon Fibers

20040074458 Swedish Defence Research Establishment, Linkoeping
Novel Technology for Hydroacoustic Signature Management
Bjoekert, S.; Karasalo, I.; Savage, S.; Staaf, O.; Svensson, S.; Sep. 2003; In Swedish; In English
Report No.(s): PB2004-104588; FOI-R-1015-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report concerns the early stages in the development of a new technology for underwater signature management. The aim of the work presented is on an anechoic coating with a tailored sonic velocity and absorption profile. Both a computational

model to optimize the coating performance and the development of coating material are reported. In this initial stage of the development the coating is based upon homogeneous discreet layers rather than a gradient material. The individual layers are made up of polymer composite, where the matrix material is a styrene butadiene rubber (SBR) with nano- and micro-sized reinforcements.
NTIS
Underwater Acoustics; Acoustic Velocity; Coating

20040074512 Lawrence Livermore National Lab., Livermore, CA
Uranyl-Fluoride (U-233) Solutions in Spherical Stainless Steel Vessels with Reflectors of Be, CH2 and Be-CH2 Composites Part II
Heinrichs, D. P.; Apr. 08, 2002; In English
Report No.(s): DE2004-15005947; UCRL-JC-139232-P2; No Copyright; Avail: National Technical Information Service (NTIS)

A series of criticality studies were performed at the Lawrence Livermore National Laboratory in the late 1950's using aqueous solutions of U-233 in the form of UO2F2 stabilized with 0.3% by weight of HF. These experiments were assigned the program name Falstaff. The U-233 concentration in these experiments ranged from 0.13 to 0.87 kg/l. Eight type 347 stainless steel spheres ranging in inner radius from 7.87 to 12.45 cm were available for use as containers for the solutions. The scope of this evaluation is limited to the experiments involving the four lowest concentrations of uranyl-fluoride solution with 0.45, 0.37, 0.24 and 0.13 kg (U-233)/l. Reflectors of beryllium, polyethylene and beryllium-polyethylene composites were used.
NTIS
Fluorides; Methylene; Spheres; Stainless Steels; Uranium 233

20040074991 Lawrence Livermore National Lab., Livermore, CA
Intergrowth Structure in U-and Hf-Bearing Pyrochlore and Ziroconolite: TEM Investigation
Xu, H.; Wang, Y.; Zhao, P.; Bourcier, W. L.; Van, R.; Dec. 04, 2002; In English
Report No.(s): DE2004-15006446; UCRL-JC-151293; No Copyright; Avail: National Technical Information Service (NTIS)

Transmission electron microscopy results from a sintered ceramics with stoichiometry of Ca(U(sub 0. 5)Ce(sub 0.25)Hf(sub 0.25))Ti(sub 2)O(sub 7) show the material contains both pyrochlore and zirconolite phases and structural intergrowth of zirconolite lamellae within pyrochlore. (001) plane of zirconolite is parallel to (111) plane of pyrochlore because of their structural similarities. The pyrochlore is relatively rich in U, Ce, and Ca with respect to the coexisting zirconolite.
NTIS
Ceramics; Analogies; Transmission Electron Microscopy

20040075068
Effect of Sc and Heat Treatment on Microstructure and Properties of a 7XXX DC Cast Alloy
Senkov, O. N.; Bhat, R. B.; Senkova, S. V.; Tatalovich, J.; Mar. 2004; 7 pp.; In English
Contract(s)/Grant(s): F04611-02-C-0014; Proj-3005
Report No.(s): AD-A422908; No Copyright; Avail: CASI; A02, Hardcopy

Four developmental 7XXX series alloys modified with Sc, Zr and other dispersoid-forming elements were produced by continuous direct chill (DC) casting. Microstructure and mechanical properties were evaluated in both the longitudinal and transverse directions at room and cryogenic temperatures. The homogenization, solution treatment and aging schedules were optimized to obtain superior mechanical properties. In particular, the Sccontaining cast alloys showed tensile properties similar or even superior to the properties of a wrought 7075-T6 alloy. The strengthening mechanisms responsible for this improvement, optimal Sc content and the processing parameters are discussed.
DTIC
Cast Alloys; Castings; Heat Treatment; Microstructure; Temperature Effects

20040075116 Air Force Research Lab., Edwards AFB, CA
SEM Study of Deformation and Failure Mechanisms in Strained Elastomers
Liu, C. T.; Hawkins, T. W.; Brand, A.; Chiang, Fu-Pen; Apr. 2004; 18 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A422987; AFRL-PR-ED-VG-2004-136; No Copyright; Avail: CASI; A03, Hardcopy

Ivestigate the deformation and failure mechanisms on meso and macro scales in a particulate composite and Solithane 113. Determine the strain fields on the meso and macro scales of the two materials.
DTIC
Deformation; Elastomers; Failure; Microstructure

20040075224 Rutgers - The State Univ., New Brunswick, NJ
Polymeric Traypack Integrity: Bench-Scale Unit
Canavan, Jeffrey; Mar. 2002; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): SP0103-96-D-0016
Report No.(s): AD-A423156; FTR-111; No Copyright; Avail: CASI; A03, Hardcopy

This report documents the evaluation of a prototype bench-scale leak tester for the polymeric traypack. The traypack is a replacement for the group feeding metal traycan. Lids of polymeric traypacks are foil laminate film like the material used in MRE pouches and seals are thermal welds. Holes and seal defects found in MRE production can be expected in polymeric traypacks. At leak detection the unit was 100% effective at non-destructively detecting holes and leaks 200 microns or greater. Additional experimentation was conducted to determine the applicability of the unit for non- destructive residual gas testing since current destructive tests represent a substantial continuing expense. Analysis of experimental data indicates that the linear relationship between force and residual gas can be modeled with reliable results for 2 of 3 products tested with the prototype unit.
DTIC
Leakage; Scale Models

20040075227 Rutgers - The State Univ., New Brunswick, NJ
Machine Vision Inspection of Polymeric Traypack Seal Areas
Coburn, John; Canavan, Jeffrey S.; Litman, Neal; Mar. 2002; 35 pp.; In English
Contract(s)/Grant(s): SP0103-96-D-0016
Report No.(s): AD-A423161; FTR-113; No Copyright; Avail: CASI; A03, Hardcopy

This report documents experimental results of a modified production Machine Vision Inspection system for the polymeric traypack. The traypack is a replacement for the group feeding metal traycan. Polymeric traypacks are heat sealed with a foil laminate, film lid. Seal area contamination during filling and handling before sealing can be expected in polymeric traypacks. Since entrapped matter can lead to open seals, defects, and seal anomalies, a method of measurement for seal area contamination is useful in quantifying effects of filler changes, line speeds, and product formulations. Proper lighting was the most important factor in achieving accurate results. The unit was 96% effective at detecting small areas of opaque contamination after lighting changes were made. Experimental contaminates used were creamed ground beef, beef stew and water. Offset, diffuse lighting yielded significantly improved results for the products tested compared to the integrated, direct strobe light. Additional fine-tuning will be required to obtain 90+% effectiveness with water.
DTIC
Computer Vision; Inspection

20040075666 NASA Marshall Space Flight Center, Huntsville, AL, USA
Verification of an Analytical Method for Measuring Crystal Nucleation Rates in Glasses from DTA Data
Ranasinghe, K. S.; Wei, P. F.; Kelton, K. F.; Ray, C. S.; Day, D. E.; 2004; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

A recently proposed analytical (DTA) method for estimating the nucleation rates in glasses has been evaluated by comparing experimental data with numerically computed nucleation rates for a model lithium disilicate glass. The time and temperature dependent nucleation rates were predicted using the model and compared with those values from an analysis of numerically calculated DTA curves. The validity of the numerical approach was demonstrated earlier by a comparison with experimental data. The excellent agreement between the nucleation rates from the model calculations and fiom the computer generated DTA data demonstrates the validity of the proposed analytical DTA method.
Author
Glass; Crystallization

20040075691 NASA Marshall Space Flight Center, Huntsville, AL, USA

Deformation, Stress Relaxation, and Crystallization of Lithium Silicate Glass Fibers Below the Glass Transition Temperature

Ray, Chandra S.; Brow, Richard K.; Kim, Cheol W.; Reis, Signo T.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The deformation and crystallization of Li(sub 2)O (center dot) 2SiO2 and Li(sub 2)O (center dot) 1.6SiO2 glass fibers subjected to a bending stress were measured as a function of time over the temperature range -50 to -150 C below the glass transition temperature (Tg). The glass fibers can be permanently deformed at temperatures about 100 C below T (sub)g, and they crystallize significantly at temperatures close to, but below T,, about 150 C lower than the onset temperature for crystallization for these glasses in the no-stress condition. The crystallization was found to occur only on the surface of the glass fibers with no detectable difference in the extent of crystallization in tensile and compressive stress regions. The relaxation mechanism for fiber deformation can be best described by a stretched exponential (Kohlrausch-Williams-Watt (KWW) approximation), rather than a single exponential model.The activation energy for stress relaxation, Es, for the glass fibers ranges between 175 and 195 kJ/mol, which is considerably smaller than the activation energy for viscous flow, E, (about 400 kJ/mol) near T, for these glasses at normal, stress-free condition. It is suspected that a viscosity relaxation mechanism could be responsible for permanent deformation and crystallization of the glass fibers below T,

Author

Glass Fibers; Crystallization; Stress Relaxation

20040077050 NASA Ames Research Center, Moffett Field, CA, USA

Integration of Pressure-Sensitive Paint Data to Obtain Loads

Bell, James; Research and Technology 1999; December 2000, pp. 63; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

A primary reason for developing pressure-sensitive paint (PSP) for wind tunnel testing has been the desire to use PSP in measuring aircraft loads. This would obviate the need for a separate loads model and test, as well as make loads data available much earlier in the design cycle than is presently the case. However, the ability of PSP to deliver accurate loads data cannot be validated until integrated pressures from PSP have been shown to give accurate force and moment values. The main objective was to modify the current PSP data reduction code to support integration of pressure data over a model surface grid and to compare PSP-derived force and moment measurements with those obtained from the balance.

Author

Pressure Sensitive Paints; Wind Tunnel Tests

20040077105 NASA Ames Research Center, Moffett Field, CA, USA

CFD Analysis of Arc-Jet and Flight Environments for the B-2 Flight Experiment

Loomis, Mark; Palmer, Grant; Research and Technology 1999; December 2000, pp. 81; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames Research Center has been developing new ultrahigh temperature ceramics (UHTC) for potential use in the sharp leading edges of future space vehicles. These materials have been developed and tested in ground-based arc-jet facilities, and a flight test program called SHARP (slender hypervelocity research aerothermodynamic research probes) has been initiated. The first flight demonstration, SHARP-61, incorporated a 0.141 -inch-radius UHTC nose-tip on a U.S. Air Force reentry vehicle in collaboration with Sandia National Laboratory; it was successfully flown in May 1997. The second flight test, SHARP-B2, incorporates four instrumented UHTC strakes mounted on the side of the entry vehicle; it i s scheduled to fly in June 2000. The goal of these flight tests is to assess the performance of the materials under realistic entry conditions. Computational fluid dynamics (CFD) simulations of the flight environment have been performed to aid in the design of the test hardware and instrumentation, and simulations of critical qualifying ground tests in the arc-heated wind tunnels have been performed to aid in test interpretation and instrument checkout, and to show traceability of the ground-test environment to flight.

Derived from text

Arc Heating; Ceramics; Computational Fluid Dynamics; Ground Tests; Sharp Leading Edges; Simulation

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*.

20040074993 Defence Science and Technology Organisation, Edinburgh, Australia

Ab Initio Computational Chemical Studies of Molecular Processes and Decomposition in Ammonium Perchlorate

White, A.; February 2004; 41 pp.; In English

Report No.(s): DSTO-TR-1552; DODA-AR-013-032; Copyright; Avail: Other Sources

Ammonium perchlorate is widely used as an oxidizer in composite propellants for rocket motors. Its decomposition is of interest in stability, sensitivity and combustion studies for rocket motor safety and performance analysis and prediction. This document presents some theoretical studies conducted to yield insights into the mechanisms and kinetics of ammonium perchlorate decomposition.

Author

Ammonium Perchlorates; Propellant Decomposition; Protons; Ions; Crystal Structure

20040075076 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Aerobic Biodegradation of Alternative Fuel Oxygenates in Unsaturated Soil Columns

Mares, Kevin A.; Mar. 2004; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422919; AFIT/GEM/ENV/04M-13; No Copyright; Avail: CASI; A07, Hardcopy

Groundwater contamination problems caused by methyl-tertiary butyl ether (MTBE) in subsurface waters have prompted the search for a gasoline oxygenate replacement. In order to avoid the problems encountered with MTBE, it is prudent to evaluate the fate and transport in the subsurface of proposed replacements, such as ethanol. In this study, ethanol transport and degradation in unsaturated soil was investigated using a series of eight soil columns. This preliminary study was to see if the soil column system components functioned properly, how similarly the eight soil columns performed, and if soil oxygen concentration affected degradation of ethanol. Tracer tests, using sodium chloride, determined the hydraulic characteristics of the soil columns. Oxygen sensors measured microbial activity in the soil columns when ethanol was added to the columns. The sensors were part of a control system that stabilized oxygen concentration at two levels (8% in four columns and 16% in four columns) to see the effect of oxygen concentration on ethanol degradation. A gas chromatograph (GC) was used to quantify column influent and effluent ethanol concentrations. The tracer tests showed an average retention time, pore volume, and mass balance error of 13.3 hr (+/- 1.4), 18.9 L (+/- 2.0), and 1.3% (+/- 3.8), respectively. The oxygen sensor data, which indicated a drop in oxygen concentration over time when ethanol was added, suggested that microbial activity was occurring. The microbial aerobic metabolism of ethanol caused the oxygen concentrations to drop to the set points of 8% and 16%, at which they stabilized. The GC analysis also showed ethanol degradation. Influent ethanol concentrations were ^ 1000 ppm, column effluent concentrations were at or near the method detection limit (MDL) of 1 ppm for both oxygen concentrations. DTIC

Additives; Aerobes; Biodegradation; Contamination; Ground Water; Soils; Water Pollution

20040075673 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Review of LOX/Kerosene Combustion Instability in American and Russian Combustion Devices in Application to Next-Generation Launch Technology

Rocker, Marvin; Nesman, Tomas E.; Hulka, James R.; Dougherty, N. Sam; August 27, 2003; 2 pp.; In English; JANNAF 52nd Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

The Next-Generation Launch Technology (NGLT) project was introduced with its objectives. To meet the objectives, NASA has directed aerospace industry to perform advances and risk reduction of relevant technologies, including propulsion. Originally, the propulsion industry focused on producing both LOWLH2 and LOWkerosene flight engine technology demonstrators. These flight engine technology demonstrators were briefly reviewed. NASA recently redirected this focus to Lowkerosene only. Discussion of LOWkerosene combustion devices was and is prefaced by grave concerns about combustion instability. These concerns have prompted a review of LOWkerosene combustion instability in American and Russian combustion devices. In the review of the Russian propulsion industry's experience in eliminating LOWkerosene combustion instabilities, the history of principal Russian rocket scientists and their role in the development of LOXkerosene combustion devices is presented. The innovative methods implemented by the Russians of eliminations combustion instabilities in LOXkerosene combustion devices were reviewed. The successful elimination of these combustion instabilities has resulted in

two generations of Russian-produced, high-performance LOWkerosene combustion devices.
Author (revised)
Aerospace Industry; Propulsion; Oxygen-Hydrocarbon Rocket Engines

20040075901
U.S. Nuclear Waste Technical Review Board Report to the U.S. Congress and the Secretary of Energy. January 1, 2003, to December 31, 2003
May 2004; 168 pp.; In English
Report No.(s): PB2004-105718; No Copyright; Avail: CASI; A08, Hardcopy

In 1987, the U.S. Nuclear Waste Technical Review Board (Board) was created as an independent federal agency by Congress in the Nuclear Waste Policy Amendments Act. The Board was charged with evaluating the technical and scientific validity of the U.S. Department of Energy's (DOE) efforts to develop a system for disposing of high-level radioactive waste and spent nuclear fuel. The Board is required to report its findings and recommendations to Congress and the Secretary of Energy at least twice a year. This document describes activities undertaken by the Board from January 1 through December 31, 2003.
NTIS
Radioactive Wastes; Disposal

20040076962 Alabama Univ., Huntsville, AL, USA
Uncertainty Analysis on Heat Transfer Correlations for RP-1 Fuel in Copper Tubing
Driscoll, E. A.; Landrum, D. B.; May 13, 2004; 11 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA
Report No.(s): HAWK-TC-02; No Copyright; Avail: CASI; A03, Hardcopy

NASA is studying kerosene (RP-1) for application in Next Generation Launch Technology (NGLT). Accurate heat transfer correlations in narrow passages at high temperatures and pressures are needed. Hydrocarbon fuels, such as RP-1, produce carbon deposition (coke) along the inside of tube walls when heated to high temperatures. A series of tests to measure the heat transfer using RP-1 fuel and examine the coking were performed in NASA Glenn Research Center's Heated Tube Facility. The facility models regenerative cooling by flowing room temperature RP-1 through resistively heated copper tubing. A Regression analysis is performed on the data to determine the heat transfer correlation for Nusselt number as a function of Reynolds and Prandtl numbers. Each measurement and calculation is analyzed to identify sources of uncertainty, including RP-1 property variations. Monte Carlo simulation is used to determine how each uncertainty source propagates through the regression and an overall uncertainty in predicted heat transfer coefficient. The implications of these uncertainties on engine design and ways to minimize existing uncertainties are discussed.
Author
Heat Transfer; Correlation; Pipes (Tubes); Copper; High Temperature; Regenerative Cooling

20040077136 NASA Ames Research Center, Moffett Field, CA, USA
Propellant Preservation for Mars Missions
Kittel, Peter; Research and Technology 1999; December 2000, pp. 134; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The last few years have seen extensive technology planning for human missions to Mars. These missions will make extensive use of cryogenic propellants, some of which will be transported to Mars. Additional propellants will be manufactured, liquefied, and stored on Mars. The missions that use these propellants could start early this century. Although many of the plans are still evolving, it has been possible to derive a set of cooler requirements. Recent estimates of these requirements are given here along with a discussion of whether the requirements can be met with existing coolers and coolers currently being developed. In recent years, a variety of transportation scenarios have been considered. The analysis reported here relates to one of the more promising nonnuclear options. It makes use of solar electric propulsion (SEP). The SEP baseline concept follows: 1. A SEP tug boosts the TMI (trans-Mars injection) stage to a highly elliptical orbit. This phase requires 400 days of propellant storage for the TMI piloted stage and 250 days for the TMI cargo stages. 2. The ascent and descent stages require about 580 days of propellant storage for the piloted mission and 550 days for the cargo case. These stages use oxygen (O2) and methane (CH4) for propellants. 3. The TEI (trans-Earth injection) stage requires a storage duration of 1200 days. This stage uses hydrogen (H2) as the propellant. 4. All tanks are cooled by cryocoolers to eliminate boil off. 5. The tank design is standardized to 3.29-meter-diameter spheres. Fixing the volume results in the stages having multiple tanks, with many of

the tanks full at launch. A thermal model was used to estimate the cooler requirements. This model could estimate the tank size and mass for MLI (multilayer insulation) insulated tanks with and without coolers. The cooling power and the mass of the power source and radiators were included for ZBO (zero boil-off) storage. In the first case, the volume of the tank was variable. The volume was adjusted until it was large enough to accommodate the boil-off during the mission and still preserve the required propellant until it was needed. In the latter case, the volume was fixed. An optional cooled shield has been included in the model for hydrogen tanks. The results of the model are presented.
Derived from text
Mars Missions; Preserving; Propellant Storage; Cryogenic Rocket Propellants

29
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*.

20040075895 NASA Marshall Space Flight Center, Huntsville, AL, USA
Strategic Research Directions In Microgravity Materials Science
Clinton, Raymond G., Jr.; Wargo, Michael J.; Marzwell, Neville L.; Sanders, Gerald; Schlagheck, Ron; Semmes, Ed; Bassler, Julie; Cook, Beth; [2004]; 20 pp.; In English; Transformational Space Launch and Operations Technology Conference, 24-26 May 2004, Washington, DC, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Office of Biological and Physical Research (OBPR) is moving aggressively to align programs, projects, and products with the vision for space exploration. Research in advanced materials is a critical element in meeting exploration goals. Research in low gravity materials science in OBPR is being focused on top priority needs in support of exploration: 1) Space Radiation Shielding; 2) In Situ Resource Utilization; 3) In Situ Fabrication and Repair; 4) Materials Science for Spacecraft and Propulsion Systems; 5) Materials Science for Advanced Life Support Systems. Roles and responsibilities in low gravity materials research for exploration between OBPR and the Office of Exploration Systems are evolving.
Derived from text
Microgravity Applications; Materials Science

20040077174 NASA Ames Research Center, Moffett Field, CA, USA
A Liquifier for Mars Surface Applications
Salerno, Louis J.; Helvensteijn, Ben; Kittel, Peter; Research and Technology 1999; December 2000, pp. 62-63; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

NASA is planning an extensive set of robotic and human exploration missions that will make extensive use of cryogenic propellants. In-situ-consumable production (ISCP) will reduce the mass launched from Earth by manufacturing propellant gases on the Mars surface. NASA's Exploration programs will benefit significantly from ISCP, providing that low cost, lightweight methods of propellant gas liquefaction are available to make exploration financially feasible. The objective was to demonstrate that the planned 2003 Mars surface oxygen gas liquefaction requirement could be met with an existing, off-the-shelf tactical cryogenic cooler and a simple heat exchanger. The requirement is that oxygen gas produced during the daytime on the Mars surface (typical temperature environment of 240 K) be liquefied at a rate of 12.6 grams per hour (g/hr) and stored at a pressure of 0.2 atmospheres (atm) (0.2 megapascals (MPa)).
Author
In Situ Resource Utilization; Mars Surface; Cryogenic Rocket Propellants; Coolers

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20040075519 National Defense Univ., Washington, DC
Alternative Governance: A Tool for Military Laboratory Reform (Defense Horizons, Number 34, November 2003)
Coffey, Timothy; Lackie, Kenneth W.; Marshall, Michael L.; Nov. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422384; No Copyright; Avail: CASI; A02, Hardcopy

Throughout the Cold War, the USA maintained an edge over adversaries by fielding tech technologically superior warfighting systems. This strategy depended on a strong research and development (R&D) effort in both the public and private sectors, and the community of military laboratories in the Department of Defense played an essential role in the overall effort. Because of the importance of these labs during the Cold War, defense planners continually focused on ways to improve and strengthen them. The end of the Cold War, however, shifted the focus away from laboratory improvement toward consolidation, closure, realignment, and personnel downsizing, as many came to believe much of the R&D done by the military laboratories could, and even should, be done by the private sector.
DTIC
Horizon; Technology Assessment

20040075798 NASA Ames Research Center, Moffett Field, CA, USA
A Model for the Limiting Piston Stroke in Vortex Ring Formation
Shariff, K.; Research and Technology 1997; September 1998, pp. 50-51; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Many devices eject a mass of fluid either in one shot or periodically. Examples include heart valves and flapping wings. Often the goal is to maximize the volume of fluid moving as a coherent vortex ring away from the exit. M. Gharib (California Institute of Technology) used a piston to experimentally study fluid ejected from a pipe and found that the largest coherent mass of fluid was attained at a piston stroke (normalized by diameter) of 4 under a variety of circumstances, including different histories of the piston motion. For longer strokes, the mass broke up into smaller vortices and a trailing jet. He also found that this maximum stroke, when expressed as a time, corresponds to the ejection period of many biological systems, including normal hearts. The present contribution was a simple model that predicts the limiting stroke and the associated properties of the vortex such as circulation. Reasons for insensitivity to piston motion emerge from the model, and piston motions that maximize the ejected mass were obtained.
Derived from text
Vortex Rings; Models

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*.

20040074460 Swedish Defence Research Establishment, Linkoeping
Pilot Study System Assessment of Signature Management Technologies in a Network Centric Warfare Perspective
Klum, P.; Bohman, L.; Nelsson, C.; Rahm, J.; Ousbaeck, J.; Nov. 2003; In Swedish
Report No.(s): PB2004-104558; FOI-R-1009-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The pilot study objectives were to ascertain preliminary ideas on how signature management technologies might contribute in a network centric warfare perspective, as well as to identify future research directions. Another purpose was to introduce project managers at FOI to the network centric warfare doctrine and to find the consequences in their area of expertise respectively. The report describes a survey of dimensioning scenarios, sensors and future sensor networks, different technologies for low observables and the need for assessment tools. Finally, the role of signature management technologies in different scenarios is discussed. The scenarios of interest have been international operations, urban warfare and a generalized network centric warfare scenario. Preliminary conclusions concerning the direction of future research are presented. The new scenarios, with diversified sensor threat and varied operational environments, mean new challenges for the signature management technology, such as multi spectral solutions and adaptability to different backgrounds. The need for a convertible low signature mode in exposed situations was emphasized. Some research areas that have been identified are: Assess signature management technologies in relation to other protective measures, Mi- and multi static radar signatures. Adaptive surfaces (materials and constructions that allow an adaptive signature), techniques that allow a fast change between high and low signature, signature management for protecting sensor apertures, and modeling tools to predict signatures in new environments.
NTIS
Electronic Warfare; Acoustics; Radar Signatures

20040074495 Helsinki Univ. of Technology, Espoo

Multipath Propagation Characterization for Terrestrial Mobile and Fixed Microwave Communications

Zhao, X.; 2002; 44 pp.; In English

Report No.(s): PB2004-105760; REPT-S-256; No Copyright; Avail: CASI; A03, Hardcopy

Multipath propagation is a key issue studied throughout this thesis, and it causes dispersions in delay, frequency and spatial domains. These are dominant phenomena in both terrestrial mobile and fixed wideband communications. In this thesis, multipath propagation mechanisms including diffraction, refraction, reflection and scattering are studied when radio waves interact with dielectric and metallic objects, or an atmospheric duct. Measurements were also performed for empirical modelling and validation of the theoretical work carried out in this thesis.

NTIS

Diffraction; Mobile Communication Systems; Multipath Transmission

20040075050 Naval Postgraduate School, Monterey, CA

Command Structure of the Ballistic Missile Defense System

Weller, David B.; Mar. 2004; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422370; No Copyright; Avail: CASI; A05, Hardcopy

The USA is embarking on a course of designing and fielding a Ballistic Missile Defense System (BMDS) to protect the USA and her citizenry against ballistic missile attacks. The BMDS will need a Command and Control, Battle Management, and Communications (C2BMC) organization/system to support military and national decision makers in times of crisis. The C2BMC also must be able to react quickly once a missile event has occurred. This thesis will cover the doctrinal issues with merging Theater Missile Defense (TMD) and the National Missile Warning System into one system, how the Unified Command Plan affects missile defense efforts, the lessons learned from Desert Storm, and presents alternative chains of command that might allow the BMDS to engage threat missiles in a timely and efficient manner. Preliminary findings indicate that a "flattened" chain of command for missile defense forces seems to be a positive starting point for the initial deployment of the BMDS. (7 figures, 50 refs.)

DTIC

Antimissile Defense; Ballistic Missiles; Command and Control; Intercontinental Ballistic Missiles; International Relations; Missile Defense

20040075061 Air Force Inst. of Tech., Wright-Patterson AFB, OH

An Investigation of the Optimal Sensor Ensemble for Sensor Fusion

Clemans, Paul P.; Mar. 2004; 90 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422890; AFIT/GOR/ENS/04-03; No Copyright; Avail: CASI; A05, Hardcopy

This thesis continues the research begun by Storm, Bauer and Oxley in 2003 into the fusion of classifiers. It examines the fusion of up to three correlated classifiers using three different fusion techniques. The overall objective was to determine the optimal ensemble of classifiers to maximize the expected classification accuracy. The ISOC fusion method (Haspert, 2000), the ROC Within fusion method (Oxley and Bauer, 2002) and a Probabilistic Neural Network were the three fusion techniques employed in these set of experiments. Performance of the classifiers and the fusion methods is measured via ROC curves. Two possible configurations of feature correlations were examined. The expected true positive value relative to a prior distribution of correlation levels for each configuration was then used to compare the classifiers and the fused classifiers performance and thereby allowing for the selection of an optimal ensemble.

DTIC

Command and Control; Multisensor Fusion

20040075138 Texas Univ., Arlington, TX

Energy Efficient Wireless Sensor Networks Using Fuzzy Logic

Liang, Qilian; Jun. 2004; 140 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0466

Report No.(s): AD-A423016; No Copyright; Avail: CASI; A07, Hardcopy

During the period of 12/1/2003-- 5/31/2004, we have proposed different approaches on energy efficient wireless sensor networks. (1) We proposed a cross-layer design approach for fault-tolerance and energy efficiency. Network layer (sensor network routing), MAC layer, and physical layer (channel coding and interleaver) were considered in this approach. (2) Theory and performance analysis for sensor placement and lifetime of wireless sensor networks were studied, and statistical

distribution of the node lifetime and network lifetime were presented. (3) A fully-distributed energy-efficient self-organizing protocol was proposed for wireless sensor networks, and an Expellant Self-Organization (ESO) scheme was developed. (4) Energy efficient intrusion detections and corresponding strategies were studied and simulated for wireless sensor networks. (5) Tradeoffs between latency and energy efficiency were evaluated in wireless sensor networks. Fourteen papers were produced during the past six months, and are attached to this report.
DTIC
Communication Networks; Fuzzy Systems

20040075153 Air Force Research Lab., Eglin AFB, FL
Comparative Study of Spread Spectrum and Time Modulated Ultra-Wide-Band Communications
Wong, Tan F.; Shea, John M.; Fang, Yuguang; Denny, Mark D.; Nabritt, Maurice; Jan. 2004; 66 pp.; In English
Contract(s)/Grant(s): F08630-02-C-0008; Proj-2068
Report No.(s): AD-A423034; AFRL-MN-EG-TR-2004-7050; No Copyright; Avail: CASI; A04, Hardcopy

Ultra-wideband communications have recently received much attention. A number of military and commercial applications of ultra-wideband have been suggested. An ultra- wideband transmitter generates signals of very large bandwidths (in excess of gigahertzs) by transmitting nanosecond or subnanosecond pulses at baseband in some randomized fashion. As a result, an ultra-wideband system is in reality a baseband spread spectrum (SS) system with a very large spreading gain. Many of the characteristics and advantages of conventional SS communications carry over to ultra-wideband. For instance, a typical ultra-wideband system is capable of supporting multiple users, is robust against jamming and interference, is robust against multipath fading, and is suitable for applications requiring low probabilities of interception and detection (LPI/ LPD). On the other hand, the use of a very large bandwidth also imposes some new challenges, like wideband antenna design, acquisition design, and interference with other systems. The goal of this project was to provide an independent evaluation of the usefulness and effectiveness of Time-Modulated Ultra-Wideband (TM-UWB) for short- to medium-range communication in a battlefield environment. TM-UWB and SS were compared in three hypothetical application scenarios that are of interest to the Air Force: a cooperative attack weaponry system, an aerial surveillance system, and a buried facility probing system. Results showed a strong potential advantage of using TM-UWB in the buried facility probing system, for which a short-range, high-rate, low-power, wall-penetrating communication system is needed. For the other two scenarios of medium- and long-range communications, the advantage of using TM-UWB was not clear and needs to be further investigated. Ultra wideband appears to be best suited for systems with fairly short link ranges and it far outperforms its counterpart indoors. (16 tables, 37 figures, 23 refs.)
DTIC
Broadband; Spread Spectrum Transmission; Wideband Communication; Wireless Communication

20040075876 Department of Energy, Washington, DC, USA
DOE Science Networking Challenge: Roadmap to 2008
2003; In English
Report No.(s): DE2003-815539; No Copyright; Avail: National Technical Information Service (NTIS)

U.S. Department of Energy (DOE) Science Networking resources are crucial for achieving DOE's 21st century science mission. This report puts forth a roadmap for the networks and collaborative tools that the Science Networking and Services environment requires for DOE science fields including astronomy/astrophysics, chemistry, climate, environmental and molecular sciences, fusion, materials science, nuclear physics, and particle physics. Success in these fields depends on scientists' ability to move large amounts of data, access experimental and computing resources via the network, and collaborate in real time from multiple locations across the country and around the world. Implementation of the roadmap presented in this report will be a critical element in keeping DOE a leader in world-class scientific discoveries.
NTIS
Nuclear Physics; Real Time Operation; Astrophysics; Networks

20040076976 Defence Science and Technology Organisation, Edinburgh, Australia
Clutter Spatial Distribution and New Approaches of Parameter Estimation for Weibull and K-Distributions
Dong, Yunhan; April 2004; 55 pp.; In English
Report No.(s): DSTO-RR-0274; DODA-AR-013-086; Copyright; Avail: Other Sources

The spatial distribution of surface clutter in general depends on radar resolution, grazing angle and scatterers on the surface. The Weibull, K- and lognormal distributions are commonly used to approximate the clutter spatial distribution.

Comparisons among all three distributions are reviewed and extended. Statistical properties of the Weibull and K-distributions in the log domain are derived and then used in new approaches, named as unbiased estimation schemes, for faster parameter estimation for the Weibull and K-distributions. The maximum likelihood estimates for the K-distribution are also derived without the need of the derivative of the Bessel function. The proposed unbiased estimation schemes provide nearly as identical estimates as the maximum likelihood scheme does, according to real aperture radar data and synthetic aperture radar data analysed.
Author
Spatial Distribution; Clutter; Weibull Density Functions; Statistical Distributions

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*.

20040074468 Swedish Defence Research Establishment, Linkoeping
Optical Signatures: Final Report
Nelsson, C.; Forssell, G.; Hermansson, P.; Haegaerd, A.; Nyberg, S.; Nov. 2003; In English
Report No.(s): PB2004-104552; FOI-R-1008-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Within the Optical signatures project fundamental research concerning signature phenomena and signature analysis has been conducted during the period 2001-2003. The work has concerned target and background signatures as well as the atmospheric influence on the signature. A data bank with background signatures has been compiled from measurements. Based on it, a statistical analysis has been made and a study of the spectral content of the background. It will be a good basis for the formulation of LO requirements for platforms within the armed forces. The capacity of modeling has increased through acquisition and own development of signature codes. As an example a semi-empirical model has been developed. Furthermore, the competence has improved as an effect of validation work. Competence and simulation software is now available at FOI for the support of evaluation of existing and new platform concepts. Polarization effects of targets and backgrounds have been studied. As an example, the capability to find camouflaged objects with a polarization sensitive sensor has been analyzed. A program for texture-based signature analysis from images has been developed and is now used within the defense sector also outside FOI. Previously collected atmospheric transmission data has been used to develop a new aerosol attenuation model for the Swedish environment.
NTIS
Atmospheric Attenuation; Simulation; Signature Analysis; Statistical Analysis

20040074489 Helsinki Univ. of Technology, Espoo, Finland
Fuzzy Traffic Signal Control. Principles and Applications
Niittymaki, J.; 2002; 76 pp.; In English
Report No.(s): PB2004-105785; No Copyright; Avail: CASI; A05, Hardcopy

The FUSICO (Fuzzy Signal Control)-research project was started in 1996 at the Helsinki University of Technology. The main goals of the project are theoretical analysis of fuzzy traffic signal control, generalized fuzzy rules using linguistic variables, validation of fuzzy control principles, calibration of membership functions, and development of a fuzzy adaptive signal controller. This thesis discusses four hypotheses for fuzzy traffic signal control. They are (I) generality of fuzzy control, (II) competitiveness of fuzzy control (III) multilevelity, -dimensionality and -objectiveness and (IV) realisticity in real traffic signal control. The control principles and rules for the fuzzy control are modeled based on the actions of an experienced policeman represented by knowledge of an experienced signal control planner. According to the results the control parameters of fuzzy traffic signal control can be divided into three different groups: traffic volume, capacity, and level of service parameters. The fuzzy control algorithm of isolated traffic signal control can be derived based on these parameters. The fuzzy inference is perhaps the most important part of fuzzy control, but also the methods of fuzzification and defuzzification have to be introduced. Some artificial methods, like genetic algorithms and neural networks, have been tested without any benefits in comparison with the empirical membership functions. The fuzzy similarity method, which is based on Lukasiewicz's logic, has been introduced as a potential defuzzification method.
NTIS
Air Traffic Control; Genetic Algorithms; Linguistics

20040074490 Helsinki Univ. of Technology, Espoo, Finland

Defect and Yield Analysis of Semiconductor Components and Integrated Circuits

Karilahti, M.; 2003; 84 pp.; In English

Report No.(s): PB2004-105784; No Copyright; Avail: CASI; A05, Hardcopy

Semiconductors were studied from the point of material, component, electrical and functional properties. Several methods were used to accomplish this, e.g. X-ray topography, etch pit analysis, statistical methods, and neural nets. The compound semiconductor components, i.e. GaAs varactor diodes, AlGaAs/InGaAs p-HEMTs, and LEDs (GaAs/AlGaAs and GaPN) were studied using the method of synchrotron X-ray topography. First, the silicon wafers studied were selected from fully processed lots with varying, though, low yields. The electrical circuits were fabricated with a CMOS (Complementary Metal-Oxide Semiconductor) process, well suited for mixed-signal applications. Then, synchrotron X-ray topography and etch pit micrographs of the wafers were analyzed with an image processing software, written entirely for this study, to quantify the strain and defects present in the images. This information was then correlated with electrical parameters previously measured from the wafers, including the yield. Several of the parameters quantified from the synchrotron X-ray images show a strong correlation with certain measured parameters, e.g. PMOS transistor threshold voltage, polysilicon sheet resistance, N- sheet contact chain resistance. Then, some parameters practically do not correlate, e.g. NMOS breakdown voltage. A strong correlation of device yield with near-surface strain measured by synchrotron X-ray topography is found.

NTIS

Defects; Semiconductors (Materials); Metal Oxide Semiconductors; Topography; Threshold Voltage

20040075059 InfoScribe Technologies Ltd., Beavercreek, OH

Magnetron Sputtered Pulsed Laser Deposition Scale Up

Laube, Samuel J.; Heyob, Jeffery J.; Aug. 14, 2003; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-98-C-5038; Proj-4347

Report No.(s): AD-A422887; AFRL-ML-WP-TR-2003-4184; No Copyright; Avail: CASI; A05, Hardcopy

The objective was primarily to utilize the newly developed Air Force super-hard coating process technologies in practical applications, such as turbine engine rotor components, precision shafts and ball bearings, and bearing races. This would give the Air Force the capability of practically coating real precision mechanical parts with solid lubricant films of the highest toughness. These films would be of the highest hardness and the most resilient to damage, extending the life of high cost precision aircraft components. This is driven by the fact that the primary cost in producing aircraft components is the precision machining required.

DTIC

Magnetron Sputtering; Magnetrons; Pulsed Laser Deposition; Pulsed Lasers

20040075097 Air Force Inst. of Tech., Wright-Patterson AFB, OH

An Experimental Design for Measuring In Situ Radiation Damage to a Piezoelectric Transducer

Severson, Michael R.; Mar. 2004; 114 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422955; AFIT/GNE/ENP/04-06; No Copyright; Avail: CASI; A06, Hardcopy

An experiment was conducted investigating the use of an acoustic pulse waveguide to collect response measurements from three piezoelectric acoustic emission (AE) transducers while the transducers were exposed to an active nuclear reactor neutron flux ranging from 1 x 10(exp 11) to 2. 4 x 10(exp 12) neutrons per sq cms. Material, mechanical, and radiation studies were performed to determine a practical design for the construction of the experiment. Discreet frequency pulses generated by an Arbitrary Waveform Generator were transmitted by an aluminum waveguide to the core of the Ohio State University Research Reactor (OSURR). Three AF transducers coupled to the waveguide were exposed to the reactor neutron fluence and their response to each frequency pulse was measured over time. The recorded data was used to study the correlation between the neutron dose and resulting device damage. Response measurements were also taken in situ during post-irradiation periods to determine if response changes due to radiation damage would recover with time. Data sampling of transducer response was reproducible with a standard deviation that ranged between 3% and 8% of the mean value for all frequencies. Final transducer response levels varied between devices and frequencies, but were consistently degraded. Decreases in response between transducers ranged from 36% to 78% using the average percent decrease over ten test frequencies. Individual frequency response degradation ranged from 16% to 92%.

DTIC

Acoustic Emission; Experiment Design; Piezoelectric Transducers; Radiation Damage

20040075122 Materials Research Society, Warrendale, PA

Materials Research Society Symposium Proceedings. Volume 789. Held in Boston, Massachusetts, December 1-5 2003. Quantum Dots Nanoparticles and Nanowires

Guyot-Sionnesi, P.; Mattoussi, H.; Woggon, U.; Wang, Z. L.; Jan. 2004; 421 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0067

Report No.(s): AD-A422993; No Copyright; Avail: CASI; A18, Hardcopy

CdSe(sub x)Te(sub 1-x) nanoparticles (with different stoichiometry ratio x) dispersed in silicon dioxide films have been grown by magnetron sputtering technique followed by thermal annealing. Effect of Thermal annealing conditions on the structural, compositional, optical and electronic properties of nanoparticles has been studied Using GAXRD, XPS, TEM, and spectroscopic ellipsometry techniques A structural transformation in the nanoparticle core mediated purely by surface layer effects in the case of CdTe and a spontaneous self-organization of nanoparticles into nanorods in the case of CdSe via fractal growth has been observed. Preliminary observations from the ellipsometry measurements carried out on some of these nanoparticle films shows a blue shift of absorption edge.

DTIC

Conferences; Nanoparticles; Nanostructures (Devices); Quantum Dots

20040075131 Arkansas Univ., Fayetteville, AR

Optical Properties of III-V Semiconductor Nanostructure and Quantum Wells

Manasreh, Omar; Jan. 2002; 23 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0299

Report No.(s): AD-A423002; AFRL-SR-AR-TR-04-0262; No Copyright; Avail: CASI; A03, Hardcopy

The authors have investigated the interband and intersubband transitions in III-V semiconductor quantum wells and quantum dots. They also investigated intersubband transitions in III-nitride multiple quantum wells grown on a sapphire substrate, in particular, intersubband transitions in InGaAs/GaAs multiple quantum dots and GaN/AlGaN multiple quantum wells. Polarization effect on the phonon modes in GaN/AlGaN heterojunctions field effect transistors also were reported. The report contains detailed discussions of the results obtained during the last 18 months. It concludes with a list of related technical papers, books, and symposia. (1 table, 10 figures, 63 refs.)

DTIC

Absorptivity; Heterojunctions; Nanostructure (Characteristics); Optical Properties; Photoluminescence; Quantum Dots; Quantum Wells; Semiconductors (Materials)

20040075147 Grambling State Univ., LA

Synthesis and Characterization of Polyimides to be Used in the Fabrication of a Low Driving Voltage Electro-Optic Modulator

Walton, Connie; Sarkisov, Sergey; Apr. 2004; 44 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0014

Report No.(s): AD-A423027; AFRL-SR-AR-TR-04-0251; No Copyright; Avail: CASI; A03, Hardcopy

The aim of this project was to synthesize polyimides that exhibit second order nonlinear optic behavior and to fabricate a Low Driving Voltage Electro-optic Modulator. Undergraduate and graduate students were involved in all aspects of this project. A high temperature polyimide that had a NLO chromophore incorporated was synthesized and its properties characterized. The E-O coefficient of the polyimide was determined to be 1.98pm/V and expected to have a driving voltage of 9.0 volts. In the detailed analysis of the design of the E-O Modulator Single-arm Interferometer it was determined that the waveguide should have two modes. In the design of the Modulator a new method of coupling light using micro-scratches was tested.

DTIC

Electro-Optics; Fabrication; Low Voltage; Modulators; Polyimide Resins; Polyimides

20040075148 Georgia Inst. of Tech., Atlanta, GA

Nanojets: Electrification Energetics Dynamics Stability and Breakup

Landman, Uzi; Nov. 2003; 42 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0426

Report No.(s): AD-A423028; AFRL-SR-AR-TR-04-0259; No Copyright; Avail: CASI; A03, Hardcopy

A large part of the initial phase of this work involved the development and testing of the molecular dynamics computer

code and associated analysis routines, to be used in the study of electrified jets and electrohydrodynamics of a number of common molecular and ionic fluids that are currently being used experimentally in these areas - along with fundamental interest in these systems, these studies aim at the application of electrified jets to colloid thruster technology. A major portion of our efforts was devoted to advance the computer algorithms to the point that we could simulate the operation of a colloid thruster and, as will be discussed below, we have entered this latter stage. Existing studies of electrified jets and electrohydrodynamic phenomena specifically involving the interaction of fluids with eternally applied electric fields utilize continuum modeling and there have been no prior atomistic simulations in these areas. A significant component or our progress to date has been the development of parallel computer algorithms that can efficiently model systems as complex as a colloid thruster, yet be flexible enough to allow modeling of other interesting phenomena involving the electrodynamics of dielectric and charged fluids.
DTIC
Electrification; Microelectromechanical Systems; Nanotechnology; Stability

20040075149 Pennsylvania State Univ., University Park, PA
Cluster Dynamics: Foundations for Developing Nanoscale Materials
Castleman Jr, A. W.; Dec. 2003; 20 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0122
Report No.(s): AD-A423029; AFRL-SR-AR-TR-04-0261; No Copyright; Avail: CASI; A03, Hardcopy

Attaining the ability to produce materials through cluster assembly offers great potential advantages, namely the prospect of forming nanoscale materials having selected optical, electronic, or structural properties on the one hand, or useful catalytic, reactive or energy storage characteristics on the other. The work conducted as part of this program involved investigations of the properties of transition metal compounds comprised of nitride, carbides and oxides, with attention to their varying electronic nature with cluster size, and composition. Findings are reported from three interrelated phases of work: (1) forming and studying cluster building blocks, elucidating their properties, investigating methods to accomplish their production in the bulk, and assessing their potential for use as cluster assembled materials; (2) studying the excitation and relaxation dynamics of the clusters following photoexcitation, with attention to providing an understanding of their behavior in terms of observed delayed electron and atomic ion emission; and providing baseline data for assessing theoretical approaches for handling the dynamics of systems having a large number of free electrons; and (3) undertaking studies which provide insight into the potential catalytic behavior of selected clusters, Met-Cars and CAMs, including investigations that serve to identify the fundamentals of catalysis of selected reactions.
DTIC
Photoexcitation; Transition Metals; Electronic Structure; Carbides; Nitrides; Oxides

20040075150 California Inst. of Tech., Pasadena, CA
Mixing Chemical Reactions and Combustion in High- Speed Turbulent Flows
Dimotakis, Paul E.; Mar. 31, 2004; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0006; Proj-2308
Report No.(s): AD-A423030; AFRL-SR-AR-TR-04-0252; No Copyright; Avail: CASI; A03, Hardcopy

Research conducted under the sponsorship of this grant focused on fundamental investigations of mixing, chemical-reaction and combustion processes; in turbulent, subsonic, and supersonic flows. Research on hydrocarbon- combustion was on methane and ethane flames. Flame extinction strain-rate measurements, flame speed, and detailed experiment- simulation comparisons indicate difficulties in modeling of fuel-rich flames. Direct Numerical Simulations (DNS) of axisymmetric unsteady flows in both cold and hot impinging jets were also performed. The research included work on high- speed internal flows of interest to scramjet mixing and combustion, aimed at flow-control and flameholding issues. DNS and Large Eddy Simulations (LES) of Rayleigh-Taylor instability flows studied Reynolds number effects on mixing in this important flow. Advances in high-performance digital- imaging systems were transferred to the laboratory environment enabling measurements unachievable by other means.
DTIC
Chemical Reactions; Combustion; High Speed; Supersonic Combustion Ramjet Engines; Taylor Instability; Turbulent Flow

20040075170 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Optical Characterization and Modeling of Compositionally Matched Indium Arsenide-Antimonide Bulk and Multiple Quantum Well Semiconductors
Phillips, Scott C.; Mar. 2004; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423056; AFIT/GAP/ENP/04-05; No Copyright; Avail: CASI; A06, Hardcopy

Indium arsenide-antimonide (InAsSb) semiconductors have been determined to emit in the 3-5 micrometer range, the window of interest for countermeasures against infrared electro-optical threats. This experiment set out to cross the bulk to quantum well characterization barrier by optically characterizing two sets of compositionally matched type I quantum well and bulk well material samples. Absorption measurements determined the band gap energy of the bulk samples and the first allowed subband transition for the quantum wells. By collecting absorption spectra at different temperatures, the trend of the energy transitions was described by fitting a Varshni equation to them. The expected result of the quantum well always having slightly higher energy than its bulk counterpart was observed. An etalon effect also was observed in the quantum wells, caused by the cladding layers in those samples. Photoluminescence spectra also were collected to characterize the change in electron temperature (Te) as the excitation power was varied. As expected, electron temperature increased with increasing power and increasing temperature. The start of the longitudinal optical phonon-dominated cooling range due to excitation intensity also was determined for the samples from 1/Te. It was found that the quantum well required higher excitation intensities to achieve this effect. Lastly, the energy transitions found for the quantum well samples were compared to those found by a finite element method model. The predicted energies all had a constant value above what was found experimentally, indicating the program had a translation error within it. (10 tables, 47 figures, 18 refs.)
DTIC
Absorption Spectra; Antimonides; Indium Arsenides; Photoluminescence; Quantum Wells; Semiconductor Devices; Semiconductor Lasers; Semiconductors (Materials)

20040075178 Materials Research Society, Warrendale, PA
Materials Research Society Symposium Proceedings. Volume 797. Held in Boston, Massachusetts, December 2-4 2003. Engineered Porosity for Microphotonics and Plasmonics
Wehrspohn, Raif; Garcia-Vidal, Francisco; Notomi, Masaya; Scherer, Axel; Jan. 2004; 264 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0039
Report No.(s): AD-A423077; AFRL-SR-AR-TR-04-0244; No Copyright; Avail: CASI; A12, Hardcopy

Symposium W, "Engineered Porosity for Microphotonics and Plasmonics," held December 2-A at the 2003 MRS Fall Meeting in Boston, Massachusetts, combined the areas of optical nanoparticles, microphotonics, photonics crystals and the emerging field of plasmonics. The program started with a review and recent advances in the understandings of porous silicon the famous light-emitting silicon sponge which caused a real hype in the beginning of the YOs New results and first devices in the area of photonic crystals have been presented and caused very stimulating discussions. The understanding of the photonic crystal properties also resulted in new insight in the classical area of ridge waveguides, and new designs were proposed. Finally, the emerging field of plasmonics caused a lot of attraction and will possibly lead in the future to further exciting and well-attended workshops. This volume represents 50% of the presentations and gives a very good overview of the symposium. Financial support by the AFOSR is gratefully acknowledged. The editors would also like to thank all of the invited speakers for their excellent presentations, the participants for their contributions and questions, and the referees for their work.
DTIC
Conferences; Crystals; Plasmons; Porosity

20040075191 Pattern Analysis and Recognition Corp., La Jolla, CA
Multispectral Measurements in the Surf Zone
Schoonmaker, Jon; Dirbas, Joseph; Gilbert, Gary; May 7, 2004; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-C-0172
Report No.(s): AD-A423095; No Copyright; Avail: CASI; A02, Hardcopy

Over the past year an index has been defined which quantifies the surf zone with respect to an electro-optical (EO) system's ability to find targets. The purpose of this index is to both normalize the EO Mine Counter Measure (MCM) systems performance expectations to the environment in which it is tested and to assess the value of its performance in an operational environment. For example if a given system has a Probability of Detection (P(sub D)) requirement of 90% in a clear water surf zone and is tested in murky waters the surf zone index of the murky water is used to determine what P(sub D) is required in the murky water to yield the 90% P(sub D) clear water requirement. The surf zone index is defined in this paper and expanded from the deterministic contrast transmittance as reported in earlier papers(1) to a probabilistic approach. Examples of how to measure the index using readily available low cost spectral imagers such as PAR Government Systems Corporation's Mission Adaptable Narrowband Tunable Imaging Spectrometer (MANTIS) system are given. Finally, the surf zone index usage is discussed and demonstrated.
DTIC
Countermeasures; Electro-Optics

20040075199 Pennsylvania Univ., Philadelphia, PA
A Compensation-Based Optimization Methodology for Gain-Boosted OPAMP
Yuan, Jie; Farhat, Nabil; Jan. 2001; 5 pp.; In English
Contract(s)/Grant(s): N00014-94-1-0931
Report No.(s): AD-A423112; No Copyright; Avail: CASI; A01, Hardcopy

A gain-boosted OPAMP design methodology is presented. The methodology provides a systematic way of gain- boosted OPAMP optimization in terms of AC response and settling performance. The evolution of the major poles and zeros of the gain-boosted OPAMP is studied, which reveals the rationale behind our optimization effort. A sample OPAMP was implemented in 0.6 micrometere CMOS technology. It achieves a DC gain of 88 decibels, a bandwidth of 725MHz with 490 phase margin and a 0.1 settling time of 4.5ns. The sample/hold front- end of a 12-bit 5OMSample/s ADC was implemented with this OPAMP. It achieves an SNR of 78 decibels for an 8.1MHz input signal.
DTIC
Operational Amplifiers

20040075235 Air Force Research Lab., Hanscom AFB, MA
Electron Attachment and Detachment: C6F6
Miller, T. M.; VanDoren, J. M.; Viggiano, A. A.; Jan. 2004; 8 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A423196; AFRL-VS-HA-TR-2004-1094; No Copyright; Avail: CASI; A02, Hardcopy

Electron attachment to C(sub 6)F(sub 6) is especially interesting because of the large change in symmetry between the neutral (D(sub 6h)) and anion (C(sub 2v)). We have made measurements of rate constants for electron attachment to C(sub 6)F(sub 6) and thermal electron detachment from the parent anion, C(sub 6) F(sub 6), over the temperature range 297-400K. in 133 Pa of He gas. A flowing-afterglow Langmuir probe (FALP) apparatus was used for this work. At 298K, the electron attachment rate constant is kappa(sub a) = 8.6(plus or minus)3.0 x 10(exp 8) cu cm s(exp -1), and the detachment rate constant kappa (sub d) is approximately 35 s(exp-1). As the temperature increases kappa (sub d) increases rapidly, to about 3000 s(exp -1) at 400K. The attachment/detachment equilibrium implies that the electron affinity of C(sub 6)F(sub 6) is 0.53(plus or minus)0. 05 eV. Density functional calculations were carried out in order to obtain thermal quantities needed to convert the equilibrium constant kappa(sub a)/ kappa(sub d) into EA(C(sub 6)F(sub 6)). G3(MP2) calculations yielded an electron affinity of 0.454 eV. The fluoride affinity of C(sub 6)F(sub 6) was calculated to be 1. 26 eV at 298 K using this same method. We expect the G3(MP2) results to be good within 0.1 eV.
DTIC
Electron Attachment; Electron Density (Concentration)

20040075254 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Coplanar Air Launch with Gravity-Turn Launch Trajectories
Callaway, David W.; Mar. 23, 2004; 75 pp.; In English
Report No.(s): AD-A423220; AFIT/GAE/ENY/04-M04; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this study was to determine the feasibility of launching a vehicle based on the Boeing AirLaunch System in a coplanar, direct to rendezvous trajectory with gravity-turn. The focus of the research was to model the launch trajectory and determine the ability to reach different coplanar orbits. The launch trajectory was modeled using two-dimensional equations of motion and a boundary value problem was posed and solved for the gravity-turn trajectory. Trajectories were then created in an attempt to reach different altitudes through coasting and transfer orbits. Finally a specific orbital altitude was chosen and the trajectories were analyzed to find the most efficient route to the target orbit for fuel and time.
DTIC
Air Launching; Air to Air Missiles; Gravitation; Launching; Missiles; Planar Structures; Trajectories

20040075497 Naval Undersea Warfare Center, Newport, RI
A Fiber Optic Switch Employing Optical Amplifiers
Ruffa, Anthony A.; Apr. 6, 2004; 15 pp.; In English
Report No.(s): AD-D020135; No Copyright; Avail: CASI; A03, Hardcopy

A method and apparatus of switching a digital signal from a single input optical fiber to one or more optical fibers comprising the steps of providing an input signal into the input optical fiber, splitting the input optical fiber to form a plurality of split optical fibers each carrying the input signal, amplifying the signal in at least one of the plurality of split optical fibers

with a laser activated amplifier, and then attenuating the signal in all of the split optical fibers to produce at least one output signal in one or more of the designated split optical fibers.
DTIC
Fiber Optics; Light Amplifiers; Switches

20040075792 NASA Ames Research Center, Moffett Field, CA, USA
Carbon-Nanotube-Based Nanotechnology
Saini, Subhash; Research and Technology 1997; September 1998, pp. 74-75; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Carbon nanotubes are large linear fullerenes (close-caged molecules) made of sheets of carbon atoms arranged in six-folded hexagonal patterns. Since their discovery in 1991, nanotubes (rolled up sheets of carbon) have been vigorously investigated both theoretically and experimentally. The single-wall nanotubes are the strongest fibers known, and, depending on how the carbon sheet i s rolled, a nanotube possesses unusual electronic properties. NASA s primary interest in nanotubes derives from three technologically interesting properties. First, single-wall nanotubes can be either metallic or semiconducting, thus providing the possibility of nanotube heterojunctions for nanoelectronic components in future ultrafast computers. Second, nanotubes are hollow, tubular, caged molecules that can serve as lightweight containers for packing and carrying hydrocarbon fuels on future space missions. Third, nanotubes have very good elasto-mechanical (strongest, yet highly flexible, tubular fiber known) properties that can be used in a lightweight, highly elastic, and very strong fibrous material for use in fabricating future spacecraft components.
Derived from text
Carbon Nanotubes; Hydrocarbon Fuels; Molecules; Nanotechnology; Electrical Properties

20040075827 NASA Ames Research Center, Moffett Field, CA, USA
Modeling Carbon Nanotube Electronic Devices
Jaffe, Richard L.; Han, Jie; Research and Technology 1997; September 1998, pp. 77; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Carbon nanotubes are large linear fullerenes (close-caged molecules) made of sheets of carbon atoms arranged in six-folded hexagonal patterns. Since their discovery in 1991, nanotubes (rolled up sheets of carbon) have been vigorously investigated both theoretically and experimentally. The single-wall nanotubes are the strongest fibers known, and, depending on how the carbon sheet is rolled, a nanotube possesses unusual electronic properties. NASA s primary interest in nanotubes derives from three technologically interesting properties. First, single-wall nanotubes can be either metallic or semiconducting, thus providing the possibility of nanotube heterojunctions for nano-electronic components in future ultrafast computers. Second, nanotubes are hollow, tubular, caged molecules that can serve as lightweight containers for packing and carrying hydrocarbon fuels on future space missions. Third, nanotubes have very good elasto-mechanical (strongest, yet highly flexible, tubular fiber known) properties that can be used in a lightweight, highly elastic, and very strong fibrous material for use in fabricating future spacecraft components.
Derived from text
Carbon Nanotubes; Electrical Properties; Hydrocarbon Fuels; Nanotechnology; Electromechanical Devices

20040075844 National Telecommunications and Information Administration, Washington, DC, USA
Relative Propagation Impairments between 430 MHz and 5750 MHz for Mobile Communication Systems in Urban Environments
Papazian, P.; Cotton, M.; Dec. 2003; In English
Report No.(s): PB2004-105364; NTIA-TR-04-407; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes mobile radiowave propagation measurements made in the downtown area of Denver, Colorado. The measurements were made to determine the relative nature of propagation impairments over a range of frequencies proposed for new communication services. In some cases these proposals would require moving existing commercial services or military communication systems to make way for new broadband mobile communication services. The argument for moving existing fixed services is that lower frequencies that suffer fewer propagation impairments are better suited to mobile applications. This work measures these propagation impairments so these questions can be addressed quantitatively.
NTIS
Mobile Communication Systems; Radio Transmission; Radio Waves; Telecommunication

20040075869 Oak Ridge National Lab., TN, Department of Energy, Washington, DC
Development of Proof-of-Concept Units for the Advanced Medium-Sized Mobile Power Sources (AMMPS) Program
Andriulli, J. B.; Scudiere, M. B.; White, C. P.; Farquanharson, G.; Theiss, T. J.; Mar. 2002; In English
Report No.(s): DE2003-814503; ORNL/TM-2001/222; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this report is to document the development of the proof-of-concept units within the Advanced Medium-sized Mobile Power Sources (AMMPS) program. The design used a small, lightweight diesel engine, a permanent magnet alternator, power electronics and digital controls as outlined in the philosophy detailed previously. One small proof-of-concept unit was completed and delivered to the military. The unit functioned well but was not optimized at the time of delivery to the military. A tremendous amount of experience was gained during this phase that can be used in the development of any follow-on AMMPS production systems. Lessons learned and recommendations for follow-on specifications are provided. The unit demonstrated that significant benefits are possible with the new design philosophy. Trade-offs will have to be made but many of the advantages appear to be within the technical grasp of the market.
NTIS
Ac Generators; Engine Design; Permanent Magnets

20040077160 NASA Ames Research Center, Moffett Field, CA, USA
Nanoelectronics Modeling
Anantram, M. P.; Yang, Liu; Govindan, T. R.; Han, Jie; Svizhenko, Alexi; Research and Technology 1999; December 2000, pp. 56-57; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Nanoelectronics research at Ames encompasses topics in molecular devices and miniaturization of conventional semiconductor devices. The objective is to acquire the knowledge necessary to build future generations of computing devices and sensors to fulfill NASA s challenges in aerospace transport and space missions. There were three significant accomplishments in FY99. First, we modeled electron transport in capped carbon nanotubes and gleaned the effect of caps and defects on electron emission, which is important in the use of the nanotubes as probe tips and wires. Second, through modeling and analysis we related conductance to mechanical deformation of carbon nanotubes, which is important in the use of nanotubes as sensors. Third, we developed a simulator for quantum mechanical transport in semiconductor devices, which provides important capability to study future generations of ultrasmall devices. A brief description of each is presented.
Derived from text
Nanotechnology; Mathematical Models; Electronics; Miniaturization; Semiconductor Devices

20040077173 NASA Ames Research Center, Moffett Field, CA, USA
Computational Quantum Optoelectronics for Information Technology
Ning, C. Z.; Cheung, S. C.; Goorjian, P. M.; Li, J.; Liu, A.; Research and Technology 1999; December 2000, pp. 61-62; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The interaction between laser light and semiconductor nanostructures is the basis for current and future optoelectronics-based information technology. The objective of the Computational Quantum Optoelectronics (CQP) project at Ames Research Center is to explore new optoelectronic devices, to study speed and size limits imposed by fundamental physics principles, and to design and optimize the performance of existing devices to meet NASA's needs in information technology. During FY99 the project made significant accomplishments in three areas: comprehensive semiconductor laser simulation, ultrafast laser modulation with a terahertz heating field, and terahertz wave generation in semiconductor quantum wells.
Author
Optoelectronic Devices; Information Systems; Quantum Electronics

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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*.

20040074343 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Sliding Mode Control of a Thermal Mixing Process
Richter, Hanz; Figueroa, Fernando; June 30, 2004; 7 pp.; In English; 2004 American Control Conference, 30 Jun. - 2 Jul. 2004, Boston, MA, USA
Contract(s)/Grant(s): NASW-99027
Report No.(s): SE-2003-09-00083-SSC; No Copyright; Avail: CASI; A02, Hardcopy

In this paper we consider the robust control of a thermal mixer using multivariable Sliding Mode Control (SMC). The mixer consists of a mixing chamber, hot and cold fluid valves, and an exit valve. The commanded positions of the three valves are the available control inputs, while the controlled variables are total mass flow rate, chamber pressure and the density of the mixture inside the chamber. Unsteady thermodynamics and linear valve models are used in deriving a 5th order nonlinear system with three inputs and three outputs, An SMC controller is designed to achieve robust output tracking in the presence of unknown energy losses between the chamber and the environment. The usefulness of the technique is illustrated with a simulation.
Author
Sliding; Mathematical Models; Control Systems Design; Mixing; Thermodynamics; Multivariable Control

20040074472 Lockheed Martin Corp., Syracuse, NY, USA
Imaging of Acoustically Coupled Oscillations Due to Flow Past a Shallow Cavity: Effect of Cavity Length Scale
Oshkai, P.; Geveci, M.; Rockwell, D.; Pollack, M.; Dec. 2002; 70 pp.; In English
Report No.(s): DE2004-821962; LM-02K135; No Copyright; Avail: Department of Energy Information Bridge

Flow-acoustic interactions due to fully turbulent inflow past a shallow axisymmetric cavity mounted in a pipe are investigated using a technique of high-image-density particle image velocimetry in conjunction with unsteady pressure measurements. This imaging leads to patterns of velocity, vorticity, streamline topology, and hydrodynamic contributions to the acoustic power integral. Global instantaneous images, as well as time-averaged images, are evaluated to provide insight into the flow physics during tone generation. Emphasis is on the manner in which the streamwise length scale of the cavity alters the major features of the flow structure. These image-based approaches allow identification of regions of the unsteady shear layer that contribute to the instantaneous hydrodynamic component of the acoustic power, which is necessary to maintain a flow tone. In addition, combined image analysis and pressure measurements allow categorization of the instantaneous flow patterns that are associated with types of time traces and spectra of the fluctuating pressure. In contrast to consideration based solely on pressure spectra, it is demonstrated that locked-on tones may actually exhibit intermittent, non-phase-locked images, apparently due to low damping of the acoustic resonator. Locked-on flow tones (without modulation or intermittency), locked-on flow tones with modulation, and non-locked-on oscillations with short-term, highly coherent fluctuations are defined and represented by selected cases. Depending on which of,these regimes occur, the time-averaged Q (quality)-factor and the dimensionless peak pressure are substantially altered.
NTIS
Topology; Oscillations; Cavities; Acoustics; Image Analysis

20040074473 Lockheed Martin Corp., Syracuse, NY, USA
Organized Oscillations of Initially-Turbulent Flow Past a Cavity
Lin, J. C.; Rockwell, D.; Sep. 2000; 50 pp.; In English
Report No.(s): DE2004-821949; LM-00K080; No Copyright; Avail: Department of Energy Information Bridge

Flow past an open cavity is known to give rise to self-sustained oscillations in a wide variety of configurations, including slotted-wall, wind and water tunnels, slotted flumes, bellows-type pipe geometries, high-head gates and gate slots, aircraft components and internal piping systems. These cavity-type oscillations are the origin of coherent and broadband sources of noise and, if the structure is sufficiently flexible, flow-induced vibration as well. Moreover, depending upon the state of the cavity oscillation, substantial alterations of the mean drag may be induced. In the following, the state of knowledge of flow past cavities, based primarily on laminar inflow conditions, is described within a framework based on the flow physics. Then, the major unresolved issues for this class of flows will be delineated. Self-excited cavity oscillations have generic features, which are assessed in detail in the reviews of Rockwell and Naudascher, Rockwell, Howe and Rockwell. These features, which are illustrated in the schematic of Figure 1, are: (i) interaction of a vorticity concentration(s) with the downstream corner, (ii) upstream influence from this corner interaction to the sensitive region of the shear layer formed from the upstream corner of the cavity; (iii) conversion of the upstream influence arriving at this location to a fluctuation in the separating shear layer; and (iv) amplification of this fluctuation in the shear layer as it develops in the streamwise direction. In view of the fact that inflow shear-layer in the present investigation is fully turbulent, item (iv) is of particular interest. It is generally recognized, at least for laminar conditions at separation from the leading-corner of the cavity, that the disturbance growth in the shear layer can be described using concepts of linearized, inviscid stability theory, as shown by Rockwell, Sarohia, and Knisely and Rockwell. As demonstrated by Knisely and Rockwell, on the basis of experiments interpreted with the aid of linearized theory, not only the fundamental component of the shear layer instability may be present, but a number of additional, primarily lower frequency components can exist as well. In fact, the magnitude of these components can be of the same order as the

fundamental component. These issues have not been addressed for the case of a fully-turbulent in-flow and its separation from the leading corner of the cavity.
NTIS
Cavities; Turbulent Flow; Oscillations

20040074475 Lockheed Martin Corp., Syracuse, NY, USA
Imaging of the Self-Excited Oscillation of Flow Past a Cavity During Generation of a Flow Tone
Geveci, M.; Oshkai, P.; Rockwell, D.; Lin, J. C.; Pollack, M.; May 2002; 80 pp.; In English
Report No.(s): DE2004-821957; LM-02K040; No Copyright; Avail: Department of Energy Information Bridge

Flow through a pipeline-cavity system can give rise to pronounced flow tones, even when the inflow boundary layer is fully turbulent. Such tones arise from the coupling between the inherent instability of the shear flow past the cavity and a resonant acoustic mode of the system. A technique of high-image-density particle image velocimetry is employed in conjunction with a special test section, which allows effective laser illumination and digital acquisition of patterns of particle images. This approach leads to patterns of velocity, vorticity, streamline topology and hydrodynamic contributions to the acoustic power integral. Comparison of global, instantaneous images with time- and phase-averaged representations provides insight into the small-scale and large-scale concentrations of vorticity, and their consequences on the topological features of Streamline patterns, as well as the streamwise and transverse projections of the hydrodynamic contribution to the acoustic power integral. Furthermore, these global approaches allow the definition of effective wavelengths and phase speeds of the vortical structures, which can lead to guidance for physical models of the dimensionless frequency of oscillation.
NTIS
Cavities; Oscillations; Fluid Flow; Acoustics; Hydrodynamics

20040074510 Lawrence Livermore National Lab., Livermore, CA
Applications of Sensitivity Analysis to Uncertainty Quantification in Variably Saturated Flow
Woodward, C. S.; Grant, K. E.; Maxwell, R.; Jan. 01, 2002; In English
Report No.(s): DE2004-15005952; UCRL-JC-146976; No Copyright; Avail: National Technical Information Service (NTIS)

In this paper, we present results demonstrating the effectiveness of a sensitivity analysis approach to uncertainty quantification of a variably saturated flow model. The basis for our method is a software system which simultaneously solves for solutions of large-scale nonlinear systems of equations and the sensitivity of the solutions to selected parameters. We present test cases showing the effects on the relative uncertainty of pressure due to heterogeneity in the absolute permeability and to differences in parameterizing the Van Genuchten curve soil parameters, (alpha) and n.
NTIS
Sensitivity Analysis; Flow Characteristics; Concentration (Composition)

20040074521 Lawrence Livermore National Lab., Livermore, CA
International Workshop on the Physics of Compressible Turbulent Mixing
Schilling, O.; Nov. 28, 2001; In English
Report No.(s): DE2004-15005873; UCRL-ID-146350; No Copyright; Avail: National Technical Information Service (NTIS)

The report contains the summary presentation of the 'Summary of the 8th International Workshop on the Physics of Compressible Turbulent Mixing' held on December 9-14, 2001 in Pasadena, California.
NTIS
Turbulent Mixing; Shock Waves

20040074524 Lawrence Livermore National Lab., Livermore, CA
Mixing-Controlled Exothermic Fields in Explosions
Kuhl, A. L.; Oppenheim, A. K.; Ferguson, R. E.; Feb. 07, 2001; In English
Report No.(s): DE2004-15005776; UCRL-JC-142375; No Copyright; Avail: National Technical Information Service (NTIS)

A theoretical model of combustion in explosions at large Reynolds, Peclet and Damkohler numbers is described. A key feature of the model is that combustion is treated as material transformations in the Le Chatelier state plane, rather than 'heat release'. In the limit considered here, combustion is concentrated on thin exothermic sheets (boundaries between fuel and oxidizer). The products seem to expand along the sheet, thereby inducing vorticity on either side of the sheet that continues to feed the process. The results illustrate the linking between turbulence (vorticity) and exothermicity (dilatation) in the limit

of fast chemistry thereby demonstrating the controlling role that fluid dynamics plays in such problems.
NTIS
Explosions; Combustion; Exothermic Reactions; Fluid Dynamics

20040075035 Florida Univ., Gainesville, FL, USA
Development of Design Tools for Flow-Control Actuators
Mathew, Jose; Gallas, Quentin; Cattafesta, Louis N., III; [2003]; 45 pp.; In English
Contract(s)/Grant(s): NAG1-2249; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses the: 1. Development coupled electro/fluid/structural lumped-element model (LEM) of a prototypical flow-control actuator. 2. Validation the coupled electro/fluid/structural dynamics lumped-element models. 3. Development simple, yet effective, design tools for actuators. 4. Development structural dynamic models that accurately characterize the dynamic response of piezoelectric flap actuators using the Finite Element Method (FEW as well as analytical methods. 5. Perform a parametric study of a piezo-composite flap actuator. 6.Develop an optimization scheme for maximizing the actuator performance.
Author
Design Analysis; Fluid Dynamics; Dynamic Structural Analysis; Piezoelectric Actuators

20040075515 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Effect of Dimple Pattern on the Suppression of Boundary Layer Separation on a Low Pressure Turbine Blade
Casey, John P.; Mar. 2004; 201 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422961; AFIT/GAE/ENY/04-M05; No Copyright; Avail: CASI; A10, Hardcopy

Three dimple patterns were investigated to ascertain their relative effectiveness on controlling boundary layer separation from a low-pressure turbine blade. The three cases included a single row of dimples at 65% of the axial chord with 2.22 cm spacing, a single row of dimples at 65% of the axial chord with 4.44 cm spacing, and a two-row staggered pattern with rows at 65% and 76% of the axial chord with 4.44 cm spacing. The multiple row case was such that the center of the upstream dimple set at the midpoint between two downstream dimples. The dimple spacing was measured center-on-center. Each of the dimple patterns was studied and compared to an unmodified blade at axial chord Reynolds numbers based on inlet velocity of 25k, 45k, and 100k. Experimental data was collected in a low-speed, draw down wind tunnel containing a linear turbine cascade of 8 Pak-B blades. Measurements of surface pressure, boundary layer parameters, wake velocity, and total pressure losses were made to examine the flow. No dimple pattern dramatically outperformed the others. Each of the dimple patterns studied improved the average total pressure loss coefficient by 34% for Re 25k and 1% Tu. Complementing the experimental effort was a three-dimensional computational fluid dynamics study. Four models were built and analyzed. The models included an unmodified blade, blades with dimples at 65% of the axial chord with 2 cm or 4 cm spacing, respectively, and a multiple row case consisting of dimples at 65% and 76% of the axial chord with 2 cm spacing. Again the upstream dimple set at the midpoint between two downstream dimples. The computational fluid dynamics study provided detailed flow visualization in and around the dimples as well as a comparison to experimental data for solver verification. It was shown that the computational and experimental results showed similar trends in wake loss and boundary layer traverses.
DTIC
Boundary Layer Separation; Low Pressure; Separated Flow; Turbine Blades

20040075662 Tuskegee Inst., AL, USA
Injection Characteristics of Non-Swirling and Swirling Annular Liquid Sheets
Harper, Brent, Technical Monitor; Ibrahim, E. A.; McKinney, T. R.; April 1, 2004; 15 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-13 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A03, Hardcopy

A simplified mathematical model, based on body-fitted coordinates, is formulated to study the evolution of non-swirling and swirling liquid sheet emanated from an annular nozzle in a quiescent surrounding medium. The model provides predictions of sheet trajectory, thickness and velocity at various liquid mass flow rates and liquid-swirler angles. It is found that a non-swirling annular sheet converges toward its centerline and assumes a bell shape as it moves downstream from the nozzle. The bell radius, and length are more pronounced at higher liquid mass flow rates. The thickness of the non-swirling annular sheet increases while its stream-wise velocity decreases with an increase in mass flow rate. The introduction of swirl results in the formation of a diverging hollow-cone sheet. The hollow-cone divergence from its centerline is enhanced by an increase in liquid mass flow rate or liquid-swirler angle. The hollow- cone sheet its radius, curvature and stream-wise velocity

increase while its thickness and tangential velocity decrease as a result of increasing the mass flow rate or liquid-swirler angle. The present results are compared with previous studies and conclusions are drawn.
Author
Annular Nozzles; Flow Velocity; Liquid Flow; Mathematical Models; Swirling

20040075668 NASA Marshall Space Flight Center, Huntsville, AL, USA
Hot Stuff? Thermal Imaging Applied to Cryocrystallography
Snell, E. H.; 2004; 1 pp.; In English; Hauptmann Woodward Medical Research Institute Meeting, 26 Apr. 2004, Buffalo, NY, USA; No Copyright; Avail: Other Sources; Abstract Only

In the past we have used thermal imaging techniques to visualize the cryocooling processes of macromolecular crystals. From these images it was clear that a cold wave progresses through a crystal starting at the face closest to the origin of the cold stream and ending at the point furthest away. During these studies we used large volume crystals, which were clearly distinguished fiom the loop holding them. These large crystals, originally grown for neutron diffiaction studies, were chosen deliberately to enhance the imaging. As an extension to this work, we present used thermal imaging to study small crystals, held in a cryo-loop, in the presence of vitrified mother liquor. The different d a r e d transmission and reflectance properties of the crystal in comparison to the mother liquor surrounding it are thought to be the parameter that produces the contrast that makes the crystal visible. An application of this technology may be the determination of the exact location of small crystals in a cryo-loop. Data fkom initial tests in support of application development was recorded for lysozyme crystals and for bFGF/dna complex crystals, which were cryocooled and imaged in large loops, both with visible light mad with h i k e d rdi&tion. The crystals were clearly distinguished from the vitrified solution in the infiared spectrum, while in the case of the bFGF/dna complex the illumination had to be carefully manipulated to make the crystal visible in the visible spectrum. These results suggest that the thermal imaging may be more sensitive than visual imaging for automated location of small crystals. However, further work on small crystals robotically mounted at SSRL did not clearly visualize those crystals. The depth of field of the camera proved to be limiting and a different cooling geometry was used, compared to the previous, successful experiments. Analysis to exploit multiple images to improve depth of field and experimental work to understand cooling geometry effects is ongoing. These results will be presented along with advantages and disadvantages of the technique and a discussion of how it might be applied.
Author
Crystals; Visible Spectrum; Imaging Techniques; Cryogenics

20040075672 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Interpolation Method for Obtaining Thermodynamic Properties Near Saturated Liquid and Saturated Vapor Lines
Nguyen, Huy H.; Martin, Michael A.; February 11, 2004; 32 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

The two most common approaches used to formulate thermodynamic properties of pure substances are fundamental (or characteristic) equations of state (Helmholtz and Gibbs functions) and a piecemeal approach that is described in Adebiyi and Russell (1992). This paper neither presents a different method to formulate thermodynamic properties of pure substances nor validates the aforementioned approaches. Rather its purpose is to present a method to generate property tables from existing property packages and a method to facilitate the accurate interpretation of fluid thermodynamic property data from those tables. There are two parts to this paper. The first part of the paper shows how efficient and usable property tables were generated, with the minimum number of data points, using an aerospace industry standard property package. The second part describes an innovative interpolation technique that has been developed to properly obtain thermodynamic properties near the saturated liquid and saturated vapor lines.
Author
Thermodynamic Properties; Interpolation; Equations of State; Vapors

20040075682 Purdue Univ., West Lafayette, IN, USA
Hydrodynamic Modeling of Oxidizer-Rich Staged Combustion Injector Flow
Harper, Brent, Technical Monitor; Canino, J. V.; Heister, S. D.; Garrison, L. A.; May 13, 2004; 11 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A03, Hardcopy

The main objective of this work is to determine the unsteady hydrodynamic characteristics of coaxial swirl atomizers of interest in oxidizer-rich staged combustion (ORSC) liquid rocket engines. To this end, the pseudo-density (homogeneous flow)

treatment combined with the Marker-and-Cell (MAC) numerical algorithm has been used to develop an axisymmetric with swirl, two-phase, unsteady model. The numerical model is capable of assessing the time-dependent orifice exit conditions and internal mixing for arbitrary fuel and oxidizer gas injection conditions. Parametric studies have been conducted to determine the effect of geometry, gas properties, and liquid properties on the exit massflow rate and velocity. It has been found that the frequency at which the liquid film oscillates increases as the density ratio and thickness increase, decreases as film thickness and liquid swirl velocity increase, and is unaffected by the mixing length. Additionally, it has been determined that the variation in the massflow rate increases as the liquid swirl velocity and liquid film thickness increase, and decreases as the density ratio, collar thickness, and mixing length increase.
Author
Hydrodynamics; Atomizers; Oxidizers; Liquid Propellant Rocket Engines; Two Phase Flow; Two Dimensional Models

20040075699 NASA Marshall Space Flight Center, Huntsville, AL, USA
Exploring the Saturn System in the Thermal Infrared: The Composite Infrared Spectrometer
Flasar, F. M.; Kunde, V. g.; Abbas, M. M.; Achterberg, R. K.; Ade, P.; Barucci, A.; Bezard, B.; Bjoraker, G. L.; Brasunas, J. C.; Calcutt, S., et al.; 2004; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The Composite Inbred Spectrometer (CIRS) is a remote-sensing Fourier Transform Spectrometer on the Cassini orbiter that measures thermal radiation over two decades in wave number, from 10 to 1400 cm (1 mm to 7pm), with a spectral resolution that can be set from 0.5 to 20 cm. The far in portion of the spectrum (10 - 600 cm) is measured with a polarizing interferometer having thermopile detectors with a common 4-mrad field of view. The middle infrared portion is measured with a traditional Michelson interferometer having two focal planes (600 - 1100cm, 1100-1400 cm). Each focal plane is composed of a 1x10 array of HgCdTe detectors, each detector having a 0.3-mrad field of view. CIRS observations will provide three-dimensional maps of temperature, gas composition, and aerosols/condensates of the atmospheres of Titan and Saturn with good vertical and horizontal resolution, from deep in their tropospheres to high in their mesospheres. CIRS ability to observe atmospheres in the limb viewing mode (in addition to nadir) offers the opportunity to provide accurate and highly resolved vertical profiles of these atmospheric variables. The ability to observe with high-spectral resolution should facilitate the identification of new constituents. CIRS will also map the thermal and compositional properties of the surfaces of Saturn's icy satellites. It will similarly map Saturn's rings, characterizing their formation and evolution. The combination of broad spectral range, programmable spectral resolution, the small detector fields of view, and an orbiting spacecraft platform will allow CIRS to observe the Saturnian system in the thermal infrared at a level of detail not previously achieved.
Author
Spectral Resolution; Thermodynamic Properties; Aerosols; Thermal Radiation; Infrared Spectrometers; Remote Sensing

20040075728 NASA Ames Research Center, Moffett Field, CA, USA
Arc-Jet Flow Characterization
Fletcher, Douglas G.; Research and Technology 1997; September 1998, pp. 88-89; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Arc-jet facilities have been used extensively to evaluate materials for use in the thermal protection of aerospace vehicles, from Apollo spacecraft and the shuttle to the X-33 and the X-34. Although arc-jet tests are indicative of how well a material will perform in extreme aerothermal heating environments, it has not been possible to directly relate arc- jet test results to flight applications. The main obstacle has been an inability to determine the total enthalpy of the nonequilibrium arc-jet flow, and its distribution among kinetic, thermal, and chemical modes. The objective of this work is to develop diagnostic techniques to determine these quantities, thereby improving our understanding of the relationship between arc-jet test and flight environments. As part of this effort, a laser-spectroscopic instrument has been developed to characterize the flow environment by measuring the free-stream enthalpy in large-scale arc-jet facilities. This approach involves making flow-property measurements using two-photon laser-induced fluorescence (LIF) of atomic nitrogen; it was recently demonstrated in a series of tests conducted in the Aerodynamic Heating Facility (AHF). The flow properties, which include velocity, translational temperature, and species concentration, were measured simultaneously over a range of facility operating conditions.
Author
Flow Characteristics; Spectroscopy; Laser Induced Fluorescence; Enthalpy

20040075733 NASA Ames Research Center, Moffett Field, CA, USA
Turbulence Modeling Validation Study
Bardina, J. E.; Huang, P. G.; Coakley, T. J.; Research and Technology 1997; September 1998, pp. 46; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The present study is part of an ongoing effort to evaluate and develop turbulence models for aerodynamic applications. The objective of the study was to investigate the performance of several turbulence models on a variety of aerodynamic flows and to make recommendations regarding their applicability in aeronautical applications. The models studied were the Jones-Launder k-epsilon model, the k-omega model of Wilcox, the one-equation model of Spalart and Allmaras, and the two-equation k-omega shear-stress transport (SST) model of Menter. Ten flows were investigated including five free-shear flows and five boundary-layer flows, of which three were complex flows involving separation or shock waves or both. The results of numerical predictions were compared with experimental results, which included surface pressures, skin friction, and profiles of velocity and turbulent kinetic energy and shear stress. The turbulence models were evaluated on the basis of numerical accuracy with respect to experimental results, numerical sensitivity to grid spacing and refinement, sensitivity to free-stream turbulence conditions, and the choice of the numerical code. Typical results of the study are shown. It was found that the Menter SST model gave the best overall results followed by the Spalart-Allmaras model and then the k-omega and k-epsilon models. With respect to sensitivity, the Spalart-Allmaras model gave the best results, closely followed by the SST model and then the k-omega and k-epsilon models.
Author
K-Epsilon Turbulence Model; K-Omega Turbulence Model; Aerodynamics

20040075750 NASA Ames Research Center, Moffett Field, CA, USA
Modeling of Steady Secondary Flows in Pulse Tube Cryocoolers
Lee, Jeffrey M.; Kittel, Peter; Research and Technology 1997; September 1998, pp. 123-124; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A linearized solution for describing steady secondary flows generated by periodic compression and expansion of a gas in a tube has been developed and verified. The small-amplitude series expansion in the inverse Strouhal number at the anelastic limit is applied to the two-dimensional axisymmetric equations for mass, momentum, and energy conservation for an ideal gas. The solution i s calculated to higher- order for understanding mass and enthalpy streaming. This work is useful for predicting the streaming losses that are present in pulse tube cryocoolers. and can be of order 1 for a large Valensi number. Decreasing heat transfer between the gas and the tube decreases steady velocities for systems in which nonzero velocity boundary conditions exist at each end of the tube, such as for orifice pulse tubes. For systems in which one end of the tube is closed, such as for basic pulse tubes, increasing heat transfer between the gas and tube decreases steady velocities. The model predicts that a conversion of steady work flow to heat flow occurs whenever temperature,
Derived from text
Boundary Conditions; Cryogenic Cooling; Heat Transfer; Strouhal Number; Steady Flow; Enthalpy

20040075753 NASA Ames Research Center, Moffett Field, CA, USA
Computational Fluid Dynamics in Rotor Design
Caradonna, Francis X.; Research and Technology 1997; September 1998, pp. 42; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Rotorcraft are important because they can hover, and the efficiency of this hover is fundamental to helicopter productivity. It is surprising, therefore, that our ability to predict hover efficiency (and thereby to design optimum rotors) is limited. This is because the rotor flow field i s so sensitive to the rotor wake that there are large analytical errors. This same wake sensitivity also causes large experimental errors. (If a perfect prediction capability existed, there would be no way to know it, because of experimental error.) Therefore, the attainment of greater rotor analysis capability is a twofold problem of improving both computational and experimental accuracy. This effort is directed at the computational part of the problem.
Derived from text
Computational Fluid Dynamics; Rotary Wing Aircraft; Hovering; Flow Distribution; Accuracy

20040075760 NASA Ames Research Center, Moffett Field, CA, USA
Aerothermal Analysis of the X-34 Vehicle
Palmer, Grant; Polsky, Susan; Research and Technology 1997; September 1998, pp. 86-87; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The X-34 vehicle will provide the first flight demonstration under NASA's Reusable Launch Vehicle (RLV) program of a fully reusable launch vehicle. Under a fixed-price contract with NASA, Orbital Sciences Corporation (OSC) is to provide a Mach 8 suborbital RLV technology demonstrator. The vehicle is 18.3 meters in length, has a wingspan of 8.4 meters, and is powered by a single LOX-kerosene engine. The X-34 is carried below an L-1011 aircraft to an altitude in excess of 9

kilometers, where the vehicles separate, the X-34 engine starts, and the X-34 vehicle continues along its flight trajectory. The first flight is scheduled for 1999. This paper briefly describes the aerothermal analysis of the Thermal Protection System performed by OSC.
Derived from text
Aerothermodynamics; Control Surfaces; Thermal Protection; Surface Temperature; X-34 Reusable Launch Vehicle; Thermal Analysis

20040075788 NASA Ames Research Center, Moffett Field, CA, USA
Direct Simulation of a Supersonic Turbulent Boundary Layer
Guarini, S.; Moser, R. D.; Shariff, K.; Research and Technology 1997; September 1998, pp. 83; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Turbulence modeling introduces one of the major sources of uncertainty in the prediction of aeronautical flows. This statement is even truer for supersonic flows for which physical insight is lacking and for which any modeling ideas that do exist remain unvalidated because of lack of data. Physical understanding and proper modeling of turbulent supersonic flow have seen a new beginning, however, thanks to a number of direct simulations by several groups in the last decade. For instance, an important effect which has recently come to light in free shear flows i s a significant reduction with Mach number in the ability of the flow to produce turbulent shear stress from turbulent energy.
Derived from text
Simulation; Turbulence Models; Turbulent Flow; Supersonic Boundary Layers; Shear Flow

20040075807 NASA Ames Research Center, Moffett Field, CA, USA
B-Spline Method for Turbulent Flow Simulation
Kravchenko, A.; Moin, P.; Shariff, K.; Research and Technology 1997; September 1998, pp. 51; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

B-splines are an attractive basis for a numerical method. Because of the continuity of a high number of derivatives, B-splines have resolving power approaching that of spectral functions, but provide greater flexibility in geometry and grid distribution. They are not as flexible as finite elements, but they are much more accurate for the same number of degrees of freedom. Furthermore, if they are used in a Galerkin formulation, the resulting scheme conserves not only the discretized quantities (such as mass and momentum) but quadratic invariants as well (such as kinetic energy for inviscid incompressible flow). This protects the scheme against aliasing and ensures that there is no numerical smoothing of the unresolved scales of motion. The B-spline method was implemented for incompressible flow in two generalized coordinates using a Galerkin formulation. Fourier expansions are used for the third direction. The B-spline zonal mesh capability developed by Shariff and Moser, which gives the same high degree of derivative continuity at zonal boundaries as everywhere else, is used. It increases gridding flexibility and leads to a significant reduction in the number of grid points required. Basis vectors are used that already satisfy the incompressibility constraint. This leads to a reduction in the number of degrees of freedom from four to two per grid point. However, there is a high cost associated with calculating the Galerkin nonlinear term and in inverting the mass matrix. More work is required to improve the efficiency of the method.
Author (revised)
Turbulent Flow; Numerical Analysis; Incompressible Flow

20040075818 NASA Ames Research Center, Moffett Field, CA, USA
Area Measurement of Skin Friction in Complex Three-Dimensional Flows
Brown, James L.; Research and Technology 1997; September 1998, pp. 54-55; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A surface-imaging skin-friction instrument provides measurement of the wall shear-stress vector over a large surface region during a single wind tunnel test using an oil-film interference method. During a test, a camera captures images of the fringe pattern produced by illuminating an oil film with quasi-monochromatic light. By using a visual tracer in the oil, the surface streamlines can also be determined. Analysis of the fringe images using a Hilbert-transform-based technique determines the oil thickness distribution in the region where fringes are visible. A combination of the oil thickness and surface direction is then used to calculate the surface shear-stress distribution by numerically solving the thin-oil film equation: where tau(sub x) and tau(sub z) are the x- and z-components of the surface shear stress, and mu is the dynamic viscosity of the oil. All quantities in this equation are known from the height measurement except tau(sub x) and tau(sub z). However, an additional piece of information is needed to solve this equation. If the surface streamline direction gamma is obtained from

visual tracers or from a streamline image, then tau(sub x) = tau cos(gamma) and tau(sub z) = tau sin(gamma), and the equation may be solved for tau. To test the technique in a demanding situation, it was applied to a three-dimensional (3-D) flow in which a cylinder is mounted normal to a flat plate. An incoming turbulent boundary layer encounters the vertically mounted cylinder and a highly complex 3-D flow results.
Author (revised)
Skin Friction; Friction Measurement; Three Dimensional Flow

20040075852 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Berkeley, CA, USA
Estimating Flow Parameters using Ground-Penetrating Radar and Hydrological Data during Transient Flow in the Vadose Zone
Kowalsky, M.; Finsterle, S.; Rubin, Y.; 2003; In English
Report No.(s): DE2003-813382; LBNL-52504; No Copyright; Avail: National Technical Information Service (NTIS)

Methods for determining the parameters necessary for modeling fluid flow and contaminant transport in the shallow subsurface are in great demand. Soil properties such as permeability, porosity, and water retention are typically estimated through the inversion of hydrological data (e.g., measurements of capillary pressure and water saturation). However, ill-posedness and non-uniqueness commonly arise in such inverse problems making their solutions elusive. Incorporating additional types of data, such as from geophysical methods, may greatly improve the success of inverse modeling. In particular, ground-penetrating radar (GPR) has proven sensitive to subsurface fluid flow processes. In the present work, an inverse technique is presented in which permeability distributions are generated conditional to time-lapsed GPR measurements and hydrological data collected during a transient flow experiment. Specifically, a modified pilot point framework has been implemented in iTOUGH2 allowing for the generation of permeability distributions that preserve point measurements and spatial correlation patterns while reproducing geophysical and hydrological measurements. Through a numerical example, we examine the performance of this method and the benefit of including synthetic GPR data while inverting for fluid flow parameters in the vadose zone. Our hypothesis is that within the inversion framework that we describe, our ability to predict flow across control planes greatly improves with the use of both transient hydrological measurements and geophysical measurements (GPR-derived estimates of water saturation, in particular).
NTIS
Contaminants; Flow Characteristics; Fluid Flow

20040075891 Purdue Univ., West Lafayette, IN, USA, Alabama Univ., Huntsville, AL, USA
Analysis of Regen Cooling in Rocket Combustors
Harper, Brent, Technical Monitor; Merkle, C. L.; Li, D.; Sankaran, V.; May 13, 2004; 8 pp.; In English; 52nd JANNAF Joint Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A02, Hardcopy

The use of detailed CFD modeling for the description of cooling in rocket chambers is discussed. The overall analysis includes a complete three-dimensional analysis of the flow in the regenerative cooling passages, conjugate heat transfer in the combustor walls, and the effects of film cooling on the inside chamber. The results in the present paper omit the effects of film cooling and include only regen cooling and the companion conjugate heat transfer. The hot combustion gases are replaced by a constant temperature wall boundary condition. Load balancing for parallel cluster computations is ensured by using single-block unstructured grids for both fluids and solids, and by using a 'multiple physical zones' to account for differences in the number of equations. Validation of the method is achieved by comparing simple two-dimensional solutions with analytical results. Representative results for cooling passages are presents showing the effects of heat conduction in the copper walls with tube aspect ratios of 1.5:l.
Author
Combustion Chambers; Three Dimensional Models; Regenerative Cooling; Heat Transfer; Film Cooling

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20040074337 Defence Science and Technology Organisation, Edinburgh, Australia
Enhancing Imagery to Improve the Visibility of Detail
Whatmough, Robert; February 2004; 37 pp.; In English
Report No.(s): DSTO-TR-1557; DODA-AR-013-039; Copyright; Avail: Other Sources

Imagery from surveillance sensors is often not suitable for immediate viewing, because the number of grey levels or colours used is much larger or smaller than the number available on the display device. This Report considers some old and new techniques for making imagery ready to view, so that both broad features and fine detail are visible. The basic techniques often give poor results when they encounter the peculiarities of particular sensors or scenes; in these cases variations are available that overcome the problems at a cost in computing time. Examples of the application of techniques and variations to airborne sensor imagery are given.
Author
Display Devices; Imagery; Viewing; Visibility

20040074338 Defence Science and Technology Organisation, Edinburgh, Australia
Visualizing Line-of-Sight Information in Matlab
Mewett, David; Hall, Damian; Davies, Adam; March 2004; 27 pp.; In English
Report No.(s): DSTO-GD-0397; DODA-AR-013-059; Copyright; Avail: Other Sources

There are many ways to visualize areas that are within line-of-sight of a sensor or communications transmitter. This document describes how to use visualisation and mapping commands in Matlab to produce a variety of line-of-sight maps to suit customers" requirements.
Author
Line of Sight; Optical Tracking

20040075025 Missouri Univ., Rolla, MO, USA
Electrochemical and Hydrodynamic Interferences on the Performances of an Oxygen Microsensor with Built-in Electrochemical Microactuator
Kim, Chang-Soo; Lee, Chae-Hyang; 2004; 7 pp.; In English
Contract(s)/Grant(s): NAG9-1423; 01-OBPR-01; No Copyright; Avail: CASI; A02, Hardcopy

A concept of novel electrochemical in situ self-calibration technique for an oxygen microsensor has been proposed to devise a convenient calibration method without an externally coupled apparatus. Systemic investigations on the influences of various electrochemical (pH) and hydrodynamic (solution stirring) conditions on the proposed microsensor performances are presented. The results suggest that: 1) The calibrating microenvironments can be manipulated with carefully engineered sensor designs and optimized generating signals; 2) The external oxygen permeable membrane is needed to minimize the electrochemical and hydrodynamic interferences.
Author
Microinstrumentation; Hydrodynamics; Oxygen; Electrolysis; Ph

20040075036 Space Telescope Science Inst., Baltimore, MD, USA
Time Resolved Spectroscopy of High Field Polars (FUSE 00)
Barrett, Paul; June 11, 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10247; No Copyright; Avail: CASI; A01, Hardcopy

The following work has been accomplished: 1) The emission lines of O VI1 and He II were used to produce Doppler tomograms of the plasma emission. 2) An improved interstellar absorption model is being developed for the CIAO spectral fitting program, Sherpa. Use of the earlier version of this model showed it to be inadequate for its purpose. Once this model is working, we intend to complete our analysis of V884 Her and those of other FUSE programs. In addition to the above work, this grant has helped support the following related work: 1) The publication of the paper "Periodicities in the X-ray intensity variations of TV Columbae: an Intermediate Polar" by Rana, V. R., Singh, K. P., Schlegel, E. M., & Barrett, P. 2004, AJ, 126,489, and 2) FUSE data of a possible nova-like variable Ret 1 has been analyzed and shown to contain

a hot (37000 deg) white dwarf (WD 0334-6400). The FUV spectrum shows strong absorption lines of C III.
Derived from text
Spectroscopy; Time Functions; Tomography; Emission Spectra

20040075052 Army Construction Engineering Research Lab., Champaign, IL
Identification and Mapping of Sagebrush/Grass Successional Stages with Landsat Thematic Mapper Data at Yakima Training Center, Washington
Leedy, Craig R.; Tueller, Paul T.; Gao, Wei; Tweddale, Scott A.; Feb. 2004; 62 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422424; ERDC/CERL-TR-04-2; No Copyright; Avail: CASI; A04, Hardcopy

In the future, remote sensing technologies will become an increasingly important and valuable tool for military land managers in semiarid regions. These technologies, when combined with field samples, have the potential to accurately monitor rangeland trends from year to year with smaller monetary investments compared to field sampling exclusively. This research attempted to identify and map successional changes on semiarid rangelands at Yakima Training Center, WA, using remote sensing techniques by developing a model derived from analysis of dependent and independent variables chosen from field surveys of vegetation and geomorphic data, along with the interpretation of Landsat TM data. Preliminary results based on small data sets separated by elevation and slope direction showed both low and some reasonable R2 values, including some R2 near 0.70. The removal of elevation and slope direction and consideration of multicollinearity and outliers and influentials provided generally significant relationships among dependent and independent variables. Significant relationships between multiple dependent and independent variables were also identified using canonical correlation analysis. Variability among the releves, collection of field vegetation and soil data over the entire summer including many phenophases, and the correction of the raster radiance values for topography were assumed to be factors that may have reduced the predictive capabilities of the techniques investigated.
DTIC
Education; Grasses; Landsat Satellites; Resources Management; Satellite Imagery; Thematic Mappers (Landsat)

20040075071 Army Test and Evaluation Command, Aberdeen Proving Ground, MD
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 125
Overbay, Larry; Dec. 2003; 54 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422913; ATC-8741; No Copyright; Avail: CASI; A04, Hardcopy

This scoring record documents the efforts of Geophex Ltd, to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. The firing record was coordinated by Larry Overbay and by 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 Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Ordnance; Scoring; Standardization

20040075499 Missouri Univ., Rolla, MO, USA
Flexible Microsensor Array for the Monitoring and Control of Plant Growth System
Kim, Chang-Soo; Porterfield, D. Marshall; Nagle, H. Troy; Brown, Christopher S.; [2004]; In English; Habitation 2004, USA
Contract(s)/Grant(s): NAG9-1423; 01-OBPR-01
Report No.(s): MC25; No Copyright; Avail: Other Sources; Abstract Only

Testing for plant experiments in space has begun to explore active nutrient delivery concepts in which water and nutrients are replenished on a continuous basis for long-term growth. The goal of this study is to develop a novel microsensor array to provide information on the dissolved oxygen environment in the plant root zone for the optimum control of hydroponics and solid substrate plant cultivation systems in the space environment. Miniaturized polarographic dissolved oxygen sensors have been designed and fabricated on a flexible Kapton (trademark) (polyimide) substrate. Two capabilities of the new microsensor array were explored. First, measurements of dissolved oxygen in the plant root zone in hydroponics and solid substrate culture systems were made. The microsensor array was fabricated on a flexible substrate, and then cut out into a mesh type to make a suspended array that could be placed either in a hydroponics system or in a solid substrate cultivation system to measure the oxygen environments. Second, the in situ self-diagnostic and self-calibration capability (two-point for oxygen)

was adopted by dynamically controlling the microenvironment in close proximity to the microsensors. With a built-in generating electrode that surrounds the microsensor, two kinds of microenvironments (oxygen-saturated and oxygen-depleted phases) could be established by water electrolysis depending on the polarity of the generating electrode. The unique features of the new microsensor array (small size, multiple sensors, flexibility and self-diagnosis) can have exceptional benefits for the study and optimization of plant cultivation systems in both terrestrial and microgravity environments. The in situ self-diagnostic and self-calibration features of the microsensor array will also enable continuous verification of the operability during entire plant growth cycles. This concept of automated control of a novel chemical monitoring system will minimize crew time required for maintenance, as well as reduce volume, mass, and power consumption by eliminating bulky diagnosis systems including calibrant (fluid and gas) reservoir and flow system hardware.
Author
Microinstrumentation; Hydroponics; Plant Roots; Oxygen; Dissolved Gases

20040075513 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Special Nuclear Material Imaging Using a High Purity Germanium Double Sided Strip Detector
Sulham, Clifford V.; Mar. 2004; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422965; AFIT/GNE/ENP/04-07; No Copyright; Avail: CASI; A06, Hardcopy

The purpose of this research is to investigate the feasibility of using a High Purity Germanium Double Sided Strip Detector (HPGeDSSD) to image Special Nuclear Material (SNM) for use in the field of nuclear nonproliferation. SNM shape can be determined by using a gamma ray imaging system that is capable of imaging either Pu-239 or U-235. The detector used for this research is a liquid-nitrogen cooled germanium detector with five charge collection strips on both faces. The strips on the two faces are orthogonal to each other, creating a five by five array of data collection pixels. When the detector is coupled to a parallel hole collimator, an imaging system is achieved. The system is capable of imaging individual or multiple photon energies. The capability of the imaging system to produce images of simulated Pu-239 was demonstrated. The analyses of the images allowed distributed sources to be distinguished from point sources, which was the primary goal for developing this technology.
DTIC
Germanium; Imaging Techniques; Purity

20040075619 Utah State Univ., Logan, UT, USA
Pixel-Level Fusion of Active/Passive Data for Real-Time Composite Feature: Extraction and Visualization
Steinberg, Alan; Pack, Robert; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 12-1 - 12-5; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A system has been developed whereby active LADAR and passive imaging data are registered in hardware at the pixel level. For the sake of discussion, the sensor is herein called a LADAR/EO pixel-level Fusion Sensor or LEFS. This sensor produces structural and spectral data embodied in one dataset, permitting composite feature extraction and visualization. The combined use of LADAR and passive EO/IR data has well known synergism. Our system fuses these two data types in a novel way such that real-time performance is possible. This significantly enhances the ability to quickly and correctly identify targets. By fusing the range data from the active sensor with the pixel-registered imagery, registered 3D images are available in real time. Each pixel is coded with full spectral information combined with structural information obtained by the active system. The resulting fully aligned high-dimension feature vector enhances target recognition and permits dense point matching for precise image mosaicking. A significant benefit is in combining the ability of pencil beam active systems to work at long ranges and to penetrate obscurants with the passive array s wide instantaneous field of view at increased resolution. One application in which this has had enormous benefit is in observation through partial or intermittent obscuration; e.g. with partial cloud cover or foliage. Reflected radiation associated with features within gaps in the obscuration are sensed passively while at the same time the active pencil beam efficiently maps structure within the revealed region. Pixel-level registration of data permits extended regions to be mapped by combining temporally or spatially diverse collections.
Author (revised)
Real Time Operation; Optical Radar; Multisensor Fusion; Pattern Recognition

20040075659 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Stennis Space Center Verification and Validation Capabilities
Daehler, Erik; March 20, 2002; 9 pp.; In English; Poster for JACIE High Spatial Resolution Commercial Imagery Workshop, 25-27 Mar. 2002, Reston, VA, USA
Contract(s)/Grant(s): NASl3-650
Report No.(s): SE-2002-03-00029-SSC; Copyright; Avail: CASI; A02, Hardcopy

Verification and validation capabilities are discussed for: spatial response,reflectance radiometry, positional accuracy,in-flight instruments, lab calibration, thermal radiometry,hyperspectral radiometry, and portable atmospheric monitoring.
Derived from text
Radiometers; Calibrating

20040075713 NASA Ames Research Center, Moffett Field, CA, USA
Galactic Bulge Observations
Roellig, Thomas L.; Chan, Kin-Wing; Research and Technology 1997; September 1998, pp. 117; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The mid-infrared spectrometer (MIRS) that flew on the joint NASA/Japanese Space Agency Infrared Telescope in Space (IRTS) mission in 1995 yielded a wealth of data that are presently being analyzed and reported on. Here we present the results of MIRS studies of the Galactic Bulge region. The MIRS operated over wavelengths ranging from 4.6 to 11.7 microns with a spectral resolution of about 0.23 to 0.36 microns. This i s an ideal spectral region and resolution for investigations of infrared emissions from solid material, since it covers many of the diagnostic stretching and bending modes of candidate interstellar material. The IRTS/MIRS telescope/instrument combination achieved sensitivities that were orders of magnitude better than those of any other instrumentation previously used for diffuse mid-infrared emission studies.
Derived from text
Galactic Bulge; Infrared Telescopes; Spaceborne Telescopes; Spectral Bands; Spectrometers

20040075717 NASA Ames Research Center, Moffett Field, CA, USA
2-D Super Resolution Used on Mars Pathfinder
Kanefsky, Bob; Cheeseman, Peter; Stoker, C.; Research and Technology 1997; September 1998, pp. 128-129; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Data Understanding Group at Ames Research Center is developing the theory and practice of combining information from multiple images. The group has already produced a technique called Two-Dimensional (2-D) Super-Resolution; this technique uses multiple images of the same scene, taken by the same instrument under nearly identical lighting conditions and from nearly identical instrument orientations, and produces a single output image of higher resolution than the input images. The inescapable slight differences in instrument orientation, and in the registration of scene features on the pixel grid of the instrument, ensure that any point in the scene is pixelized differently in each input image. The 2-D Super-Resolution technique exploits these registration differences to create a mathematical model of the original scene-using the information from all the low-resolution input images-which has much higher resolution than those images. The resolution can typically be improved by a factor equal to the square root of the number of input images. This model can then be used to generate a high resolution output image.During the Mars Pathfinder mission (July through October 19971, the technique was used by Ames personnel working on the Pathfinder science team. The Imaging for Mars Pathfinder (IMP) camera on the lander was commanded to take image sequences especially designed to be processed by the super-resolution algorithm.
Author
Mars Pathfinder; Image Resolution; Cameras

20040075751 NASA Ames Research Center, Moffett Field, CA, USA
Gravity Probe B Project
Goebel, J.; Research and Technology 1997; September 1998, pp. 122-123; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Ames Research Center is supporting the development and manufacture of the guide-star telescope detectors of the Gravity Probe B (GPB) Project. GPB is a Stanford University/Lockheed-Martin/Marshall Space Flight Center Physical Science Mission that has called upon Ames Research Center's expertise in cryogenic electronics to help meet the program's launch schedule. The Ames technical contribution has been made over a period of 2 years and is expected to conclude shortly after launch, currently scheduled for March 2000 from Vandenberg Air Force Base. The GBP fine-motion guide-star tracking

system uses a 5.6-inch aperture, all fused-quartz telescope which is attached to a quartz block assembly containing the relativistic-effect sensing gyroscopes. The guide-star telescope rotates about a central axis, thereby providing a constant pointed reference direction to a star fixed on the celestial sphere; this is the distant inertial reference frame. The satellite that contains this assembly will be in a polar orbit about Earth. The precession rate of the sensed gyroscope directional output from the distant inertial reference frame is a possible indication of a general relativistic deviation from that expected by Newtonian gravitational theory. A precession rate is expected to occur at an angular scale of a few arcseconds per year, and it is expected to be measured with an accuracy of about 0.2 milliarcsecond per year. For comparison, the apparent angular diameters of the few nearest stars, visible to all but the largest telescopes as points of light, are less than 10 milliarcseconds. The GPB fine-motion guide-star tracking system
Derived from text
Gravity Probe B; Schedules; Star Trackers; Relativistic Effects

20040075767 NASA Ames Research Center, Moffett Field, CA, USA
Environmental Research Aircraft and Sensor Technology
Wegener, Steve; Research and Technology 1997; September 1998, pp. 166; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Environmental Research Aircraft and Sensor Technology (ERAST) Program provides focus for critical technology development and flight demon- stration that reduce the technical and economic risk of using remotely piloted aircraft (RPA) as a means of collecting scientific data in a timely and cost-effective manner. The ERAST Sensor and Science Mission Element provides focus for sensor (science and platform) and mission development and demonstration. development program designed to provide the Atmospheric Effects of Aviation Program and the Upper Atmosphere Research Program with a new generation of small, lightweight, low-power RPA- class sensor systems.
Author
Research Aircraft; Imaging Techniques; Digital Cameras

20040075785 NASA Ames Research Center, Moffett Field, CA, USA
Detection of Aircraft in Video Images
McCandless, Jeffrey W.; Ahumada, Albert J.; Kaiser, Mary K.; Research and Technology 1997; September 1998, pp. 80-81; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

NASA is collaborating with the aircraft industry to develop technology for a supersonic passenger airplane called the High-speed Civil Transport (HSCT). One issue that is being examined is the replacement of the conventional forward cockpit windows with synthetic displays. The imagery in these displays would be obtained from video cameras mounted outside the aircraft. A benefit of this configuration is that the video imagery can be examined with computers to determine if another aircraft is in the scene. The goal of this HSCT sub-project is to develop computer vision programs to detect aircraft that are moving in the video images. During FY97, a series of computer programs were written to process video images and to search for moving objects (e.g., other aircraft). Flight tests were conducted in April and May to obtain the video imagery to test the computer programs. Each flight test was conducted with two aircraft. One aircraft was a Boeing 737 with a camera mounted below the nose. With a field-of-view of 13 degrees, this camera recorded the images of a second aircraft (the target plane) flying in various trajectories. For example, one trajectory consisted of the target plane flying from right to left across the path of the Boeing 737, producing the image in the first figure. The position of the target plane i s indicated by the arrow in the figure. In this instance, the target plane was a Beech King Air 200 flying at a distance of 1 nautical mile relatively small in the image.
Derived from text
Cameras; Computer Programs; Computer Vision; Display Devices; Trajectories

20040075797 NASA Ames Research Center, Moffett Field, CA, USA
Airborne Tracking Sunphotometry
Russell, Philip B.; Livingston, John M.; Schmid, Beat; Ried, Damon; Research and Technology 1997; September 1998, pp. 165; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Atmospheric aerosols (suspensions of airborne particles comprising hazes, smokes, and thin clouds in the troposphere and stratosphere) play important roles in determining regional and global climates, the chemical composition of the atmosphere, and atmospheric transport processes. A fundamental measure of any aerosol is how much it attenuates light beams of various colors (i.e., various wavelengths). This attenuation is usually described in terms of the quantity known as optical depth. The

dependence of optical depth on light wavelength is the optical-depth spectrum. the optical-depth spectrum of aerosols and thin clouds. They do this by pointing detectors at the Sun (tracking it) and measuring the (relative) intensity of the solar beam in several spectral channels. The tracking head of each instrument mounts external to the aircraft cabin, thereby increasing data-taking opportunities relative to in-cabin sunphotometers and avoiding data contamination by cabin-window effects. Each channel consists of a baffled entrance tube, interference filter, photodiode detector, and integral preamplifier. The fiIter/detector/preamp sets are temperature-controlled to avoid thermally induced calibration changes. Each instrument includes an entrance-window defogging system to prevent condensation (a problem otherwise common in aircraft descents), Solar tracking is achieved by azimuth and elevation motors driven by differential Sun sensors. In general, Sun tracking is achieved continuously, independent of aircraft pitch, roll, and yaw, provided that change rates in those axes do not exceed about 8 degrees per second and that the Sun is above the aircraft horizon and is unblocked by clouds or aircraft obstructions (e.g., tail, antennas). Data are digitized and recorded by an onboard data acquisition and control system. Real-time data processing and color display are routinely provided. The Ames airborne sunphotometers determine The science data set includes the detector signals, derived optical depths, detector temperature, Sun tracker azimuth and elevation angles, tracking errors, and time. Each instrument must maintain its radiometric calibration (including window and filter transmittance, as well as detector responsivity and electronic gain) to within 1 % in each spectral channel for periods of several months to a year. Author (revised)

Photometers; Aerosols; Optical Thickness; Solar Instruments

20040075801 NASA Ames Research Center, Moffett Field, CA, USA

Global Land Surface Monitoring with Low-Resolution Satellite Imagery

Hlavka, Christine A.; Dungan, Jennifer; Research and Technology 1997; September 1998, pp. 154; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The only practical way to produce maps of large regions of the globe is to use remotely sensed data that have coarse spatial resolution, such as data from the advanced very-high-resolution radiometer (AVHRR) at 1.1 -kilometer resolution, or the soon-to- be launched moderate-resolution imaging spectro- radiometer (MODIS) instrument at resolutions of 250 meters to 1 kilometer (MODIS is a "moderate- resolution" instrument by today s standards). How- ever, the accuracy of the resultant maps is in doubt, especially for mapping highly fragmented land-cover types such as burn scars in forests and grasslands and ponds in Arctic tundra. These land-cover types are important in climatology, hydrology, and other Earth sciences. The objective of this project i s to develop an approach for improving area estimates by model- ing the distribution of patch sizes of homogeneous land cover, such as open water or the ash layer left by fire.

Derived from text

Spatial Resolution; Satellite Imagery; Remote Sensing; Advanced Very High Resolution Radiometer; Hydrology

20040075814 NASA Ames Research Center, Moffett Field, CA, USA

Low-Speed Pressure-Sensitive Paint Research

Mehta, Rabindra D.; Brown, Owen C.; Research and Technology 1997; September 1998, pp. 52-53; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Pressure-sensitive paint (PSP) i s a relatively new measurement technique used in aerodynamic wind tunnel testing. PSP contains a unique sensor molecule that can be excited with light that has an appropriate wavelength. The excited sensor molecule returns to its original state by re-emitting light, or by reactions with nearby oxygen molecules in a process known as oxygen quenching. The emitted intensity of excited PSP is therefore directly proportional to the local partial pressure of oxygen and hence to the local pressure at the painted surface. Scientific grade charge-coupled device (CCD) cameras are used to record digital images of wind tunnel models painted with PSP. Images are taken with the wind tunnel running and with the wind tunnel turned off (this latter image serving as a reference). Software is used to calibrate the ratio of the wind-on and wind-off image intensities to pressures at various points on the model sensed by conventional pressure taps. Since the intensity-versus-pressure relation is (ideally) linear, only a few pressure taps are needed for proper calibration. improvement in design and testing. PSP provides the capability to record the complete pressure field over a model surface with high spatial resolution. Wind tunnel models can be constructed with only a few pressure taps instead of the thousands of taps typically needed for structural load modeling. This saves precious design-cycle time.

Author

Pressure Sensitive Paints; Wind Tunnel Models

20040075820 NASA Ames Research Center, Moffett Field, CA, USA

Aircraft-Borne Meteorological Measurement Systems

Bui, T. Paul; Chan, K. Roland; Pfister, Leonhard; Trias, Antonio A.; Bowen, Stuart W.; Dean-Daly, Jonathan; Chang, Cecilia; Moore, Elizabeth; Bui, David; Research and Technology 1997; September 1998, pp. 160; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The aircraft-borne Meteorological Measurement System (MMS) provides high-resolution meteorological parameters (pressure, temperature, and the three- dimensional wind vector). The MMS consists of three major systems: (1) an air-motion sensing system to measure the velocity of the air with respect to the aircraft, (2) an aircraft motion-sensing system to measure the velocity of the aircraft with respect to Earth, and (3) a data-acquisition system to sample, process, and record the measured quantities. Because much of the instrumentation i s attached to the aircraft at carefully chosen locations, the MMS is a platform- specific instrument and cannot be moved from one aircraft to another.

Derived from text

Data Acquisition; Detection; Meteorological Instruments; Air Flow; Wind Direction; Wind Velocity

20040077061 NASA Ames Research Center, Moffett Field, CA, USA

The SOFIA Telescope Assembly Alignment Simulator

Haas, Michael R.; Black, David S.; Blair, Jeffrey C.; Cardinale, Paul A.; Mai, Nghia N.; Mak, Michael S.; Marmie, John A.; McIntyre, Michael J.; Squires, David D.; Stokely, Eric, et al.; Research and Technology 1999; December 2000, pp. 109-110; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The NASA Stratospheric Observatory for Infrared Astronomy (SOFIA) is scheduled to begin routine flight operations from Ames in early 2003. To facilitate installation and integration of science instruments with the observatory, a Telescope Assembly Alignment Simulator (TAAS) is being designed and built. Such a facility is required because of the high flight rate, frequent instrument change-outs, and limited access to the telescope cavity.

Derived from text

Alignment; Simulators; Sofia (Airborne Observatory); Telescopes; Assembly; Fabrication

20040077070 NASA Ames Research Center, Moffett Field, CA, USA

Stratospheric Tracer-Field Measurements with a New lightweight Instrument: The Argus Spectrometer

Loewenstein, Max; Jost, Hansjuerg; Greenblatt, B. Jeffries; Research and Technology 1999; December 2000, pp. 182-183; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Argus is a new, lightweight spectrometer designed for measuring the stratospheric nitrous oxide (N20) and methane (CH4) tracer fields in situ from balloons and aircraft. It is a second-generation instrument drawing on the experience gained with the very successful Atmospheric Laboratory for Applications and Science (ATLAS) instrument measuring N20 and flying on the NASA ER-2 since 1986. During the past several years Argus was part of the Observations from the Middle Stratosphere (OMS) balloon payload probing the tropical and mid- latitude stratosphere in studies of transport issues related to dispersion of aircraft exhaust. A major concern motivating these studies was the potential for nitrogen oxides (NO,) generated in the exhaust plume of a supersonic high flyer to reach the tropical ozone production region by rapid transport from a midlatitude flight corridor. NO, is effective in destroying ozone (03) in a well-known catalytic cycle that can proceed rapidly under stratospheric photochemical conditions. Several results from research are described.

Derived from text

Spectrometers; Atmospheric Chemistry; Stratosphere; Weight Reduction

20040077073 NASA Ames Research Center, Moffett Field, CA, USA

Perceptual Impact of Predictive Compensation for Time Delays in Virtual Environments

Adelstein, Bernard D.; Ellis, Stephen R.; Jung, Jae Y.; Research and Technology 1999; December 2000, pp. 162-163; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In visually presented virtual environments (VE), measured displacement of the observer s head is used to position and orient the viewed simulation content in head-mounted or other types of video displays. Because of latencies within and between individual VE system hardware and software components, time delay in rendering the visual consequences of input motion is unavoidable. These delays disrupt image stability and, therefore, can disturb the observer s sense of presence and ability to perform useful work in a VE. Predictive compensation software, by extrapolating ahead in time, offers means to mitigate the consequences of VE delays. However, prediction introduces noise and overshoot artifacts into measured human motion that can be as perceptually disruptive as the original uncompensated VE time delay. The immediate objective of this

work is to ascertain the perceptual impact of artifacts arising from predictive compensation of VE time delay, and ultimately to use this understanding to guide the design of novel compensation schemes.
Derived from text
Computer Programs; Display Devices; Simulation; Time Lag

20040077076 NASA Ames Research Center, Moffett Field, CA, USA
A Design Model for the Digital Array Scanned Interferometer
Dunagan, Stephen E.; Hammer, Philip D.; Research and Technology 1999; December 2000, pp. 169-170; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

An instrument model has been developed for the digital array scanned interferometer (DASI) sensor. This model predicts instrument performance in the context of specific measurement applications, and may be used to evaluate the instrument for a range of potential missions. The model may also be used to tune a design to meet specific measurement requirements, and it provides the foundation for onboard adaptation of the sensor for mission-specific measurements in a "smart-sensor" environment.
Derived from text
Design Analysis; Arrays; Interferometers

20040077116 NASA Ames Research Center, Moffett Field, CA, USA
Geothermal Springs Camera and Sensor Probe
Trent, Jonathan; Hines, John W.; Friedericks, Charlie; Daily, Richard; Research and Technology 1999; December 2000, pp. 164-165; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Geothermal Springs Camera and Sensor Probe (aka Mini Monster Cam) is a research instrument developed to support the search for life in extreme temperatures. The purpose of the probe is to find and observe eukarya (multicell organisms) in the depths of geothermal hot springs. Although we know that single-cell organisms proliferate in hot springs, the probe will help prove or disprove the existence of eukarya (Mini Monsters) that might feed on the single-cell organisms. This work is part of a larger effort to define the limits of life on Earth to help narrow the search for life on other planets.
Derived from text
Cameras; Probes; Extraterrestrial Life; Temperature Sensors; Geothermal Technology

20040077128 NASA Ames Research Center, Moffett Field, CA, USA
CCD Photometry Tests for Planet Detection
Koch, David G.; Borucki, William J.; Jenkins, Jon; Webster, Larry D.; Witteborn, Fred; Research and Technology 1999; December 2000, pp. 111-112; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

For the first time in history we now know of more planets outside our solar system than in it. All of these extrasolar planets are about the size of Jupiter or larger. The Kepler Mission proposes to search for hundreds of Earth-size planets. The concept consists of monitoring 100,000 stars continuously for four years for planetary transits. An Earth-sized transit of a solar-like star produces a relative change in brightness of 8x10(exp -3) for a duration of a few to 16 hours, depending on the orbit and inclination of the planet. A technology demonstration showed that a relative precision of better than 2 X l0 (exp -5) is achievable when all of the realistic noise sources are incorporated in a full-up end-to-end system. A commercially available back-illuminated charged coupled device (CCD) was used for the tests. The same device can be used in the proposed Kepler Mission.
Derived from text
Charge Coupled Devices; Extrasolar Planets; Photometry; Planet Detection

20040077137 NASA Ames Research Center, Moffett Field, CA, USA
Visual Motion Integration and Segmentation
Stone, Lee; Buetter, Brent; Lorenceau, Jean; Masson, Guillaume; Mestre, Daniel; Research and Technology 1999; December 2000, pp. 145-146; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Much has been learned about the human ability to detect and discriminate information within local patches of image motion, and a model consisting of motion-energy detectors i s a good descriptor of human low-level motion detection. This simple quasilinear view, however, does not adequately describe human performance in motion tasks that require either global integration across the image or segmentation of multiple overlapping independent motions presented simultaneously, yet these two abilities are essential components of many aerospace tasks. The overall goal of this project i s to understand human

performance in visual motion integration and segmentation tasks. The specific aim is to examine the abilities and limitations of humans to perform the global integration used to estimate object direction, and to use motion cues to segment images into discrete objects. a first stage of local motion-energy sensors and a second-stage integration rule that combines local edge-motion signals to derive a global object direction signal. Research has shown that simple vector averaging of the local motion signals cannot account for human direction judgments. Furthermore, by showing that the static spatial configuration influences motion integration, it has been demonstrated that no algorithm that merely combines local motion information can account for human performance. Current models of human motion processing use Another difficult problem facing the human visual system is deciding when to combine local motion signals (that is, to assume they come from the same object) and when to segregate them (that is, to assume they come from different objects) as a first step in using motion to determine depth relation- ships. A clear understanding of this ability and its limitations i s critical for the design of head-up, augmented-reality, or any other display that uses superimposed imagery. The limitations in human visual segmentation performance related to three factors were measured: mean speed, eccentricity, and spatial scale. The major findings are summarized in the figure. They are: (1) that segmentation from speed cues breaks down at mean speeds above approximately 8 degrees per second; and, (2) that the spatial resolution of the segmentation process i s quite fine even in the visual periphery. Both of these findings are consistent with the view that the primary visuai cortex (VI) plays a critical role.
Derived from text
Visual Tasks; Image Motion Compensation; Segments; Motion; Detectors

20040077138 NASA Ames Research Center, Moffett Field, CA, USA
Computational Models of Human Eye-Movement Behavior
Stone, Lee; Beutter, Brent; Eckstein, Miguel; Lorenceau, Jean; Research and Technology 1999; December 2000, pp. 146-147; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Humans interact with visual displays not by passively absorbing the information like a fixed camera, but by actively searching for areas with relevant information, and by following the motion of features of interest. The specific aim of this project is to develop and test computational models of human eye-movement control with particular emphasis on two types of eye-movement behaviors: search saccades and smooth pursuit. The overall goal is to incorporate the knowledge of eye-movement behavior acquired in our laboratory into computational models that can serve as design tools in the development of safer, more effective visual displays, interfaces, and training methods, matched to human abilities and limitations. Most current models of human vision have focused on the passive ability to detect, discriminate, or identify targets in noise in carefully controlled laboratory conditions in which eye movements are suppressed. However, when humans interact with a display during aerospace tasks (for example, air traffic controllers monitoring aircraft), their eyes jump from one location to another using rapid eye movements (saccades) to point central gaze, the region of highest resolution, at the current object of interest. This active search process greatly enhances visual performance. Two major categories of models have been proposed to explain search performance: guided-search and signal-detection-theory models. Unfortunately, the former category predicts reaction time, while the latter predicts localization accuracy. To enable a direct comparison of these two models, an extension to the guided-search model that allows it to predict localization performance was developed. Both models are being tested to determine which is the better predictor of human performance. When display targets move, humans generate smooth tracking eye movements (pursuit) to follow the motion of the current object of interest. This ability is crucial when using a display to perform tasks involving motion estimation (for example, landing the shuttle by aligning a moving target with a reference within a heads-up display). Current pursuit models assume that pursuit merely minimizes the physical image motion on the back of the eye (the retina). This study has demonstrated that this simple view cannot explain the full range of human pursuit behaviors, especially the ability to track targets accurately even when one s view is partially blocked. The new control framework for pursuit, shown schematically in the figure, is consistent with new behavioral data from this study, as well as what is known of the neurophysiology and anatomy of the primate brain. This research suggests that pursuit is driven by an estimate of target motion constructed at the highest level of the brain (the cortex) and shared with perception, rather than by the simple quasireflexive integration of lower-level retinal-error signals.
Derived from text
Eye Movements; Neurophysiology; Image Motion Compensation; Reaction Time; Mathematical Models; Retina

20040077190 NASA Ames Research Center, Moffett Field, CA, USA
Vision Model Applications to Display Optimization
Larimer, James; Gille, Jennifer; Research and Technology 1999; December 2000, pp. 27-29; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Managing and controlling modern aircraft in flight remains one of the primary technology challenges of the aerospace

industry. The vehicle pilot not only controls the flight path of the aircraft, but must communicate path objectives to the air traffic control system, and receive and respond to directives from that agency in order to maintain safe and efficient flight. Additionally, the pilot is the manager of the on-board systems that are required for flight. Modern aircraft and aviation systems are highly complex, and for many of these tasks - control, management, and communications - modern display technology has been utilized as the best way to interface the pilot with the vehicle and system. For several years, Ames has been developing a display optimization tool set known as Visual Display Engineering and Optimization System (VIDEOS). In the investigation of the gray-scale/resolution trade-off for displays, it was found that without dithering, there was no trade-off; there was both a minimum spatial resolution and a minimum number of gray levels required in order to produce an image indistinguishable from a photo-quality version. With dithering, an important trade-off region emerged that corresponds to parameter values achievable by microdisplays being developed for helmet-mounted systems.
Derived from text
Display Devices; Gray Scale; Image Resolution

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*.

20040074341 NASA Langley Research Center, Hampton, VA, USA
Validation of Laser-Induced Fluorescent Photogrammetric Targets on Membrane Structures
Jones, Thomas W.; Dorrington, Adrian A.; Shortis, Mark R.; Hendricks, Aron R.; May 04, 2004; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-090-20-15
Report No.(s): AIAA Paper 2004-1663; Copyright; Avail: CASI; A02, Hardcopy

The need for static and dynamic characterization of a new generation of inflatable space structures requires the advancement of classical metrology techniques. A new photogrammetric-based method for non-contact ranging and surface profiling has been developed at NASA Langley Research Center (LaRC) to support modal analyses and structural validation of this class of space structures. This full field measurement method, known as Laser-Induced Fluorescence (LIF) photogrammetry, has previously yielded promising experimental results. However, data indicating the achievable measurement precision had not been published. This paper provides experimental results that indicate the LIF-photogrammetry measurement precision for three different target types used on a reflective membrane structure. The target types were: (1) non-contact targets generated using LIF, (2) surface attached retro-reflective targets, and (3) surface attached diffuse targets. Results from both static and dynamic investigations are included.
Author
Laser Induced Fluorescence; Membrane Structures; Photogrammetry; Targets; Algorithms

20040075063 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Improving the Estimation of Military Worth of the Advanced Tactical Laser Through Simulation Aggregation
Cook, Michael T.; Mar. 2004; 166 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422894; AFIT/GOR/ENS/04-04; No Copyright; Avail: CASI; A08, Hardcopy

Fielding High Energy Laser (HEL) weapon systems presents technological challenges as well as employment and financial challenges. The risk associated with the challenges mandates the development process include computer simulation models capable of predicting weapon system performance from the engineering level to assessing the military worth of employing HEL systems in combat scenarios. This research effort focuses on developing laser performance data at a higher fidelity engagement model and integrating the performance data into a mission level model. The propagation of the laser from the transmitting aperture to the target is modeled at the engagement level through the employment of the High Energy Laser End-to-End Operational Simulation (HELEEOS), developed by the AFIT Center for Directed Energy (CDE). The output from HELEEOS directly transfers into data lookup tables for the Extended Air Defense Simulation Model (EADSIM). The EADSIM simulations asses the combat performance of a proposed new HEL weapon, the Advanced Tactical Laser (ATL), in a well- defined mission level scenario based on HEL Joint Technology Office (JTO) requirements for future HEL systems. EADSIM is a mission level simulation model included in the Air Force Analytical Tool Kit. Specifically the research explores

the development of the necessary information requirements for HELEEOS and EADSIM to accurately model ATL effects and evaluates challenges related to modeling HEL engagements in EADSIM. Results include discussion on EADSIM HEL weapons modeling capabilities, recommendations on general mission level characteristics that should be modeled, and appropriate measures of performance for campaign-level modeling.
DTIC
High Power Lasers; Laser Weapons; Lasers; Simulation

20040075086 Stanford Univ., Stanford, CA
Coupled Asymmetric Quantum Dot (CAD) Laser
Harris, J. S.; Solomon, G. S.; May 3, 2004; 31 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0483
Report No.(s): AD-A422937; ARO-40372.1-EL; No Copyright; Avail: CASI; A03, Hardcopy

Semiconductor solid state lasers based on conduction valence band recombination are now commonplace for low power red emission, and are available commercially at nearly continuous wavelengths throughout the near UV and near IR communications bands. Furthermore, new lasers and broadband spontaneous emission sources are available through a wide wavelength range, including 3-8 micron based on both conduction-valence band and intersubband transitions, and up to 7O micron using cascaded intersubband transitions. However, competing processes make the design of these semiconductor lasers extremely difficult when extended to the very long, 3OO micron wavelength regime corresponding to low terahertz frequencies. In this program, we have developed THz laser designs based on the intersublevel transitions in self assembled quantum dots (QDs), where the lasing occurs through discrete conduction states. In an early implementation, two QDs are coupled to make a coupled asymmetric quantum dot (CAD) laser similar to the quantum cascade laser but offering improved benefits. Unfortunately, current technological limits impede the fabrication of this device. In another scheme, an ensemble of noncoupled QDs is selectively placed in a high quality cavity, called a microdisk, which is resonant with an intersublevel QD transition. In this program, we have demonstrated the initial fabrication of this structure.
DTIC
Asymmetry; Computer Aided Design; Lasers; Quantum Dots; Quantum Well Lasers

20040075123 Air Force Research Lab., Tyndall AFB, FL
Rapid Production of Mixed-Base Hydrogen Peroxide by Direct-Contact Liquefied Nitrogen Evaporation; Process Design, Scale-Up, and Validation
Hurley, James A.; Li, Lixiong; Spears, Tim A.; Nichols, Robert K.; Owens, Hugh M.; Jan. 2004; 75 pp.; In English
Contract(s)/Grant(s): F08637-98-C-6002
Report No.(s): AD-A422994; No Copyright; Avail: CASI; A04, Hardcopy

The deployment and operation of chemically driven, directed-energy weapon systems, such as the Airborne Laser (ABL), require strategies, systems, and training that have not been demonstrated previously in the Air Force, the Department of Defense, or industry. These weapons utilize large quantities of reactive chemicals. Traditional chemical equipment and processes are heavy, large, and permanently installed in fixed facilities. From 1999 to 2002, AFRL/ MLQ researchers evaluated various blending techniques and processes for producing mixed-base hydrogen peroxide (MHP). The evaluation criteria for the production facility included deployability, setup time for production, and logistics. This report focuses on the rapid production of MHP using liquefied nitrogen.
DTIC
Evaporation; Hydrogen Peroxide; Nitrogen; Weapon Systems

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20040075012 Lawrence Livermore National Lab., Livermore, CA
Combustion in Homogeneous Charge Copression Ignition Engines: Experiments and Detailed Chemical Kinetic Simulations
Flowers, D. L.; Jun. 07, 2002; In English
Report No.(s): DE2004-15006123; UCRL-LR-148630; No Copyright; Avail: National Technical Information Service (NTIS)

Homogeneous charge compression ignition (HCCI) engines are being considered as an alternative to diesel engines. The HCCI concept involves premixing fuel and air prior to induction into the cylinder (as is done in current spark-ignition engine) then igniting the fuel-air mixture through the compression process (as is done in current diesel engines). The combustion occurring in an HCCI engine is fundamentally different from a spark-ignition or Diesel engine in that the heat release occurs as a global autoignition process, as opposed to the turbulent flame propagation or mixing controlled combustion used in current engines. The advantage of this global autoignition is that the temperatures within the cylinder are uniformly low, yielding very low emissions of oxides of nitrogen (NO(sub x), the chief precursors to photochemical smog). The inherent features of HCCI combustion allows for design of engines with efficiency comparable to, or potentially higher than, diesel engines.
NTIS
Heat Transfer; Ignition; Internal Combustion Engines; Reaction Kinetics; Spontaneous Combustion

20040075537 Florida Univ., Gainesville, FL, USA
Weight Optimization of Active Thermal Management Using a Novel Heat Pump
Lear, William E.; Sherif, S. A.; [2004]; 30 pp.; In English
Contract(s)/Grant(s): NAG3-2630; NRA-01-GRC-1; Copyright; Avail: CASI; A03, Hardcopy

Efficient lightweight power generation and thermal management are two important aspects for space applications. Weight is added to the space platforms due to the inherent weight of the onboard power generation equipment and the additional weight of the required thermal management systems. Thermal management of spacecraft relies on rejection of heat via radiation, a process that can result in large radiator mass, depending upon the heat rejection temperature. For some missions, it is advantageous to incorporate an active thermal management system, allowing the heat rejection temperature to be greater than the load temperature. This allows a reduction of radiator mass at the expense of additional system complexity. A particular type of active thermal management system is based on a thermodynamic cycle, developed by the authors, called the Solar Integrated Thermal Management and Power (SITMAP) cycle. This system has been a focus of the authors research program in the recent past (see Fig. 1). One implementation of the system requires no moving parts, which decreases the vibration level and enhances reliability. Compression of the refrigerant working fluid is accomplished in this scheme via an ejector.
Author
Management Systems; Temperature Control; Solar Generators

20040077121 NASA Ames Research Center, Moffett Field, CA, USA
Development of the Vapor Phase Catalytic Ammonia Removal Process
Flynn, Michael; Borchers, Bruce; Research and Technology 1999; December 2000, pp. 155-156; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames Research Center (ARC) has recently completed the development and testing of a prototype Vapor Phase Catalytic Ammonia Removal (VPCAR) system that represents the next generation in spaceflight water recovery systems. Water is the single largest resupply requirement associated with human spaceflight, accounting for 87% by mass of an astronaut s daily metabolic requirement. The VPCAR system achieves a mass metric almost an order of magnitude better than the current state-of-the-art water processors. (Mass metric is a technique used to reduce all performance parameters into launch mass.) Incorporating the VPCAR technology into human spaceflight missions could potentially save hundreds of millions of dollars in resupply costs, depending on the specific mission scenario. As a result, a human-rated version of the VPCAR technology has been authorized for development, and when completed it will be used for human testing in a closed chamber. The VPCAR process is a two-step distillation-based water processor. The current configuration of the technology is shown. The VPCAR process is characterized by the use of a wiped-film rotating-disk vacuum evaporator to volatilize water, small molecular weight organics, and ammonia. This vapor stream is then oxidized in a vapor phase catalytic reactor to destroy any contaminants. The VPCAR process uses two catalytic beds to oxidize contaminants and decompose any nitrous oxide (N2O) produced in the first bed. The first catalytic bed oxidizes organics to carbon dioxide (CO2) and water, and ammonia to N2O and water. This oxidation reactor contains 1% platinum on alumina pellets and operates at about 523 kelvin (K). The second catalytic bed reduces the N2O to nitrogen and oxygen. This reduction catalyst contains 0.5% ruthenium on alumina pellets and operates at about 723 K. The reactor and distillation functions occur in a single modular process step, no scheduled maintenance is required, and the system has no resupply requirements. The process achieves between 97 and 98% water recovery. The VPCAR activity is significant because it represents the development of the next generation of life support water recovery technology. It also shows how the research and development capabilities of one NASA center can be integrated into the operational requirements of another NASA center to reduce the cost of human spaceflight programs. Ames has been involved from the first principle definition to the model development, bench-scale and lab-scale prototype development, and contract

management of the development of a human-rated version of the technology for transfer to a NASA spaceflight center. Johnson Space Center will develop the final spaceflight version.
Derived from text
Ammonia; Catalysts; Prototypes; Vapor Phases; Systems Engineering; Water Reclamation

20040077165 NASA Ames Research Center, Moffett Field, CA, USA
Solid-State Compressors for Mars ISRU
Finn, John; Mulloth, Lila; Borchers, Bruce; Research and Technology 1999; December 2000, pp. 150-151; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

One important way to extend the science and exploration capabilities of Mars surface missions is to use the readily available Mars atmosphere as a resource to provide critical supplies that would otherwise limit the mission or make it too expensive. Compressed and purified gases, oxygen, important chemicals, and even rover and rocket fuel can be manufactured largely from Martian atmospheric gases, saving the costs of their transport from Earth and ensuring that a mission doesn't end when it runs out of gas. These techniques are examples of a popular mission strategy that is generally termed in situ resource utilization, or ISRU. The Mars atmosphere consists mostly of carbon dioxide, with relatively small amounts of nitrogen and other gases. At about 0.7 kiloPascals (0.1 pounds per square inch) total pressure, the mixed gases are too thin to be useful directly, so the atmospheric constituents must be separated from each other and compressed. Ames Research Center (ARC) is developing solid-state adsorption compression and separation technology to acquire the Mars atmospheric constituents and make them available for downstream processing or direct use.
Derived from text
Compressors; In Situ Resource Utilization; Mars Surface; Solid State

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20040075550 National Inst. of Standards and Technology, Gaithersburg, MD, USA
ISO 9000: Questions and Answers on Quality, the ISO 9000 Standard Series, Quality System Registration, and Related Issues
Breitenberg, Maureen; April 1993; 64 pp.; In English
Report No.(s): NISTIR-4721; No Copyright; Avail: CASI; A04, Hardcopy

This report provides information on the development, content and application of the ISO 9000 standards ISO 9000 standards; quality system approval/registration; European Community requirements for quality to readers who are unfamiliar with these aspects of the standards. It attempts to answer some of the most commonly asked questions on quality; quality systems; the content, application and revision of the system approval/registration; and sources for additional help.
Author
Quality Control; Assessments

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*.

20040074351 NASA Glenn Research Center, Cleveland, OH, USA
Probabilistic Aeroelastic Analysis of Turbomachinery Components
Reddy, T. S. R.; Mital, S. K.; Stefko, G. L.; May 2004; 28 pp.; In English
Contract(s)/Grant(s): WBS 781-30-10
Report No.(s): NASA/TM-2004-213063; E-14528; No Copyright; Avail: CASI; A03, Hardcopy

A probabilistic approach is described for aeroelastic analysis of turbomachinery blade rows. Blade rows with subsonic flow and blade rows with supersonic flow with subsonic leading edge are considered. To demonstrate the probabilistic approach, the flutter frequency, damping and forced response of a blade row representing a compressor geometry is

considered. The analysis accounts for uncertainties in structural and aerodynamic design variables. The results are presented in the form of probabilistic density function (PDF) and sensitivity factors. For subsonic flow cascade, comparisons are also made with different probabilistic distributions, probabilistic methods, and Monte-Carlo simulation. The approach shows that the probabilistic approach provides a more realistic and systematic way to assess the effect of uncertainties in design variables on the aeroelastic instabilities and response.
Author
Aeroelasticity; Turbomachinery; Structural Design; Design Analysis

20040075196 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Making the Business Case for Sustainable Design in the Department of Defense
Warnke, David M.; Mar. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423102; AFIT/GEM/ENV/04M-20; No Copyright; Avail: CASI; A06, Hardcopy

Buildings are one of the largest consumers of natural resources, a major source of ecological pollution, and occasionally toxic to human health. Sustainable design is the common term associated with buildings which, during their construction, use, and eventual disposal, seek to minimize their negative impact on the environment and human health. The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system helps to assess a building's sustainability level. In the Federal Government's push to set the example for the rest of the nation, nearly every Federal Agency has chosen to adopt the LEED assessment tool. Each of the Armed Services in the Department of Defense (DoD) has set ambitious LEED certification goals. Despite their stated goals and the clear environmental and health benefits of LEED, a common concern is that LEED-designed buildings are simply too costly to construct. However, many proponents profess that LEED-designed buildings shouldn't cost significantly more than conventionally designed and constructed buildings and that the operational life-cycle cost savings rapidly compensate for any additional initial costs. Unfortunately, no comprehensive studies on initial construction costs have been performed in the DoD. Therefore, it continues to be the primary source of unit-level resistance to LEED and sustainable design. This research gathered historical cost data from 22 completed Federal construction projects and used statistical analysis to explore whether a business case could be made to support LEED using initial construction costs in the DoD. Results from the analysis were mixed. Hypothesis testing deemed there was no statistical difference in cost between LEED and conventionally designed facility construction. While on average LEED buildings were only 1.9% more expensive to construct than conventional facilities, the 9. 2% standard deviation made it difficult to make a favorable business case. (94 refs.)
DTIC
Commerce; Construction; Cost Analysis; Cost Effectiveness; Defense Program; Design to Cost

20040075546 NASA Langley Research Center, Hampton, VA, USA
Toward Effective Shell Modeling of Wrinkled Thin-Film Membranes Exhibiting Stress Concentrations
Tessler, Alexander; Sleight, David W.; [2004]; 14 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-755-06-00
Report No.(s): AIAA Paper 2004-1739; No Copyright; Avail: CASI; A03, Hardcopy

Geometrically nonlinear shell finite element analysis has recently been applied to solar-sail membrane problems in order to model the out-of-plane deformations due to structural wrinkling. Whereas certain problems lend themselves to achieving converged nonlinear solutions that compare favorably with experimental observations, solutions to tensioned membranes exhibiting high stress concentrations have been difficult to obtain even with the best nonlinear finite element codes and advanced shell element technology. In this paper, two numerical studies are presented that pave the way to improving the modeling of this class of nonlinear problems. The studies address the issues of mesh refinement and stress-concentration alleviation, and the effects of these modeling strategies on the ability to attain converged nonlinear deformations due to wrinkling. The numerical studies demonstrate that excessive mesh refinement in the regions of stress concentration may be disadvantageous to achieving wrinkled equilibrium states, causing the nonlinear solution to lock in the membrane response mode, while totally discarding the very low-energy bending response that is necessary to cause wrinkling deformation patterns. An element-level, strain-energy density criterion is suggested for facilitating automated, adaptive mesh refinements specifically aimed at the modeling of thin-film membranes undergoing wrinkling deformations.
Author
Stress Concentration; Solar Sails; Finite Element Method; Thin Films; Wrinkling; Deformation

20040077039 NASA Langley Research Center, Hampton, VA, USA

Shell Buckling Design Criteria Based on Manufacturing Imperfection Signatures

Hilburger, Mark W.; Nemeth, Michael P.; Starnes, James H., Jr.; May 2004; 25 pp.; In English; 42nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, April 2003, Norfolk, VA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WU 23-719-20-30

Report No.(s): NASA/TM-2004-212659; L-19007; No Copyright; Avail: CASI; A03, Hardcopy

An analysis-based approach .for developing shell-buckling design criteria for laminated-composite cylindrical shells that accurately accounts for the effects of initial geometric imperfections is presented. With this approach, measured initial geometric imperfection data from six graphite-epoxy shells are used to determine a manufacturing-process-specific imperfection signature for these shells. This imperfection signature is then used as input into nonlinear finite-element analyses. The imperfection signature represents a "first-approximation" mean imperfection shape that is suitable for developing preliminary-design data. Comparisons of test data and analytical results obtained by using several different imperfection shapes are presented for selected shells. Overall, the results indicate that the analysis-based approach presented for developing reliable preliminary-design criteria has the potential to provide improved, less conservative buckling-load estimates, and to reduce the weight and cost of developing buckling-resistant shell structures.

Author

Cylindrical Shells; Buckling; Composite Structures; Graphite-Epoxy Composites; Shells (Structural Forms); Laminates; Signatures; Design Analysis

20040077159 NASA Ames Research Center, Moffett Field, CA, USA

Plasticity and Kinky Chemistry of Carbon Nanotubes

Srivastava, Deepak; Dzegilenko, Fedor; Research and Technology 1999; December 2000, pp. 58-59; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Since their discovery in 1991, carbon nanotubes have been the subject of intense research interest based on early predictions of their unique mechanical, electronic, and chemical properties. Materials with the predicted unique properties of carbon nanotubes are of great interest for use in future generations of aerospace vehicles. For their structural properties, carbon nanotubes could be used as reinforcing fibers in ultralight multifunctional composites. For their electronic properties, carbon nanotubes offer the potential of very high-speed, low-power computing elements, high-density data storage, and unique sensors. In a continuing effort to model and predict the properties of carbon nanotubes, Ames accomplished three significant results during FY99. First, accurate values of the nanomechanics and plasticity of carbon nanotubes based on quantum molecular dynamics simulations were computed. Second, the concept of mechanical deformation catalyzed-kinky-chemistry as a means to control local chemistry of nanotubes was discovered. Third, the ease of nano-indentation of silicon surfaces with carbon nanotubes was established. The elastic response and plastic failure mechanisms of single-wall nanotubes were investigated by means of quantum molecular dynamics simulations.

Derived from text

Carbon Nanotubes; Chemical Properties; Mechanical Properties; Molecular Dynamics; Quantum Mechanics

20040077161 NASA Ames Research Center, Moffett Field, CA, USA

Characterization of Carbon Nanotubes under Deformation

Jaffe, Richard L.; Yang, Liu; Han, Jie; Anantram, M. P.; Research and Technology 1999; December 2000, pp. 60-61; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ongoing nanotechnology research at Ames Research Center is aimed at developing revolutionary small-scale electronic devices and sensors to meet the requirements of future NASA missions. Carbon Nanotubes (CNT) are hollow cylinders of graphitic carbon atoms; the cylinders have diameters of approximately 0.001 microns and lengths of up to several microns (more than 100 times smaller than the components of today's microprocessors). Depending on the orientation of the hexagonal carbon rings in the tube surface, some CNTs have metallic properties (that is, the band gap is zero) and others are semiconductors (that is, the band gap is finite, but less than 1 electron volt). Because of their varying electronic properties and very small size, CNT components are expected to have an important role in the development of future electronic devices. In addition, CNTs have extraordinarily large tensile modulus and tensile strength, which places them among the strongest materials known. These attributes make them promising candidates for reinforcing fibers and for microelectronic-mechanical sensors (MEMS). Single-CNT transistors have been fabricated and tested under ideal laboratory conditions, but it is not known whether they will function under typical operating conditions of integrated circuits. Previously, modeling studies were carried out to characterize idealized CNT electronic devices. This year, research focused on characterizing electronic devices and

sensors under realistic operating conditions where the CNTs are bent, flattened, and twisted by their interactions with substrates, metal contacts, and other devices.
Derived from text
Carbon Nanotubes; Deformation; Nanotechnology; Microelectronics; Characterization

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20040076944 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ocean Carbon Flux, Transport, and Burial Within the Western and Eastern US Coastal Zones
McWilliams, James C.; Moisan, John R.; Haidvogel, Dale B.; Miller, Arthur J.; Cornuelle, Bruce; Stolzenbach, Keith D.; [2004]; 22 pp.; In English
Contract(s)/Grant(s): NRA-99-OES-04; NAG5-9860; No Copyright; Avail: CASI; A03, Hardcopy

This project has been to develop and apply a regional. eddy-resolving circulation and biogeochemistry model of both the western and eastern U.S. coastal regions, capable of simulating the processes that control the carbon cycle. Validation has been by statistical comparison with analyses from various satellite measurements, including those from EOS sensors, as well as from in situ measurements. Sensitivity studies were carried out to investigate how the coastal ecosystem and biogeochemical cycles respond to changes in climate, large-scale eutrophication from indus- trial pollution, and other anthropogenic induced changes. The research has been conducted in collaboration with research groups at UCLA. NASA/GSFC (Wallops), Rutgers, and SIO. Overall. the project was focused on several key modeling issues, each of which tie back into completing the primary task of developing a coastal carbon model for both the eastern and western US. coasts. Individual groups within the entire program are still collaborating to address these specific tasks. These include: implementation of the coupled circulation/ biogeochemical model within the U.S. West Coast. including high-resolution, embedded subdomains for the Southern California Bight and Monterey Bay region; development of a biogeochemical model with resolved carbon, nitrogen and oxygen cycles; development of data assimilation techniques for use of satellite data sets; reconfiguration of the model domain to U.S. East Coast; development of coastal forcing fields: development of methods to compare the model against remotely sensed data; and, the test of model sensitivity to environmental conditions. Below, we present a summary of the progress made toward achieving these soak. Because this has been a multi-institutional, collaborative effort, we note the groups involved with particular activities.
Author
Biogeochemistry; Carbon Cycle; Environment Effects; Ecosystems; Simulation; Man Environment Interactions

20040077096 NASA Ames Research Center, Moffett Field, CA, USA
Evolutionary Relationships of Stromatolite-Building Cyanobacteria
Jahnke, Linda; Cullings, Kenneth; Vogler, Detlev; Klein, Harold P.; Research and Technology 1999; December 2000, pp. 94; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Stromatolites are one of the most abundant fossils in Precambrian rocks, and as such, provide valuable information about Earth s earliest biosphere. The microfossil record in stromatolites traces Earth's history since the oldest life over 3.5 billion years ago. Modern stromatolite structures are formed by sediment trapping and/or mineral precipitation of microbial mat communities living in shallow-water environments. Microbial mats are living stromatolites-modern-day analogs that provide an opportunity to study the way ancient microbial communities lived and evolved. Though direct evidence is lacking, fossil stromatolite diversity appears to be under the direct influence of microbial species diversity. Most modern microbial mats are constructed by cyanobacteria, but this may not have been the case for the earliest fossil stromatolites. Oxygenic photosynthesis first evolved in the cyanobacteria, so understanding the relationship between cyanobacterial and stromatolite morphology is crucial to determining the biotype of these early stromatolites and the timing of this crucial evolutionary event. This study focuses on a type of modern coniform stromatolite constructed in the thermal springs of Yellowstone National Park by a fine filamentous cyanobacterium called Phormidium. These mats are considered the best analog for the fossil conophytons that are one of the most distinctive groups of Precambrian stromatolites, with a fossil record dating back to 3.5 billion years. A variety of stable organic compounds, generally referred to as chemical fossils or biomarkers, have been extracted from these coniform mats, in particular the 2-methylhopanoids. The 2-methylhopanoids are considered a biomarker for the cyanobacteria, and detection of its fossil equivalent in 2.7-billion-year-old sedimentary rocks has established a minimum age for the evolution

of oxygenic photosynthesis. Understanding the relationships among the source of this important biomarker, stromatolite morphology, and cyanobacterial biodiversity provides essential clues in deciphering the identity of the original mat-building community and establishing the antiquity of Phormidium conophyton stromatolites.
Derived from text
Fossils; Precambrian Period; Sedimentary Rocks; Bacteria; Biomarkers; Geochronology

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20040074339 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stratospheric Water Vapor and the Asian Monsoon: An Adjoint Model Investigation
Olsen, Mark A.; Andrews, Arlyn E.; [2003]; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A new adjoint model of the Goddard Parameterized Chemistry and Transport Model is used to investigate the role that the Asian monsoon plays in transporting water to the stratosphere. The adjoint model provides a unique perspective compared to non-diffusive and non-mixing Lagrangian trajectory analysis. The quantity of water vapor transported from the monsoon and the pathways into the stratosphere are examined. The emphasis is on the amount of water originating from the monsoon that contributes to the tropical tape recorder signal. The cross-tropopause flux of water from the monsoon to the midlatitude lower stratosphere will also be discussed.
Author
Asia; Monsoons; Stratosphere; Water Vapor; Adjoints; Mathematical Models

20040074381 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust Emissions, Transport, and Deposition Simulated with the NASA Finite-Volume General Circulation Model
Colarco, Peter; daSilva, Arlindo; Ginoux, Paul; Chin, Mian; Lin, S.-J.; [2003]; 1 pp.; In English; Fall AGU 2003 Conference, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Mineral dust aerosols have radiative impacts on Earth's atmosphere, have been implicated in local and regional air quality issues, and have been identified as vectors for transporting disease pathogens and bringing mineral nutrients to terrestrial and oceanic ecosystems. We present for the first time dust simulations using online transport and meteorological analysis in the NASA Finite-Volume General Circulation Model (FVGCM). Our dust formulation follows the formulation in the offline Georgia Institute of Technology-Goddard Global Ozone Chemistry Aerosol Radiation and Transport Model (GOCART) using a topographical source for dust emissions. We compare results of the FVGCM simulations with GOCART, as well as with in situ and remotely sensed observations. Additionally, we estimate budgets of dust emission and transport into various regions.
Author
Dust; Finite Volume Method; Simulation; Atmospheric General Circulation Models; NASA Programs; Pollution Transport; Exhaust Emission

20040074382 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Estimation of the Anthropogenic Influence in the Sahel by Terra and Aqua
Koren, I.; Kaufman, Y. J.; Remer, L. A.; [2003]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Saharan dust impacts the Earth radiation balance. It was suggested that anywhere between 20-50% of the dust is anthropogenic, generated from human activity in the Sahel. Recent study By Prospero et al noticed that most of the sources should be north of Latitude of 15 deg. where population density is small. Here we use Aqua and Terra data to study the dust sources and their possible anthropogenic origin. Dust packages emitted from the Bodele depression and other sources in the southern part of the Sahara, are transported in the winter by a Northern East winds over the Sahel to the ocean. We are tracking these packages with MODIS from their sources to the ocean, showing that most of the dust reaching the Ocean from the Sahelian shore is generated in the Sahara, suggesting that the anthropogenic influence in the area is negligible. Saharan dust was suggested to be the main source of nutrients to the Amazon forest. Here we are also showing that these South Saharan sources around the Bodele depression are very active in the winter and rather passive in the summer, suggesting that the type

of dust reaching Brazil, and its mineral content from these sources may be different from the dust that arrives to North America and Europe emitted in the summer from different sources.
Author
Sahara Desert (Africa); Dust; Terra Spacecraft; MODIS (Radiometry); Human Beings

20040075039 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Geopositional Accuracy Assessment of EarthSat GeoCover Landsat Orthorectified Imagery
Zanoni, Vicki; Pagnutti, Mary; Smith, Charles; October 31, 2003; 1 pp.; In English; American Society of Photogrammetry and remote Sensing Annual Conference, 23-28 May 2004, Denver, CO, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-10-00098-SSC; No Copyright; Avail: Other Sources; Abstract Only

NASA purchased Earth Satellite Corporation (EarthSat) GeoCover orthorectified Landsat imagery of global land areas. The Landsat imagery covers three distinct time frames and is valuable to land cover change research. Since geopositional accuracy plays a critical role in this area of science research, NASA performed an independent assessment of the geopositional accuracy of each EarthSat dataset using an independent set of government provided ground control points. These points consisted of features identifiable within the 28.5 meter resolution TM imagery whose locations were accurately known.
Author (revised)
Satellite Imagery; Accuracy

20040075536 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atmospheric Soundings from AIRS/AMSU/HSB
Susskind, Joel; Atlas, Robert; 2003; 1 pp.; In English; AGU Fall Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

AIRS was launched on EOS Aqua on May 5, 2002, together with AMSU A and HSB, to form a next generation polar orbiting infrared and microwave atmospheric sounding system. The primary products of AIRS/AMSU/HSB are twice daily global fields of atmospheric temperature-humidity profiles, ozone profiles, sea/land surface skin temperature, and cloud related parameters including OLR. The sounding goals of AIRS are to produce 1 km tropospheric layer mean temperatures with an RMS error of 1K, and 1 km layer precipitable water with an rms error of 1K, and 1 km layer precipitable water with an rms error of 20 percent, in cases with up to 80 percent cloud cover. The AIRS data products are significant for studying climate variability and change, as well as for use in initialization of General Circulation Models with the objective of improving analysis fields and subsequent forecast skill. Data assimilation experiments to evaluate the impact of AIRS retrievals on analysis and forecast skill are being conducted. Sample fields of parameters retrieved from AIRS/AMSU/HSB data will be presented and validated as a function of retrieved fractional cloud cover. Select fields will also be compared to those contained in the ECMWF analysis, done without the benefit of AIRS data, on both an instantaneous and monthly mean basis, to demonstrate information that AIRS can add to that already contained in the ECMWF analysis.
Author
Atmospheric Sounding; Satellite-Borne Instruments; Earth Observing System (Eos); Advanced Microwave Sounding Unit

20040075601 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
The Relationship Between Optimal Post Density Spacing and Flood Model Performance
Davis, Bruce A.; Berglund, Judith; Estepp, Leland; Hodgson, Michael; Raber, George; Tullis, Jason; Maidment, David; Gueudet, Pierre; Fisher, Verlin, et al.; October 20, 2003; 36 pp.; In English; Terrain Data: Applications and Visualization: Making the Connection, 27-30 Oct. 2003, Charleston, SC, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-10-00095-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The object of the LIDAR Post Spacing Study is to determine the optimal post density/spacing of LIDAR data that is required to accurately represent a topographic surface and its effect on hydrologic and hydraulic modeling results for improved floodplain mapping. This viewgraph presentation will provide an overview of the project research methodology. There are two study areas in North Carolina, and one in Brownsville, Texas. The two North Carolina areas vary in terrain, land cover, and land use. The study area in Texas in on a coastal plain and very flat.
Derived from text
Flood Plains; Optical Radar; Digital Elevation Models

20040075795 NASA Ames Research Center, Moffett Field, CA, USA
Remote-Sensing Data in Estimating Inputs to Ecosystem Models
Coughlan, Joseph; Dungan, Jennifer; Research and Technology 1997; September 1998, pp. 151-154; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

To better understand carbon cycling in forest ecosystems, several process-based ecosystem models have been developed. The forest leaf-area index (LAI) and other variables describing plant biomass are necessary to run these models. The only feasible means of estimating these forest variables for spatial extents of tens of meters and larger depend on remote-sensing instruments. In the past, reflectance index measurements based on optical remote-sensing data have been used to estimate LAI. This work involves developing algorithms for combining remote-sensing data in the microwave and optical regions of the electromagnetic spectrum (1) to increase the accuracy of LA1 estimates, as well as the estimates of other variables; and (2) to extend the range of validity of LA1 estimates beyond that achieved from optical data alone.
Author
Remote Sensing; Environment Models; Ecosystems

20040075800 NASA Ames Research Center, Moffett Field, CA, USA
CRUSH Project
Johnson, Lee F.; Lobitz, Brad; Research and Technology 1997; September 1998, pp. 155; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Ames Research Center, together with the Robert Mondavi Winery (Oakville, California) and Terra Spase Vineyard Consulting (Napa, California), is evaluating the use of geospatial technology (remote- sensing, geographic information systems) in a precision agriculture context. In the Canopy Remote-Sensing for Uniformly Segmented Harvest (CRUSH) project, high-spatial resolution multispectral images were collected at midseason 1997 with an airborne ADAR-5500 digital camera system. In a technology demonstration, an image of a processed to a Normalized Difference Vegetation Index to improve sensitivity to grapevine canopy density. The Index values were then stratified and color-coded for visual discrimination. A georegistered output image was delivered to the winery for input to the grower's geographic information system. NASA and winery researchers field-sampled vines within the study block for canopy density (light interception), vine physiology (leaf-water potential, chlorophyll concentration), fruit characteristics (maturity, potential quality), and yield. The grower used a laptop computer with image display and onboard Gloha! Positioning System to physically subdivide (with flagging tape) the study block for harvest based on vine vigor (high, medium, and low). Grapes from each field segment were fermented separately and the resulting wines were formally evaluated by the winery.
Author
Remote Sensing; Satellite Imagery; Agriculture

20040075803 NASA Ames Research Center, Moffett Field, CA, USA
Modeling Leaf and Canopy Reflectance
Johnson, Lee F.; Hlavka, Christine A.; Research and Technology 1997; September 1998, pp. 155-156; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The goals of this project are to build a leaf reflectance model (LEAFMOD! that incorporates the absorbance properties of biological chemical components, to test the validity of the model, and to evaluate the sensitivity ot canopy reflectance to changes in leaf chemical composition by coupling the leaf model to a canopy model. This research will contribute to a better understanding oi the radiative transfer processes of plant canopies and will be useful in interpreting remote-sensing data, that is, images from airborne and satellite platforms, used for ecological and biogeochemical research. The results should be useful in determining the minimum sensing requirements for future high-spectral-resolution instruments. The LEAFMOD computer simulation program was developed to run in two modes: (1) a forward mode that simulates leaf reflectance and transmittance given the optical properties oi the leaf material, and (2) an inverse mode that computes the optical properties given reflectance and transmittance by finding values that reproduce the observed reilectance and transmittance in forward mode.
Derived from text
Remote Sensing; Spectral Reflectance; Leaves

20040077045 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Contribution of TOMS to Earth Science- An Overview
Bhartia, P. K.; [2004]; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Fransico, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The TOMS instrument was launched on the Nimbus-7 satellite in Oct 1978 with the goal of understanding the meteorological influences on the ozone column. The nominal lifetime of the instrument was 1 year. However, in response to the concern over possible man-made influences on the ozone layer NASA continued to nurse the instrument for 13.5 years and launched a major program to produce accurate trend quality dataset of ozone. Despite severe optical degradation and other significant anomalies that developed in the instrument over its lifetime, the effort turned out to be a tremendous success. In 1984, TOMS took center stage as the primary provider of Antarctic ozone hole maps to the world community; it continues to play that role until today. An unexpected benefit of the close attention paid to improving the TOMS data quality was that several atmospheric constituents that interfere with ozone measurement were also identified and meticulously converted into long-term datasets of their own. These constituents include clouds, volcanic S02, aerosols, and ocean phytoplankton. In addition, the high quality of the basic datasets made it possible to produce global maps of surface UV and tropospheric ozone. In most cases there are no other sources of these data sets. Advanced UV instruments currently under development in the US and Europe will continue to exploit the TOMS-developed techniques for several decades.
Author
Total Ozone Mapping Spectrometer; Ozone Depletion; Earth Sciences; Atmospheric Composition; Remote Sensing

20040077069 NASA Ames Research Center, Moffett Field, CA, USA
Modeling Leaf and Canopy Reflectance
Johnson, Lee; Hlavka, Christine; Research and Technology 1999; December 2000, pp. 171; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Leaf/canopy model simulations and measured data were used to derive information on the form and strength of the nitrogen (N) "signal" in near-infrared (1100-2500 nanometer (nm)) spectra of fresh leaves. Simulations across multiple species indicated that in total, protein absorption decreased near-infrared reflectance and transmittance by up to 1.8% and 3.7% respectively, and all other inputs held constant. Associated changes in spectral slope were generally in the range of plus or minus 0.02% per nanometer. Spectral effects were about an order of magnitude more subtle for a smaller, though potentially ecologically significant, change in N concentration of 0.5% over measured. Nitrogen influence on spectral slope was fairly consistent across four empirical data sets as judged by wavelength dependence of N correlation. The observed and simulated data showed similar trends in sensitivity to N variation. Further, these trends were in reasonable agreement with locations of absorption by protein-related organic molecules. improved understanding of the form and strength of the N signal under differing conditions may allow development of reasonably robust spectral measurement and analysis techniques for "direct" (based strictly upon N-related absorption features) N estimation in fresh leaves. A pragmatic approach for remote sensing might additionally consider surrogate measures such as chlorophyll concentration or canopy biophysical properties.
Derived from text
Leaves; Remote Sensing; Canopies; Reflectance; Biophysics; Mathematical Models

20040077117 NASA Ames Research Center, Moffett Field, CA, USA
Quantifying Denitrification and Its Effect on Ozone Recovery
Tabazadeh, Azadeh; Research and Technology 1999; December 2000, pp. 188-189; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Upper Atmospheric Research Satellite (UARS) observations indicate that denitrification occurs in the Antarctic, without significant dehydration, during mid to late June. In contrast, UARS data show no indication for the presence of large-scale denitrification in the Arctic, even during the coldest winters of the last decade. The fact that denitrification occurs in the Antarctic in a relatively warm month raises concern about the possibility for the occurrence of this event in a future colder, and possibly more humid, lower stratosphere, as a result of climate change and/or natural variability, and its subsequent effect on ozone recovery. Polar stratospheric cloud (PSC) lifetimes required for Arctic denitrification to occur in the future were contrasted against the current Antarctic cloud lifetimes during early and mid to late June. Ozone sensitivity calculations show that widespread denitrification can enhance future Arctic ozone loss by about 40% during the coldest winters of the next century. It is well known that PSCs play an important role in the formation of the springtime Antarctic "ozone hole" by activating chlorine and denitrifying the stratosphere. Because similar levels of active chlorine concentrations have been measured in both polar vortices, the lack of extensive denitrification observed in the Arctic has been speculated to be one of the main factors currently preventing the formation of an Arctic "ozone hole." At Ames, and for the first time, a quantitative study was done on the denitrification process that explains why this event currently occurs extensively in

the Antarctic and not the Arctic, using data obtained from numerous different instruments onboard the UARS.
Derived from text
Denitrogenation; Ozone; Polar Meteorology; Arctic Regions; Earth Sciences; Stratosphere

20040077119 NASA Ames Research Center, Moffett Field, CA, USA
Uncertainty and Validity of Aerosol Radiative Forcing Determinations
Pilewskie, Peter; Gore, Warren; Pezzolo, Larry; Research and Technology 1999; December 2000, pp. 191; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In February and March 1999, Ames participated in the Electro Optical Propagation around Coastal Environments (EOPACE) experiment in Duck, North Carolina, to characterize the radiative effects of boundary layer marine aerosol near the Outer Banks region of the coast of North Carolina. The NASA Ames solar spectral flux radiometer (SSFR) was integrated on the Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS) Twin Otter to measure zenith irradiance and nadir radiance. Data have been used to characterize the sea surface reflectance in a coastal region and to compare with open ocean reflectance for purposes of improving aerosol optical depth retrievals from the advanced very-high-resolution radiometer (AVHRR) satellite instrument. The Twin Otter was also equipped with microphysical sensors to measure the extinction of the aerosol. The study determined the net solar radiative forcing of the aerosol and examined dependencies of radiative parameters on wind speed and surface roughness. This research represents an important test of the previous discovery of a bias between measured and modeled spectral irradiance that is highly correlated with water vapor, and increases at a rate of 8 watts per square meter per centimeter (W/m(exp -2)/cm) of water vapor. Another aspect of this research is to modify the radiative transfer model used in a model developed at Ames to incorporate new spectral bandpasses that match that of the SSFR. The newly generated k-distributions will be compiled using the line-by-line code LBLTRM developed by Atmospheric and Environmental Research (AER). Testing began in summer 1999, and it is anticipated that the completed radiative transfer model will be operational by the first half of FY00. Analysis will be applied to the previous aerosol/water vapor study described above and to the EOPACE Duck data set. Estimates of solar spectral radiative forcing will be generated from both studies.
Derived from text
Aerosols; Radiative Heat Transfer; Earth Sciences; Marine Meteorology

20040077176 NASA Ames Research Center, Moffett Field, CA, USA
New Approaches to Using Remotely Sensed Data for Mapping Biophysical Variables
Dungan, Jennifer; Couglan, Joseph; Research and Technology 1999; December 2000, pp. 172; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Maps of biophysical variables are needed at many scales, from the field scale (for example, maps of fire risk) to the global scale (for example, maps of terrestrial biomass). In particular, biophysical variables concerning the quantity and distribution of vegetation amount are critical to many Earth Science studies. Current methods of predicting vegetation amount use remotely sensed images to provide a spatially exhaustive data source, and regression models and maximum-likelihood methods are typically used for producing maps from these images. Geostatistical approaches, which assume spatial dependence, have an untapped potential to map vegetation amount using information gained from images.
Derived from text
Remote Sensing; Biophysics; Maximum Likelihood Estimates; Vegetation; Earth Sciences

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20040074486 National Renewable Energy Lab., Golden, CO
Twelfth Workshop on Crystalline Silicon Solar Cell Materials and Processes. Extended Abstracts and Papers
Sopori, B. L.; Kalejs, J.; Aug. 2002; In English
Report No.(s): DE2004-15006541; NREL/BK-520-32717; No Copyright; Avail: National Technical Information Service (NTIS)

The 12th Workshop will provide a forum for an informal exchange of technical and scientific information between

international researchers in the photovoltaic and relevant non-photovoltaic fields. Discussions will include various aspects of impurities and defects in silicon-their properties, the dynamics during processing, and their application for developing low-cost processes for manufacturing high-efficiency silicon solar cells. The workshop will emphasize some of the promising new technologies in Si solar cell fabrication that can lower PV energy costs and meet the production demands of the future. It will also provide an excellent opportunity for researchers, in private industry and at universities, to prioritize mutual needs for future collaborative research. Sessions and panel discussions will review recent advances in crystal growth, new cell structures, new processes and process characterization techniques, and manufacturing approaches suitable for future manufacturing demands. Some presentations will address recent technologies in the microelectronics field that may have a direct bearing on PV. The three-day workshop will consist of presentations by invited speakers, followed by discussion sessions. In addition, there will be two poster sessions presenting the latest research and development results.
NTIS
Solar Cells; Crystallinity; Fabrication

20040075053 Michigan Univ., Ann Arbor, MI
Electronically Integrated Active Compliant Transmission (ACT) Actuation Technologies Proof-of-Concept Investigation of Active Velcro for Smart Attachment Mechanisms
Brei, Diann; Lindner, Douglas; Frecker, Mary; LaVigna, Chris; Clement, Joe; Dec. 2003; 99 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0441
Report No.(s): AD-A422431; F003271; ARO-41377.1-EG; No Copyright; Avail: CASI; A05, Hardcopy

This report provides a summary of the motivation, methodology and research results for two different projects supported under this effort. In Electrically integrated active compliant transmission (ACT) Actuation Technologies two different actuation approaches were developed, modeled, fabricated and experimentally validated: 1) a d31-approach based on the Recurve architecture that generates higher forces and 2) a d33-approach based upon a compliant mechanism that provides more amplified strain. A first-generation power amplifier was designed that efficiently swaps energy allowing low voltage batteries to produce high voltage drive signals. Both piezoceramic actuation systems were integrated into the INertially STAbilized Rifle (INSTAR) to eliminate aiming errors by stabilizing the barrel assembly providing a significant advancement in small arms. In the second project, Proof-of-Concept Investigation of Active Velcro Autonomous Docking of Micro- and Nano-Satellites, a new connection methodology, Smart Attachment Mechanism (SAM) technology, was invented, modeled and experimentally characterized that possesses the ability to actively connect two surfaces (engagement, retention, release) and effect relative planar motion between them (translation, rotation). This work laid the necessary foundation for further development of this unique paradigm which is useful for any unstable environment (space, fluidic, moving, vibration, etc) where active connection and motion is simultaneously required.
DTIC
Elastic Properties; Fasteners; Proving; Systems Integration

20040075062 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Value Focused Thinking Model for the Development and Selection of Electrical Energy Source Alternatives at Military Installations
Schanding, Gregory T.; Mar. 2004; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422891; AFIT/GEM/ENS/04M-02; No Copyright; Avail: CASI; A06, Hardcopy

Electrical power on military installations is vital for mission accomplishment. Most installations obtain electrical power from a local commercial utility. Although commercial power service has a very low interruption rate, the threat of a sustained power outage resulting from a terrorist act or a natural disaster is of concern. The military should posture itself to prevent such power outages and prepare to mitigate the adverse affects associated with the loss of power. This thesis presents a Value Focused Thinking approach to the development of a decision analysis model to assist a decision maker at a military installation in the generation and selection of back-up energy alternatives. The model attempts to capture the value to be gained by implementing back-up power systems which utilize fossil fuel powered generators in combination with renewable energy resources and assist the decision maker in selecting an alternative which best suits the needs of the installation. The thesis also includes a case study involving the application of this model to the USA Marine Corps installation in Twentynine Palms, California.
DTIC
Alternatives; Electricity

20040075851 Ohio Coal Research Lab. Associates, Columbus, OH, USA, Montana State Univ., Bozeman, MT, USA, Oak Ridge National Lab., TN

Enhanced Practical Photosynthetic CO2 Mitigation

Kremer, G.; Bayless, D. J.; Vis, M.; Prudich, M.; Cooksey, K.; 2002; In English

Report No.(s): DE2003-813667; No Copyright; Avail: National Technical Information Service (NTIS)

This quarterly report documents significant achievements in the Enhanced Practical Photosynthetic CO2 Mitigation project during the period from 1/3/2001 through 4/02/2002. Most of the achievements are milestones in our efforts to complete the tasks and subtasks that constitute the project objectives, and we are currently on schedule to complete Phase I activities by 10/2002, the milestone date from the original project timeline. As indicated in the list of accomplishments below, we are continuing to evaluate candidate organisms and growth surfaces, and we are expanding the test facilities in preparation for scaled up system-level testing. Specific results and accomplishments for the first quarter of 2002 include: Organisms and Growth Surfaces: (1) Isolate 1.2 s.c. (2) has been selected for further investigations because of its favorable growth properties. (2) Research on optimal conditions for the growth of cyanobacterial isolates from YNP should be carried out using distilled water which has more stable chemical parameters, although tap water use may be permissible during full scale operations (at the cost of longer organism doubling times). (3) Tr. 9.4 WF is able to generate a biofilm on an Omnisil surface. Over the long term Omnisil does not inhibit the growth of TR 9.4 isolate, though it does elongate the lag phase of growth of this isolate. (4) Initial survivability tests for the TR 9.4 organism on Omnisil screens in the CRF2 model-scale bioreactor are underway. We have experienced problems keeping the organisms alive for more than three days, but we are currently investigating several possible causes for this unexpected result. (5) Accelerated materials testing have shown that Omnisil fabric has acceptable strength properties for use in a practical bioreactor system. Bioreactor support systems and test facilities: (1) Several CO2 scrubbing experiments have been completed in the translating slug flow test system, however the error introduced by the original process for measuring CO2 concentration in the solution was so big that the resulting data was unreasonable. A new sampling method to prevent degassing of the liquid sample is being implemented, and a new set of tests has been scheduled for the week of 4/15/2002. (2) Qualitative harvesting tests of TR 9. 4 on Omnisil have been completed but the results are inconclusive. Very little harvesting effect was observed with the current harvesting system design, but the results were greatly impacted by the minimal amount of organism growth on the screens at the time of the harvesting tests. Measures are being taken to extend the colonization time to achieve a screen loading condition that represents a more realistic harvesting condition, and additional tests will be run in the near future with these screens. (3) Significant work has been completed in the design of a new up-flow bioreactor test facility, using a vertical flow as expected in practical applications as opposed to the horizontal flow used for convenience in our current CRF test systems. (4) A reasonably priced location has been selected for the pilot scale bioreactor system, and construction can now proceed in order to prepare for the installation of the solar collectors and the bioreactor.

NTIS

Carbon Dioxide Concentration; Carbon Dioxide; Biofilms; Bioreactors

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ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20040074455 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Madden-Julian Oscillation in Tropospheric Ozone

Ziemke, J. R.; Chandra, S.; January 2004; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

This is the first study to indicate a Madden-Julian Oscillation (MJO) in tropospheric ozone. Tropospheric ozone is derived using differential measurements of total column ozone and stratospheric column ozone measured from total ozone mapping spectrometer (TOMS) and microwave limb sounder (MLS) instruments. Two broad regions of significant MJO signal are identified in the tropics, one in the western Pacific and the other in the eastern Pacific. Over both regions, MJO variations in tropospheric ozone represent 5- 10 DU peak-to-peak anomalies. These variations are significant compared to mean background amounts of 20 DU or less over most of the tropical Pacific. The implications of these results are: (1) model values of TCO in the tropical Pacific region, when accounted for the MJO may be highly variable depending upon the phase of the MJO, and (2) MJO signals of this magnitude would need to be considered when investigating and interpreting particular

pollution events since ozone is a precursor of the hydroxyl (OH) radical, the main oxidizing agent of pollutants in the lower atmosphere.
Author
Atmospheric Composition; Troposphere; Ozone; Madden-Julian Oscillation; Air Pollution

20040074465 National Defence Research Establishment, Umea, Sweden
Instruments for Detection of Biological Aerosols
Waesterby, P.; Gustafson, I.; Tjaemhage, T.; Dec. 2003; In Swedish
Report No.(s): PB2004-104556; FOI-R-1096-SE; No Copyright; Avail: National Technical Information Service (NTIS)

In recent years there have been two periods of accelerated development of biological agent detection. The first started in 1991 when coalition forces faced the threat of being attacked with biological warfare agents. The second is today, after incidents of the Anthrax letters. These efforts have resulted in several detectors that are user friendly and designed for active service. The report describes methods and techniques used for detection of biological warfare agents. Several instruments are also described. The information is based on specifications from the manufacturers or retail dealers, and in some cases articles and reports. A ranking has not been done neither in the selection of instruments to be presented in the report nor among the instruments within the report.
NTIS
Aerosols; Biological Effects

20040074469 Office of Air Quality Planning and Standards, Research Triangle Park, NC
National Air Quality and Emission Trends Report 2003 Special Studies Edition
Elkins, J.; Hemby, J.; Rao, V.; Szykman, J.; Fitz-Simons, T.; Sep. 2003; In English
Report No.(s): PB2004-104010; EPA/454/R-03-008; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents national trends in air quality for ozone, particulate matter, nitrogen dioxide, carbon monoxide, lead and sulfur dioxide for 10 and 20 year periods. In addition to air quality trends from data collected at monitoring stations across the country, trends in nationwide emissions are also presented. This report also includes a special studies section including reports on chemical speciation including the urban increment, impact of the Asian dust storm, cumulative ozone exceedances, characterization of national spatial variation, and a new reporting technique.
NTIS
Ozone; Spatial Distribution

20040074470 Environmental Protection Agency, Research Triangle Park, NC
Guidance for Tracking Progress Under the Regional Haze Rule
Sep. 2003; In English
Report No.(s): PB2004-103531; EPA-454/B-03-004; No Copyright; Avail: National Technical Information Service (NTIS)

Regional haze is visibility impairment caused by the cumulative air pollutant emissions from numerous sources over a wide geographic area. Visibility impairment is caused by particles and gases in the atmosphere. Some particles and gases scatter light while others absorb light. The net effect is called 'light extinction'. The result of these processes is a reduction of the amount of light from a scene that is returned to the observer, as well as an addition of scattered light to the sight path, creating a hazy condition. This document provides guidance to EPA Regional, State, and Tribal air quality management authorities and the general public, on how EPA intends to exercise its discretion in implementing Clean Air Act provisions and EPA regulations, concerning the tracking of progress under the regional haze program. The guidance is designed to implement national policy on these issues.
NTIS
Haze; Visual Perception

20040074482 National Renewable Energy Lab., Golden, CO
Biomass Power and Conventional Fossil Systems with and without CO2 Sequestration-Comparing the Energy Balance, Greenhouse Gas Emissions and Economics
Smith, P. L.; Mann, M. K.; Jan. 2004; In English
Report No.(s): DE2004-15006537; NREL/TP-510-32575; No Copyright; Avail: National Technical Information Service (NTIS)

Lifecycle analysis of coal-, natural gas- and biomass-based power generation systems with and without CO2

sequestration. Compares global warming potential and energy balance of these systems.
NTIS
Carbon Dioxide; Biomass; Exhaust Gases; Greenhouse Effect

20040074494 Minerals Management Service, New Orleans, LA
Air Quality: User's Guide for the Gulfwide Offshore Activities Data System (GOADS)
2001; 98 pp.; In English
Report No.(s): PB2004-105779; OCS-MMS-2001-052; No Copyright; Avail: CASI; A05, Hardcopy

Contents include the following: Introduction (Principles of use and system requirements, Installation); Using the Gulfwide Offshore Activities Data System (GOADS) (Starting and exiting GOADS, Creating and Editing Data, Quality control tests, Saving and backing up work, Setting status of facilities and equipment, Finding help and extra information); UPON Survey Completion (How, when, and where to deliver data files, Failed quality control tests, QA Summary form); Appendix A: Help Text Files, Appendix B: GOADS QA Summary form data fields.
NTIS
Quality Control; Data Systems; Air Quality

20040074499 Pennsylvania State Univ., University Park, PA, USA, Colorado State Univ., Fort Collins, CO, USA
System for Measuring Workplace Protection Factors
Groves, W. A.; Reynolds, S. J.; 2004; 34 pp.; In English
Report No.(s): PB2004-105287; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this final report is to present results for this Special Emphasis Research Career Award (SERCA) entitled 'Sampling System for Measuring Workplace Protection Factors.' There have been no significant changes to Other Support of key personnel, nor was there significant re-budgeting of funds from what was approved for the project. In addition, there was not any change in the level of effort by key personnel. Finally, there was no unobligated balance exceeded 25% of the current budget year's total. The remainder of this report will be devoted to describing progress toward accomplishing the specific aims of the project.
NTIS
Budgeting; Protection

20040074500 State Univ. of New York, Plattsburgh, NY, USA
Analysis of Industrial Noise for Hearing Conservation
Lei, S. F.; 1997; 34 pp.; In English
Report No.(s): PB2004-105288; No Copyright; Avail: CASI; A03, Hardcopy

Noise measurements made for the purpose of hearing conservation practice, have as their objective the extraction of some physical metric from the noise that can be used to estimate the hazards to hearing from prolonged exposure to that noise. Unlike other areas of environmental monitoring, the substantive aspects (as opposed to the purely technological) of noise measurement practice have not evolved with the improvements in signal analysis capabilities. This research grant was originally conceived as a result of the inadequacy of current measurements to deal with complex noise measurements. Its primary objective was the broadly stated goal of using relatively new signal analysis techniques to extract metrics from a continuously sampled acoustic signal that can be used in conjunction with or as an alternative to the traditional metrics to provide a more adequate assessment of the hazard of a noise measurement. The following metrics, that can be used to quantify industrial noises, were developed as a result of this grant: (1) Frequency domain kurtosis (FDK), on any preselected frequency scale, provides an indication of which regions of the energy spectrum undergo fluctuations and the extent of these fluctuations relative to Gaussian conditions, (2) The joint peak-interval histogram which will identify each impulsive level, within a predetermined peak bin, with its interpeak interval distribution. From this surface conventional peak and interval histograms have been obtained.
NTIS
Conservation; Environmental Monitoring; Exposure; Hearing; Noise Measurement

20040074501 Washington Univ., Seattle, WA, USA
Evaluation of Dust Control Technologies in Construction Tasks
Seixas, N. S.; Camp, J.; Flanagan, M. E.; Croteau, G. A.; 2004; 40 pp.; In English
Report No.(s): PB2004-105244; No Copyright; Avail: CASI; A03, Hardcopy

Significantly elevated exposures to silica dust have been widely documented in construction activities, especially concrete cutting and grinding. Although application of water streams or spays to the cutting surface can substantially control exposures, many construction situations make the use of water infeasible. In order to evaluate the effectiveness of local exhaust ventilation (LEV) as an alternative approach silica dust control in constructions, a series of three studies were done. The study proceeded by first testing the effectiveness of LEV controls on four different types of tools in an experimental setting, then characterizing exposures occurring in eight common masonry activities in the field, and finally, considering the effectiveness of LEV on surface grinders used in field conditions. In each study, measurements were made with and without the use of LEV, and personal respirable dust and silica exposures were measured during the activity. Measurements were obtained with an inline respirable dust cyclone and filter, and with a direct reading instrument (pDR) allowing for the quantification of peak levels, and adjustment of the data for task-specific time periods.
NTIS
Air Filters; Dust Collectors

20040074506 Office of Air Quality Planning and Standards, Research Triangle Park, NC
3-Year Quality Assurance Report for Calendar Years 1999, 2000, and 2001: The SLAMS PM(2.5) Ambient Air Monitoring Program
Papp, M.; Elberly, S.; Schmidt, M.; Mar. 2004; In English
Report No.(s): PB2004-104729; EPA-454/R-04-001; No Copyright; Avail: National Technical Information Service (NTIS)
This report documents the quality assurance activities that were undertaken for the SLAMS PM2.5 environmental data operations for the calendar years 1999, 2000 and 2001 which are the first three years of implementation of the PM2.5 monitoring program. The QA Report evaluates the adherence to the quality assurance requirements described in '40 CFR 58 App. A' and evaluates the data quality indicators of precision, accuracy, bias, and completeness.
NTIS
Air Sampling; Environmental Monitoring; Quality Control

20040074511 Lawrence Livermore National Lab., Livermore, CA
Simulating Urban Effects within a Diagnostic Wind Field Model
Leone, J. M.; Sugiyama, G.; Brown, B.; Jul. 19, 2001; In English
Report No.(s): DE2004-15005949; UCRL-JC-142621; No Copyright; Avail: National Technical Information Service (NTIS)
The atmospheric dispersion of hazardous materials within the urban environment is a topic of great current interest. Urban structures have been shown/are known to cause overall slowing of the winds, channeling through street canyons, heat island phenomena, wake vortices and enhanced turbulence. Simulations that explicitly resolve individual buildings are limited by computational requirements to domains of a few kilometers. For models that simulate regions covering tens of kilometers with resolutions on the order of a kilometer, the effects of individual buildings must be parameterized by incorporating area-averaged canopy effects. For emergency response applications, results must be provided significantly faster than real time. The parameterization we have implemented is a modification of standard similarity theory based on the definition of an urban roughness layer, which is completely contained in the surface layer. Within this layer, the similarity parameters such as friction velocity and Monin-Obukhov length are taken to be functions of height rather than constant. The resultant vertical profiles evidence a slowing of the wind and an increase in turbulence compared with the standard similarity profile.
NTIS
Emergencies; Hazardous Materials; Parameterization; Velocity Distribution; Wind Velocity

20040074513 Lawrence Livermore National Lab., Livermore, CA
Java Performance for Scientific Applications on LLNL Computer Systems
Kapfer, C.; Wissink, A.; May 10, 2002; In English
Report No.(s): DE2004-15005942; UCRL-JC-148317; No Copyright; Avail: National Technical Information Service (NTIS)
Languages in use for high performance computing at the laboratory--Fortran (f77 and f90), C, and C++ - have many years of development behind them and are generally considered the fastest available. However, Fortran and C do not readily extend to object-oriented programming models, limiting their capability for very complex simulation software. C++ facilitates object-oriented programming but is a very complex and error-prone language. Java offers a number of capabilities that these other languages do not. For instance it implements cleaner (i.e., easier to use and less prone to errors) object-oriented models than C++. It also offers networking and security as part of the language standard, and cross-platform executables that make it architecture neutral, to name a few. These features have made Java very popular for industrial computing applications. The

aim of this paper is to explain the trade-offs in using Java for large-scale scientific applications at LLNL. Despite its advantages, the computational science community has been reluctant to write large-scale computationally intensive applications in Java due to concerns over its poor performance. However, considerable progress has been made over the last several years. The Java Grande Forum(1) has been promoting the use of Java for large-scale computing. Members have introduced efficient array libraries, developed fast just-in-time (JIT) compilers, and built links to existing packages used in high performance parallel computing.
NTIS
Applications Programs (Computers); C++ (Programming Language); Java (Programming Language)

20040075037 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Aerosol Sources, Absorption, and Intercontinental Transport: Synergies among Models, Remote Sensing, and Atmospheric Measurements
Chin, Mian; Ginoux, Paul; Dubovik, Oleg; Holben, Brent; Kaufman, Yoram; chu, Allen; Anderson, Tad; Quinn, Patricia; 2003; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Aerosol climate forcing is one of the largest uncertainties in assessing the anthropogenic impact on the global climate system. This uncertainty arises from the poorly quantified aerosol sources, especially black carbon emissions, our limited knowledge of aerosol mixing state and optical properties, and the consequences of intercontinental transport of aerosols and their precursors. Here we use a global model GOCART to simulate atmospheric aerosols, including sulfate, black carbon, organic carbon, dust, and sea salt, from anthropogenic, biomass burning, and natural sources. We compare the model calculated aerosol extinction and absorption with those quantities from the ground-based sun photometer measurements from AERONET at several different wavelengths and the field observations from ACE-Asia, and model calculated total aerosol optical depth and fine mode fractions with the MODIS satellite retrieval. We will also estimate the intercontinental transport of pollution and dust aerosols from their source regions to other areas in different seasons.
Author
Aerosols; Pollution Transport; Atmospheric Models

20040075081 Geological Survey, Washington, DC
Aeroradioactivity Survey and Areal Geology of Parts of Ohio and Indiana (ARMS-I)
Bates, Robert G.; May 1966; 50 pp.; In English
Report No.(s): AD-A422930; No Copyright; Avail: CASI; A03, Hardcopy

An airborne radioactivity survey was made of an area of 11,250 square miles in central and western Ohio and eastern Indiana. Parallel flight lines were flown in an east- west direction at an interval of one mile and an altitude of 500 ft above the ground. The survey was made by the U. S. Geological Survey for the U. S. Atomic Energy Commission as part of its nationwide program of airborne radioactivity surveys of nuclear installations. Reactors in the survey area are at West Jefferson, Dayton, Columbus, and Piqun, Ohio. Approximately 90 percent of the survey area has been intensely glaciated and is covered by glacial deposits ranging from a few feet to several hundred feet in thickness. In the nonglaciated softheast corner of the survey area, exposures of bedrock are common. Outwash deposits cover the bottoms of the larger valleys and patches of bess mantle the valley sides and ridges. Little geologic information was obtained from the radioactivity data. The interlobate area formed between the Miami and Scioto glacial lobes during late Wisconsin time is outlined by a radioactivity low. Two exposures of Ohio Shale north of Columbus, Ohio, are outlined by radioactivity highs.
DTIC
Geological Surveys; Geology; Ohio; Radioactivity; Surveys

20040075228 Atomic Energy Commission, Washington, DC
Aeroradioactivity Survey and Geology of the Gnome (Carlsbad) Area, New Mexico and Texas (ARMS-I)
MacKallor, Jules A.; Jan. 1965; 50 pp.; In English
Report No.(s): AD-A423163; CEX-59.4.24; No Copyright; Avail: CASI; A03, Hardcopy

An aeroradioactivity survey of about 7000 square miles around the GNOME test site near Carlsbad, N. Mex., was made by the U. S. Geological Survey in cooperation with the Division of Biology and Medicine, U. S. Atomic Energy Commission. The project was flown along east-west flight lines approximately 500 ft above the ground. Flight lines were one mile apart in the central part of the area and two miles apart elsewhere. Aeroradioactivity contacts shown on a 1:250, 000 map delineate areas of similar radioactivity. The radioactivity values, to which a cosmic correction has been applied, are shown in counts

per second (cps) , and have been corrected for deviations from the 500 ft surveying altitude. The GNOME area includes parts of three physiographic regions: the Llano Estacado and Pecos lowlands sections of the Great Plains, and the foothills and mountains. The Guadalupe Mountains lie west of Carlsbad, and the Delaware Mountains lie along the southwestern edge of the area. The radioactivity of the GNOME area is low and ranges from 50 to 600 cps. The Llano Estacado portion of the area ranges from 100 to 400 cps; the Pecos lowlands from 50 to 600 cps; and the foothills and mountains from 200 to 600 cps. DTIC

Fallout; Geology; Surveys

20040075554 NASA Langley Research Center, Hampton, VA, USA

Characteristics and Influence of Biosmoke on the Fine-Particle Ionic Composition Measured in Asian Outflow during the Transport and Chemical Evolution Over the Pacific (TRACE-P) Experiment

Ma, Y.; Weber, R. J.; Lee, Y.-N.; Orsini, D. A.; Maxwell-Meier, K.; Thornton, D. C.; Bandy, A. R.; Clarke, A. D.; Blake, D. R.; Sachse, G. W., et al.; Journal of Geophysical Research; Nov. 4, 2003; ISSN 0148-0227; Volume 108, No. D21, pp. 37-1 - 37-16; In English

Contract(s)/Grant(s): NCC1-411; Copyright; Avail: Other Sources

We investigate the sources, prevalence, and fine-particle inorganic composition of biosmoke over the western Pacific Ocean between 24 February and 10 April 2001. The analysis is based on highly time-resolved airborne measurements of gaseous and fine- particle inorganic chemical composition made during the NASA Transport and Chemical Evolution over the Pacific (TRACE-P) experiment. At latitudes below approximately 25 deg. N, relatively pure biomass burning plumes of enhanced fine-particle potassium, nitrate, ammonium, light-absorbing aerosols, and CO concentrations were observed in plumes that back trajectories and satellite fire map data suggest originated from biomass burning in southeast Asia. Fine-particle water-soluble potassium (K+) is confirmed to be a unique biosmoke tracer, and its prevalence throughout the experiment indicates that approximately 20% of the TRACE-P Asian outflow plumes were influenced, to some extent, by biomass or biofuel burning emissions. At latitudes above 25 deg. N, highly mixed urban/industrial and biosmoke plumes, indicated by SO(sup 2, sub 4) and K+, were observed in 5 out of 53 plumes. Most plumes were found in the Yellow Sea and generally were associated with much higher fine-particle loadings than plumes lacking a biosmoke influence. The air mass back trajectories of these mixed plumes generally pass through the latitude range of between 34 deg. and 40 deg. N on the eastern China coast, a region that includes the large urban centers of Beijing and Tianjin. A lack of biomass burning emissions based on fire maps and high correlations between K+ and pollution tracers (e.g., S(sup 2, sub 4) suggest biofuel sources. Ratios of fine-particle potassium to sulfate are used to provide an estimate of relative contributions of biosmoke emissions to the mixed Asian plumes. The ratio is highly correlated with fine-particle volume (r(sup 2) = 0.85) and predicts that for the most polluted plume encounter in TRACE-P, approximately 60% of the plume is associated with biosmoke emissions. On average, biosmoke contributes approximately 35-40% to the measured fine inorganic aerosol mass in the mixed TRACE-P plumes intercepted north of 25% latitude.

Derived from text

Aerosols; Chemical Evolution; Inorganic Compounds

20040075784 NASA Ames Research Center, Moffett Field, CA, USA

Submicron Optical Aerosol Spectrometer

Fonda, Mark L.; Stratton, David M.; Research and Technology 1997; September 1998, pp. 121; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A light-scattering instrument capable of measuring in situ aerosol particle sizes from 0.02 to 100 microns in concentrations as low as 1 part per billion, under low-pressure conditions (as low as -0.05 Torr) has been developed. The instrument illustrated in the first figure can provide continuous data monitoring and data collection to encompass the wide dynamic size range and concentration conditions needed in studies of planetary atmosphere models, as well as field experiments addressing Earth air-quality pollution standards. A fiber-coupled argon-ion laser system, which incorporates polarization ratio scattering measurements was used to determine the size distribution at particle sizes smaller than 0.1 micron. As particle concentration and size increases, data collection shifts to angular (diffraction-based) scattering for larger particle measurements (up to 100 microns). A customized software and electronics package automatically shifts from polarization to diffraction-based measurements as the angular scattering detector attains an acceptable signal-to-noise ratio. Results from static experiments utilizing Freon, flowthrough experiments utilizing sodium chloride (NaCl) and carbon particles, and dynamic acetylene photolysis experiments were performed that provided comparative particle-size data with data obtained with a scanning electron microscope.

Derived from text

Aerosols; Spectrometers; Optical Equipment; Size Distribution; Data Acquisition; Applications Programs (Computers)

20040075821 NASA Ames Research Center, Moffett Field, CA, USA

Atmospheric Effects of Aircraft Emissions: SONEX

Singh, Hanwant B.; Eilers, James; Research and Technology 1997; September 1998, pp. 164; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The enormous growth in aviation has given rise to concerns that emissions from aircraft may be modifying the atmosphere in important ways. SONEX (Subsonic Assessment Ozone Nitrogen Oxide Experiment), a NASA-sponsored DC-8 aircraft mission, was conducted in October-November 1997 in the vicinity of the North Atlantic flight corridor to study the effect of aircraft emissions on the nitrogen oxide families (NOx), and ozone (O3). SONEX was managed by Ames Research Center. The major SONEX science objectives were (1) to obtain high-quality measurements of reactive nitrogen species (NOx family), key ozone precursors (hydrogen oxide families (HOx)), and tracers from the upper troposphere/lower stratosphere; and (2) to use these observations in conjunction with models to assess the effect of air-traffic emissions on NOx and O3. Shannon, Ireland, and Bangor, Maine, were the two primary deployment sites; they allowed access from latitudes 35 deg N to 70 deg N over the Atlantic. The Azores provided a secondary deployment site that allowed access to subtropical air masses. Survey flights, as well as maneuvers across fresh aircraft exhaust tracks in the Organized Track System between North America and Europe, were carried out. These DC-8 efforts were closely coordinated with the European DLR/POLINAT (Deutsche Forschungsanstalt fur Luft- und Raumfahrt/ Pollution in North Atlantic Tracks) program, which used a higher-flying and smaller Falcon 20 aircraft as the primary research platform. Coordinated missions between the DC-8 and Falcon were performed successfully to accomplish both data-gathering and intercomparison objectives. Results from the SONEX mission are expected to allow an assessment of NOx and HOx upper-tropospheric photochemistry that will be greatly improved over any that have been possible to date. Anne M. Thompson of NASA Goddard Space Flight Center collaborated on this project. Author

Exhaust Emission; Atmospheric Effects; Air Pollution; Pollution Monitoring; Airborne Equipment

20040075846 Geological Survey, Columbia, MO, USA

Development and Application of Techniques for Sampling Bioavailable Airborne Organic Contaminants

Petty, J. D.; Huckins, J. N.; Cranor, W. L.; Gale, R. W.; Alvarez, D. A.; Sep. 13, 1999; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM and paper only. CD-ROM contains a 126 page document

Report No.(s): PB2004-105181; No Copyright; Avail: National Technical Information Service (NTIS)

As a focused part of a much broader study of human exposure to chemicals in the Southwestern USA, semipermeable membrane devices (SPMDs) were deployed in enclosed areas along the border between Arizona and Mexico. The main objective of this project was to determine the applicability of the integrative sampling approach of the SPMD technology to define the potential exposure of the people living in the sampled areas to complex mixtures of airborne chemicals.

NTIS

Air Pollution; Contaminants; Organic Compounds; Sampling

20040077089 NASA Ames Research Center, Moffett Field, CA, USA

Lofting of Soot Particles into the Middle Atmosphere by Gravito-Photophoresis

Pueschel, Rudolf F.; Ferry, Guy V.; Strawa, Anthony W.; Research and Technology 1999; December 2000, pp. 186-187; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The observed existence of soot aerosol at 20-kilometer (km) altitude (which arguably is generated by aircraft flying in corridors at 10 - 12 km) requires a transport mechanism in a thermally stable stratosphere that is different from isentropic or dynamic mixing. Such a mechanism could be provided by gravito-photophoresis, induced by the incidence of sunlight on strongly absorbing fractal soot particles. This particle absorptivity, in conjunction with uneven surface-coating of sulfuric acid and their fractal nature, makes soot particles (with maximum dimensions approaching 1 micrometer) particularly conducive to gravito-photophoresis. It is the requirement of a restoring torque that orients the particle with respect to gravity. This required force is provided by the fractal characteristics of soot, and a body-fixed photophoretic force is given by asymmetric thermal accommodation coefficients across the uneven surface of the particle.

Derived from text

Aerosols; Soot; Gravitation; Photophoresis; Middle Atmosphere

20040077122 NASA Ames Research Center, Moffett Field, CA, USA

Activated Carbon from Inedible Biomass

Fisher, John; Pisharody, Suresh; Research and Technology 1999; December 2000, pp. 152-153; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

As manned missions become longer, resupply of life support materials becomes increasingly more difficult and expensive. The expense of resupply can be avoided by regenerating life support materials. Bioregeneration involves the use of plants to grow food, but plants generate a large amount of inedible biomass, which must be recycled. Incineration is one of the most promising technologies for recycling wastes such as inedible biomass. Unfortunately, inherent to the process of incineration is the formation of undesirable byproducts such as nitrogen oxides (NOx) and sulfur oxides (SOx). Conventional incineration technologies treat offgases, such as NOx and SOx by using selective catalytic reduction processes, but these technologies require the injection of expendables such as ammonia to treat the NOx. Activated carbon can also be used to remove NOx and SOx via the process of adsorption. The Solid Waste Resource Recovery project group is investigating unique ways to use crop wastes to make activated carbon. This process would eliminate the need for expendables in the flue gas cleanup during long-duration, manned space missions. It may be possible to make this activated carbon from the inedible biomass available from growing plants in space. Over 40 crops are being considered for food production. One or more of these plants, which will provide the nutritional needs of crews on long missions, may be a good raw material for making activated carbon. The flow diagram shows the planned role of the activated carbon as part of the incineration process for resource recovery. The contaminants in the flue gas are adsorbed on activated carbon at room temperature. In a regeneration process at high temperatures, the adsorbed NOx is reduced by the carbon-forming nitrogen gas (N2) and carbon dioxide. The offgases formed during the activation process are directed back into the incinerator. After several regenerations, the spent carbon is mixed with the incinerator feed and is converted to carbon dioxide and water in the incinerator. Thus contaminants are removed without the need for resupply. The challenge is to make quality activated carbon, a highly porous, carbonaceous material. The porous structure is controlled by the nature of the starting material and the process used for carbonization and activation. Conversion of inedible biomass to activated carbon and the use of activated carbon to convert adsorbed NOx to N2 gas has been successfully demonstrated at Ames Research Center. There is an excellent chance that this research will result in a process that will one day be used to manufacture activated carbon in space for use in the life support system.
Derived from text
Activated Carbon; Biomass; Flue Gases; Materials Recovery

20040077124 NASA Ames Research Center, Moffett Field, CA, USA
Quantifying the Intercontinental and Global Reach and Effects of Pollution
Chatfield, Robert B.; Guo, Zitan; Research and Technology 1999; December 2000, pp. 180-181; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Atmospheric Chemistry Modeling Group is participating in an international effort to explore the projected interactions of the atmosphere with biota, human activity, and the natural environment over the next three decades. The group uses computer simulations and statistical analyses to compare theory and observations of the composition of the lower atmosphere. This study of global habitability change is part of a more ambitious activity to understand global habitability. This broad planetary understanding is central to planetary habitability, biomarker detection, and similar aspects of Astrobiology. The group has made highly detailed studies of immense intercontinental plumes that affect the chemistry of the global atmosphere, especially the region below the ozone (O3) layer whose chemical composition defines the conditions for healthy humans and the biosphere. For some decades there has been concern about the pollution from cities and industrial burning and its possible effect in increasing smog ozone, not only in continental regions, but also in plumes that spread downwind. Recently, there has been new concern about another kind of pollution plume. Projections for a greatly expanded aircraft fleet imply that there will be plumes of nitrogen oxides (NO(x)) from jet exhaust in the Northern Hemisphere downwind of major air traffic routes. Both of these are tied to large-scale O3 in the troposphere, where it is toxic to humans and plant tissues.
Derived from text
Atmospheric Chemistry; Lower Atmosphere; Ozone; Chemical Composition; Computerized Simulation; Environment Models; Pollution

20040077171 NASA Ames Research Center, Moffett Field, CA, USA
Estimation of Aerosol Direct Radiative Effects from Satellite and In Situ Measurements
Bergstrom, Robert W.; Russell, Philip B.; Schmid, Beat; Redemann, Jens; McIntosh, Dawn; Research and Technology 1999; December 2000, pp. 178-179; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames researchers have combined measurements from satellite, aircraft, and the surface to estimate the effect of airborne particles (aerosols) on the solar radiation over the North Atlantic region. These aerosols (which come from both natural and pollution sources) can reflect solar radiation, causing a cooling effect that opposes the warming caused by carbon dioxide.

Recently, increased attention has been paid to aerosol effects to better understand the Earth climate system.
Derived from text
Aerosols; Estimating; Solar Radiation; In Situ Measurement; Carbon Dioxide; Air Pollution

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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*.

20040074350 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Model Study of the Impact of Magnetic Field Reversal on Atmospheric Composition during Solar Proton Events
Sinnhuber, Miaiam; Jackman, Charles H.; Burrows, John P.; Chipperfield, Martyn P.; Kallenrode, May-Britt; Kunzi, Klaus F.; Quack, Manual; [2003]; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

During a polarity transition of the Earth's magnetic field, the structure and strength of the field change significantly from their present values. This will alter the global pattern of charged particle precipitation into the atmosphere. Thus, particle precipitation is possible into regions that are at the moment effectively shielded by the Earth's magnetic field. A two-dimensional global fbHy coupled chemistry, radiation, and transport model of the atmosphere has been used to investigate how the increased particle precipitation affects the chemical composition of the middle and lower atmosphere. Ozone losses resulting from large energetic particle events are found to increase significantly, with resultant losses similar to those observed m the Antarctic ozone hole of the 1990s. This results in significant increases in surface UV-B radiation as well as changes in stratospheric temperature and circulation over a period of several months after large particle events.
Author
Atmospheric Composition; Magnetic Fields; Solar Protons; Mathematical Models; Earth Sciences

20040075002 Brown Univ., Providence, RI, USA
Petrogenesis of Mare Basalts, Mg-Rich Suites and SNC Parent Magmas
Hess, Paul C.; [2004]; 8 pp.; In English
Contract(s)/Grant(s): NAG5-11931; No Copyright; Avail: CASI; A02, Hardcopy

The successful models for the internal evolution of the Moon must consider the volume, distribution, timing, composition and, ultimately, the petrogenesis of mare basaltic volcanism. Indeed, given the paucity of geophysical data, the internal state of the Moon in the past can be gleaned only be unraveling the petrogenesis of the various igneous products on the Moon and, particularly, the mare basalts. most useful in constraining the depth and composition of their source region [Delano, 1980] despite having undergone a certain degree of shallow level olivine crystallization.The bulk of the lunar volcanic glass suite can be modeled as the partial melting products of an olivine + orthopyroxene source region deep within the lunar mantle. Ti02 contents vary from 0.2 wt % -1 7.0wt [Shearer and Papike, 1993]. Values that extreme would seem to require a Ti- bearing phase such as ilmenite in the source of the high-Ti (but not in the VLT source) because a source region of primitive LMO olivine and orthopyroxene, even when melted in small degrees cannot account for the observed range of Ti02 compositions. The picritic glasses are undersaturated with respect to ilmenite at all pressures investigated therefore ilmenite must have been consumed during melting, leaving an ilmenite free residue and an undersaturated melt [Delano, 1980, Longhi, 1992, Elkins et al, 2000 among others]. Multi- saturation pressures for the glasses potentially represent the last depths at which the liquids equilibrated with a harzburgite residue before ascending to the surface. These occur at great depths within the lunar mantle. Because the liquids have suffered some amount of crystal fractionation, this is at best a minimum depth. If the melts are mixtures, then it is only an average depth of melting. Multisaturation, nevertheless, is still a strong constraint on source mineralogy, revealing that the generation of the lunar basalts was dominated by melting of olivine and orthopyroxene.
Author
Petrogenesis; Basalt; Lunar Mantle; Magma

20040075073 Science Applications International Corp., San Diego, CA
Improved Surface Wave Dispersion Models and Amplitude Measurements
Stevens, J. L.; Adams, D. A.; Eneva, M. G.; Baker, G. B.; Oct. 24, 2003; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA01-01-C-0082; Proj-DTRA
Report No.(s): AD-A422916; SAIC-03/2051; AFRL-VS-HA-TR-2004-1029; No Copyright; Avail: CASI; A03, Hardcopy

The report describes the status and results to reduce the magnitude threshold for which surface waves can be identified and measured reliably, and to improve the accuracy of surface wave measurements, using phase-matched filtering, development of global regionalized earth and dispersion models, and other techniques. We have focused on improvements to global earth models and dispersion maps, and improved techniques for measuring surface wave amplitudes. Completed work on implementation and testing of azimuth estimation techniques at three component stations based on polarization analysis. Global regionalized earth and dispersion models are being developed by inversion of the very large data set of phase and group velocity dispersion measurements. The complete data set now contains over one million dispersion data pointS. The dispersion measurements are inverted for earth structure; the earth structure is then used to generate dispersion predictions. Improvement in the inversion procedure has been the introduction of the capability to vary damping and smoothing parameters for each model.
DTIC
Surface Waves; Wave Dispersion

20040075102 Embry-Riddle Aeronautical Univ., Daytona Beach, FL
Infrared Spectroscopy of Hyper Velocity Shock
Erdman, Peter; May 5, 2004; 6 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0486
Report No.(s): AD-A422969; ARO-39161.1-E8-SD1; No Copyright; Avail: CASI; A02, Hardcopy

We have continued the investigation of hypervelocity shocks that began with the highly successful Bowshock I and II atmospheric sounding rocket experiments. Instruments aboard those vehicles performed measurements of the ultraviolet and vacuum ultraviolet emission excited in the high temperature gas produced by the shock ahead of the hypervelocity body. We have developed the experimental techniques and the instruments necessary to expand those earlier experiments into the infrared portion of the spectrum where ground-state, molecular, ro-vibrational emission can be observed as the most direct measure of shock temperatures With this project's support, we have defined, designed, constructed, and successftilly flown the hypervelocity shockwave experiment that has come to be known as "DEBI". The flight instrumentation originally proposed made some evolutionary changes as a result of new thoughts on the spectral regions to emphasize, detector developments, and background suppression techniques that greatly improved the infrared measurements. The flight was a complete success, with the launch vehicle and all instruments working perfectly.
DTIC
Aeronomy; Bow Waves; Hypersonic Speed; Infrared Spectroscopy; Shock Waves

20040075222 Air Force Research Lab., Hanscom AFB, MA
Estimating Velocity Turbulence Magnitudes Using the Thermosonde
Jumper, G.; Roadcap, J.; Tracy, P.; McHugh, John P.; Jan. 9, 2003; 12 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423151; AFRL-VS-HA-TR-2004-1054; No Copyright; Avail: CASI; A03, Hardcopy

Equations are developed to estimate velocity turbulence from index of refraction turbulence as measured by the thermosonde. Using an adaptation of the radar "power" method to estimate velocity fluctuations from backscattered radar return and concurrently measured atmospheric data, the method is applied to optical turbulence measured by the thermosonde. The method is then used to compare velocity turbulence levels as estimated by the thermosonde to those estimated by the "Groundwinds" lidar in the lee of Mt. Washington in New Hampshire. There is reasonable agreement in identification of the areas of high turbulence.
DTIC
Estimating; Magnitude; Turbulence

20040075242 Air Force Research Lab., Hanscom AFB, MA
Modeling Transverse Heating and Outflow of Ionospheric Ions from the Dayside Cusp/Cleft. 1 A Parametric Study
Bouhram, M.; Malingre, M.; Jasperse, J. R.; Dubouloz, N.; Jan. 2003; 20 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423203; AFRL-VS-HA-TR-2004-1078; No Copyright; Avail: CASI; A03, Hardcopy

The transport patterns of non-thermal H+ and 0+ field-aligned flows from the dayside cusp/cleft, associated with transverse heating by means of wave-particle interactions and in combination with the poleward motion due to the magnetospheric convection are investigated. This has been accomplished by developing a steady-state, two- dimensional,

trajectory-based code. The ion heating is modelled by means of a Monte Carlo technique, via the process of ion cyclotron resonance (ICR), with the electromagnetic left-hand circular polarized component of a broad-band, extremely low-frequency (BBELF) turbulence. The altitude dependence of ICR heating from 1000km to 3 Earth radii (RE) is modelled by a power law spectrum, with an index a, and a parameter w0 that is proportional to the spectral density at a referenced gyrofrequency. Because of the finite latitudinal extent of the cusp/cleft, the incorporation of the horizontal- convection drift leads to a maximum residence time tD of the ions when being energized. A large set of simulations has been computed so as to study the transport patterns of the H+ and 0+ bulk parameters as a function of tD, a, and WO. Residence time effects are significant in 0+ density patterns while negligible for H+. When comparing the results with analytical one-dimensional theories (Chang et al., 1986; Crew et al., 1990), we find that mean ion energies and pitch angles at the poleward edge of the heating region are slightly influenced by tD and may be used as a probe of ICR parameters (a, wo). Conversely, poleward of the heating region, upward velocity and mean energy dispersive patterns depend mainly on tD (e.g. the magnitude of the convection drift) with latitudinal profiles varying versus tD. In short, the main conclusion of the paper is that any triplet (tD, a, wo) leads to a unique transport-pattern feature of ion flows associated with a cusp/cleft ionospheric source.
DTIC
Heating; Ions

20040075688 NASA Marshall Space Flight Center, Huntsville, AL, USA
Challenges in Modeling the Sun-Earth System
Spann, James; [2004]; 1 pp.; In English; Spring AGU Meeting, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The transfer of mass, energy and momentum through the coupled Sun-Earth system spans a wide range of scales in time and space. While profound advances have been made in modeling isolated regions of the Sun-Earth system, minimal progress has been achieved in modeling the end-to-end system. Currently, end-to-end modeling of the Sun-Earth system is a major goal of the National Space Weather and NASA Living With a Star (LWS) programs. The uncertainty in the underlying physics responsible for coupling contiguous regions of the Sun-Earth system is recognized as a significant barrier to progress. Our limited understanding of the underlying coupling physics is illustrated by the following example questions: how does the propagation of a typical CME/solar flare influence the measured properties of the solar wind at 1 AU? How does the solar wind compel the dynamic response of the Earth's magnetosphere? How is variability in the ionosphere-thermosphere system coupled to magnetospheric variations? Why do these and related important questions remain unanswered? What are the primary problems that need to be resolved to enable significant progress in comprehensive modeling of the Sun-Earth system? Which model/technique improvements are required and what new data coverage is required to enable full model advances? This poster opens the discussion for how these and other important questions can be addressed. A workshop scheduled for October 8-22, 2004 in Huntsville, Alabama, will be a forum for identifying ana exploring promising new directions and approaches for characterizing and understanding the system. To focus the discussion, the workshop will emphasize the genesis, evolution, propagation and interaction of high-speed solar wind streamers or CME/flares with geospace and the subsequent response of geospace from its outer reaches in the magnetosphere to the lower edge of the ionosphere-mesosphere-thermosphere. Particular emphasis will be placed on modeling the coupling aspects of these phenomena across boundaries between regions and on data analysis that guides and constrains model results. Specific topics to be addressed are: Corotating interaction regions, Coronal mass ejections, Energetic particles, System preconditioning, Extreme events and super storms, End-to-End modeling efforts.
Author
Sun; Earth Magnetosphere; End-to-End Data Systems; Space Weather; Solar Wind; Solar Flares; Mass Transfer

20040075770 NASA Ames Research Center, Moffett Field, CA, USA
Studies of Stratospheric Bromine Compounds
Lee, Timothy J.; Parthiban, Srinivasan; Research and Technology 1997; September 1998, pp. 161; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Recently a proposal was made that these heterogeneous reactions of BrON0: may also contribute to catalytic destruction of ozone. However, it i s proposed here that a more likely explanation for both the elimination of BrONO, and the destruction of ozone (03) is provided by an observation made by researchers in 1974; that is, it was shown that BrON02 and O3 react at 195 kelvin to form a bromide nitrate (02BrON02) molecule (a structure was never determined). Using the tools of computational quantum chemistry, the equilibrium structures, dipole moments, harmonic vibrational frequencies, and infrared intensities of the reactants and products of reactions have been determined. In order to assess the reliability of these calculations, results for BrON02 have been compared with very-high- level singles and doubles coupled cluster theory

calculations with a perturbational estimate for triples (denoted as CCSDITI) and also with experiment where available. Heats of formation of some of these compounds have been evaluated, and the energetics of possible dissociation pathways assessed. Author

Ozone; Bromine Compounds; Dissociation; Atmospheric Chemistry

20040075782 NASA Ames Research Center, Moffett Field, CA, USA

Molecular Biomarkers in Living Stromatolites

Jahnke, Linda L.; Farmer, Jack D.; Klein, Harold P.; Research and Technology 1997; September 1998, pp. 95-96; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Stromatolites, among the most common fossils in the geologic record, are defined as organo- sedimentary structures formed by sediment trapping microbial communities living in shallow water environments. The microfossil record in stromatolites 3.5 billion years ago. During most of this time, microbial life has dominated Earth, and has been responsible for transforming the primitive anaerobic environments of early Earth, devoid of free molecular oxygen, to the modern aerobic world that supports contemporary biology. Microbial mats are "living" stromatolites, modern day analogs that provide an opportunity (a window to the past) to study the way ancient microbial communities lived and evolved. Today, a variety o i these "living" analogs, representing a range of environmental and organismal parameters, are available for study throughout the world. For the most part, the dominate members of recent mats are oxygenic photosynthetic bacteria, the cyanobacteria. The evolution of oxygen-producing photosynthesis within the cyanobacteria heralded the beginnings of our modern aerobic world, and the timing of this event is of particular interest in attempts to understand the process of Earth's evolution.

Derived from text

Microorganisms; Photosynthesis; Sediments; Biomarkers; Aerobes; Fossils

20040075787 NASA Ames Research Center, Moffett Field, CA, USA

Telltale Electric Currents During Impacts on Rocks

Freund, Friedemann; Borucki, Jerome G.; Lise, Marshall; Research and Technology 1997; September 1998, pp. 104-106; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Since all igneous rocks on Earth and presumably on Mars solidified from water-laden magmas, the presence of peroxy links deserves attention because, when peroxy links can break apart, they generate also known as positive holes, similar to the holes in semiconductors which are necessary, together with electrons, to build a transistor. Peroxy links dissociate upon heating, but it has now been recognized that they also break apart when subjected to a sudden mechanical shock. A relatively weak shock suffices; for example, the shock supplied by a steel ball impacting a piece of rock.at 100 meters per second. The shock causes the peroxy links to momentarily release positive holes. These act as highly mobile charge carriers and propagate through the mineral structure, jumping from mineral to mineral grain and thus flowing through a rock that would otherwise be considered a good insulator. To demonstrate the effect, a series of shock- impact experiments was conducted, using for lower velocities a crossbow that can accelerate steel balls up to 100 meters per second, and for higher velocities, 1-6 kilometers per second, the Ames Vertical Gun Range. This paper focuses on the low-velocity impact experiments.

Derived from text

Rocks; Electric Current; Meteorite Collisions

20040075796 NASA Ames Research Center, Moffett Field, CA, USA

Paleoenvironmental Studies

DAntoni, Hector L.; Research and Technology 1997; September 1998, pp. 151-154; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A revision of a pollen profile was undertaken in order to start astrobiological research in South America. Gruta del lndio del Rinc6n del Atuel (GIRA) is a rock shelter located at lat. 34" 45's and long. 68" 22' W, east of the Andes. The stratigraphy of GIRA includes fossil traces of archeological, paleontological, and paleoecological events. Previous research in this important site showed three groups of ecological indicators: (1) plants of the Monte ecosystem that depend on the groundwater table (phreatophytes), (2) Monte ecosystem plants that are independent of the groundwater (nonphreatophytes), and (3) plants of the Patagonia ecosystem. These groups of indicators were used to piece together plant succession in this area in a time frame of more than 32,000 years before present (BP). Such history includes a first occupation by the Patagonia ecosystem during the last 20,000 years, corresponding to the last Ice Age, then a Monte occupation from 10,000 years to the present. The latter is subdivided into a phase of phreatophytic dominance that ends about 2500 years BP and a

nonphreatophytic dominance that persists through the present. This time, a thorough analysis of its paleoenvironmental content was performed in looking for indicators of declining ecosystems.
Author
Paleontology; Fossils

20040075802 NASA Ames Research Center, Moffett Field, CA, USA
Amazon Ecology from Space
Potter, Christopher; Research and Technology 1997; September 1998, pp. 156-157; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The degree to which primary production, soil carbon, and trace-gas fluxes in tropical forests of the Amazon are limited by moisture availability and other environmental factors has been examined using a new ecosystem modeling application for Brazil. A regional geographic information system serves as the data source of climate drivers, satellite "greenness" images, land cover, and soil properties for input to the NASA-CASA model over an 8-kilometer-grid resolution. This study describes the first published use of satellite remote sensing to simulate regional carbon and nitrogen fluxes and associated "green-house" gas emissions in the rain forests and savannas of Brazil.
Derived from text
Amazon Region (South America); Carbon; Climate; Ecosystems; Environment Models; Satellite Imagery; Trace Elements

20040075825 NASA Ames Research Center, Moffett Field, CA, USA
Quantitative Infrared Spectroscopy of Minor Constituents of Earth's Atmosphere
Chackerian, Charles, Jr.; Giver, Lawrence P.; Research and Technology 1997; September 1998, pp. 169; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Infrared spectroscopic techniques have become extremely powerful tools for use in achieving a number of observational objectives in understanding and monitoring the health of Earth s atmosphere. Prerequisite to designing appropriate instruments well as to interpreting the observations that monitor the important molecular species, quantitative laboratory spectroscopic measurements must be done. measurements provide (1) line and band intensity values that are needed to establish limits of detectability for as vet unobserved species and to quantify the abundance of those species that are observed; (2) line positions, half-widths, and pressure induced shifts, all of which are needed for remote and in sensing techniques; and (3) data on these basic molecular at temperatures and pressures appropriate to the real atmosphere. Good progress has been made in calibrating the BOMEM Fourier Transform Spectrometer (FTS) intensity determinations with measurements obtained with the Kitt Peak interferometer on carbon dioxide (COLI. The analysis for line intensities has begun for nitric acid (HN03) using infrared spectra previously obtained. An experimental study was completed which demonstrates that magnetic rotation spectroscopy can detect free radical molecular species (in situ) in the part-per-trillion mixing ratio range. In connection with this work, measurements were done to establish Zeeman tuning rates in the infrared spectrum of nitrogen dioxide (NOz) measure line intensities and shapes of gaseous water in the 1-millimeter spectral region to help in understanding the apparent anomaly associated with absorption of solar radiation by clouds in Earth s atmosphere. The signal-to-noise ratio (S/N) on these spectra, recorded with the high-resolution BOMEM FTS and 25-meter base-path multiple-traversal absorption cell, were greatly enhanced by incorporating an infrared bandlimiting filter wheel with S/N ratios greater than 1000 achieved in 30 minutes of integration.
Author
Earth Atmosphere; Infrared Spectroscopy; Atmospheric Chemistry; Remote Sensing; Zeeman Effect; Infrared Spectra; Solar Radiation

20040075898 Hawaii Univ., Honolulu, HI, USA
Validation and Analysis of SRTM and VCL Data Over Tropical Volcanoes
Mouginis-Mark, Peter J.; June 14, 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG5-9038; No Copyright; Avail: CASI; A02, Hardcopy

The focus of our investigation was on the application of digital topographic data in conducting first-order volcanological and structural studies of tropical volcanoes, focusing on the Java, the Philippines and the Galapagos Islands. Kilauea volcano, Hawaii, served as our test site for SRTM data validation. Volcanoes in humid tropical environments are frequently cloud covered, typically densely vegetated and erode rapidly, so that it was expected that new insights into the styles of eruption of these volcanoes could be obtained from analysis of topographic data. For instance, in certain parts of the world, such as Indonesia, even the regional structural context of volcanic centers is poorly known, and the distribution of volcanic products

(e.g., lava flows, pyroclastic flows, and lahars) are not well mapped. SRTM and Vegetation Canopy Lidar (VCL) data were expected to provide new information on these volcanoes. Due to the cancellation of the VCL mission, we did not conduct any lidar studies during the duration of this project. Digital elevation models (DEMs) such as those collected by SRTM provide quantitative information about the time-integrated typical activity on a volcano and allow an assessment of the spatial and temporal contributions of various constructional and destructional processes to each volcano's present morphology. For basaltic volcanoes, P_c?w!m-d and Garbed (2000) have shown that gradual slopes (less than 5 deg.) occur where lava and tephra pond within calderas or in the saddles between adjacent volcanoes, as well as where lava deltas coalesce to form coastal plains. Vent concentration zones (axes of rift zones) have slopes ranging from 10 deg. to 12 deg. Differential vertical growth rates between vent concentration zones and adjacent mostly-lava flanks produce steep constructional slopes up to 40". The steepest slopes (locally approaching 90 deg.) are produced by fluvial erosion, caldera collapse, faulting, and catastrophic avalanches, all of which are usually identifiable. Due to the delay in the release of the SRTM data following the February 2000 flight, a significant part of our effort was devoted to the analog studies of the SRTM topographic data using topographic data from airborne interferometric radars. As part of the original SRTM Science Team, we proposed four study sites (Kilauea, Hawaii; Mt. Pinatubo, Philippines; Cerro Am1 and Femandina volcanoes, Galapagos Islands; and Tengger caldera, Java) where we could conduct detailed geologic studies to evaluate the uses of SRTM data for the analysis of lava flows, lahars, erosion of ash deposits, and an evaluation of the structural setting of the volcanoes. Only near the end of this project was one of these SRTM Science Team products (Luzon Island, the Philippines) released to the community, and we only had limited time to work on these data.
Author
Volcanoes; Tropical Regions; Digital Data

20040077125 NASA Ames Research Center, Moffett Field, CA, USA
SAGE 111 Ozone Loss and Validation Experiment
Craig, Michael; Hipskind, Stephen; Dolci, Wendy; Research and Technology 1999; December 2000, pp. 182; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The SAGE III Ozone Loss and Validation Experiment (SOLVE) campaign i s cosponsored by the NASA Upper Atmosphere Research Program, the Atmospheric Effects of Aviation Project, the Atmospheric Chemistry Modeling and Analysis Program, the Earth Observing System Validation Program, and the European Science Commission. It is the largest field experiment ever conducted to examine stratospheric ozone levels over the Arctic region. The mission will be conducted during the 1999-2000 winter from Kiruna, Sweden, and will employ multiple aircraft, balloons, ground-based instruments, satellites, and an extensive theory team to examine the processes that control polar to midlatitude stratospheric ozone levels. The experiment will acquire correlative measurements needed to validate the Stratospheric Aerosol and Gas Experiment (SAGE) III satellite to help quantitatively assess high-latitude ozone loss. The results of the SOLVE campaign will both expand the understanding of polar ozone processes and provide greater confidence in current ozone monitoring capabilities.
Derived from text
Ozone; Stratosphere; Polar Regions

20040077163 NASA Ames Research Center, Moffett Field, CA, USA
Corrections and Additions for the HITRAN Water Vapor Spectroscopic Database
Giver, Lawrence P.; Chackerian, Charles, Jr.; Schwenke, David W.; Research and Technology 1999; December 2000, pp. 185; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Systematic errors have been found and corrected in the HITRAN (High-Resolution Transmission Molecular Absorption Database) water vapor line absorption intensities in the visible and near-infrared spectral regions. The HITRAN database has been used extensively in the calculation of atmospheric absorption of solar radiation. The most important corrections found were a 14.4% increase of the intensity of the 940-nanometer (nm) band and an 8.7% increase of the intensity of the 820-nm band. These systematic errors in the HITRAN tabulations were due to errors in the unit conversion from the measurements published in centimeter/(centimeter atmosphere) (cm sup-1/(cm-atm)) to the HITRAN common units cm sup-1 /(molecule/cm sup2). Because the absorption of water vapor in these important regions is greater than has been used in model calculations for the Earth's atmospheric absorption, there is a diminished necessity for an hypothesized continuum absorption in the atmosphere.
Derived from text
Molecular Absorption; Solar Radiation; Computer Programs

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040074467 Swedish Defence Research Establishment, Linkoeping
Project Wave Propagation Analysis for Radio, Radar and Electroptical Wavelengths
Gustafsson, O.; Eriksson, G.; Holm, P.; Haegaerd, A.; Karlsson, E.; Oct. 2003; In Swedish
Report No.(s): PB2004-104555; FOI-R-0985-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Propagation of electromagnetic waves has been studied within the defense research project in the C4ISR and EW area Wave propagation analysis of radio, radar and electro optical waves, with concentrations of naval environments during 2001-2003. Methods and models to analyze wave propagation together with meteorological models and methods to enhance the precision and quality of input data to the wave propagation models have been studied. The main purpose has been to improve upon the existing LBM-model (refractive index model) through alternative to ray trace models as PE-model (parabolic equation solver) and investigate methods and ray trace models for optical wave propagation. The meteorological methods of measuring as rocket sounder, water surface temperature measurement with IR-techniques and meteorological methods (the SMHI HIRLAM-model) for predicting atmospheric parameters as temperature and humidity. An international collaboration through WEAG/CEPA organizations is included within the project; Duct Mapping Improvement based on Atmospheric Data Fusion for Naval Purposes, CEPA 1.19. Participators are France, Great Britain, The Netherlands, Germany and Sweden. The study recommends a continuation of the work within the field with more emphasis on verification of the models, continuation of the meteorological methods and models and of the work with optical wave propagations.
NTIS
Wave Propagation; Electromagnetic Radiation; Atmospheric Temperature

20040074492 Helsinki Univ. of Technology, Espoo, Finland
Process-Oriented Investigation of Snow Accumulation, Snowmelt and Runoff Generation in Forested Sites in Finland
Koivusalo, H.; 2002; 94 pp.; In English
Report No.(s): PB2004-105762; TKK-VTR-6; No Copyright; Avail: CASI; A05, Hardcopy

This thesis summarizes development and application of a hydrological model for simulating forest canopy processes, snow accumulation and melt, soil and ground water interactions, and streamflow routing. A motivation behind the model development is to outline a methodology for predicting the influence of land use changes on catchment hydrological processes. In addition, the development aims at providing linkages from the hydrological model to atmospheric models through implementation of surface energy balance and to water quality models through quantification of runoff components. The work started with comparison of two existing snow energy balance models using meteorological and snow data from Northern Finland. Based on the comparison the more simple of the tested snow parameterisations was modified to improve its performance in terms of snow heat balance simulation. The modified snow model was then coupled with a canopy scheme to account for the influence of forest on snow processes. The combined model was applied to clear-cut and coniferous forest sites in Southern Finland to identify the differences in snow mass and energy fluxes between open and forest. Finally, runoff generation in a forested catchment was studied by using two different parameterizations.
NTIS
Snow Cover; Energy Budgets; Ground Water

20040074503 Scripps Institution of Oceanography, La Jolla, CA, USA
From Climate-Change Spaghetti to Climate-Change Distribution. Discussion Paper
Dettinger, M.; Feb. 2004; In English
Report No.(s): PB2004-104744; CAEC-500-04-028; No Copyright; Avail: National Technical Information Service (NTIS)

The uncertainties associated with climate-change projections for California are unlikely to disappear any time soon, and yet important long-term decisions will be needed to accommodate those potential changes. Projection uncertainties have typically been addressed by analysis of a few scenarios, chosen based on availability or to capture the extreme cases among available projections. However, by focusing on more common projections rather than the most extreme projections (using a new resampling method), new insights into current projections emerge: (1) uncertainties associated with future emissions are comparable with the differences among models, so that neither source of uncertainties should be neglected or underrepresented; (2) twenty-first century temperature projections spread more, overall, than do precipitation scenarios; (3) projections of extremely wet futures for California are true outliers among current projections; and (4) current projections that

are warmest tend, overall, to yield a moderately drier California, while the cooler projections yield a somewhat wetter future. The resampling approach applied in this paper also provides a natural opportunity to objectively incorporate measures of model skill and the likelihoods of various emission scenarios into future assessments.
NTIS
Climate Change; Drying Apparatus

20040074505 California Energy Commission, Sacramento, CA, USA
Input Needs for Down-scaling of Climate Data, Discussion Paper
Wigley, T. M. L.; Jan. 2004; In English
Report No.(s): PB2004-104743; CAEC-500-04-027; No Copyright; Avail: National Technical Information Service (NTIS)

This report addresses the external data-input needs for climate data down-scaling, with emphasis on the U.S. western region and a focus on producing high-spatial-resolution climate data for the future. Three down-scaling methods are considered: two types of dynamical down-scaling, using regional climate models (RCMs) or high-resolution global atmospheric General Circulation Models (AGCMs), and statistical down-scaling. In all cases, the quality of the down-scaled product must be dependent on the quality of the driver Atmosphere-Ocean GCM (AOGCM). One must therefore validate both the down-scaling method and the driver model. RCMs can be validated using reanalysis data for the lateral and surface boundary conditions, AGCMs can be validated by driving them with observed surface boundary conditions, and statistical models can be validated using data that were not employed in model calibration. AOGCM validation is performed by comparing their simulations of present-day climate with observed and reanalysis data. Emphasis here should be placed on the driver GCMs ability to simulate reliably present-day conditions for both the boundary conditions and fluxes and the natural modes of variability (such as ENSO) that are important in the study region. Models that perform less well in present-day validation may still be useful for investigating changes in climate. The choice of driver GCM should consider not only present day validation performance, but also the models simulations of future changes in climate over the study region. With individual models there are problems in identifying anthropogenic precipitation signals because of the large magnitude of natural variability that is common to the U.S. western region. These signal-to-noise ratio problems are exacerbated by inter-model differences in their responses to external forcing. Because different models give a wide range of results for future climate, particularly for precipitation, models should be chosen to span the range of future possibilities.
NTIS
Atmospheric General Circulation Models; Climate Models; Mathematical Models

20040074514 Lawrence Livermore National Lab., Livermore, CA
Active Climate Stabilization: Practical Physics-Based Approaches to Prevention of Climate Change
Teller, E.; Hyde, R.; Wood, L.; Apr. 18, 2002; In English
Report No.(s): DE2004-15005941; UCRL-JC-148012; No Copyright; Avail: National Technical Information Service (NTIS)

We offer a case for active technical management of the radiative forcing of the temperatures of the Earth's fluid envelopes, rather than administrative management of atmospheric greenhouse gas inputs, in order to stabilize both the global- and time-averaged climate and its mesoscale features. We suggest that active management of radiative forcing entails negligible--indeed, likely strongly negative--economic costs and environmental impacts, and thus best complies with the pertinent mandate of the UN Framework Convention on Climate Change. We propose that such approaches be swiftly evaluated in sub-scale in the course of an intensive international program.
NTIS
Atmospheric Chemistry; Climate Change; Greenhouse Effect; Mesoscale Phenomena

20040075016 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ozone Climatological Profiles for Version 8 TOMS and SBUV Retrievals
McPeters, R. D.; Logan, J. A.; Labow, G. J.; 2003; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A new altitude dependent ozone climatology has been produced for use with the latest Total Ozone Mapping Spectrometer (TOMS) and Solar Backscatter Ultraviolet (SBUV) retrieval algorithms. The climatology consists of monthly average profiles for ten degree latitude zones covering from 0 to 60 km. The climatology was formed by combining data from SAGE II (1988 to 2000) and MLS (1991-1999) with data from balloon sondes (1988-2002). Ozone below about 20 km is based on balloons sondes, while ozone above 30 km is based on satellite measurements. The profiles join smoothly between 20 and 30 km. The ozone climatology in the southern hemisphere and tropics has been greatly enhanced in recent years by the addition of balloon

sonde stations under the SHADOZ (Southern Hemisphere Additional Ozonesondes) program. A major source of error in the TOMS and SBUV retrieval of total column ozone comes from their reduced sensitivity to ozone in the lower troposphere. An accurate climatology for the retrieval a priori is important for reducing this error on the average. The new climatology follows the seasonal behavior of tropospheric ozone and reflects its hemispheric asymmetry. Comparisons of TOMS version 8 ozone with ground stations show an improvement due in part to the new climatology.
Author
Ozone; Total Ozone Mapping Spectrometer; Troposphere; Climatology; Backscattering

20040075030 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of a Multi-Decadal Simulation of Stratospheric Ozone by Comparison with Total Ozone Mapping Spectrometer (TOMS) Observations
Douglass, Anne R.; Stolarski, Richard S.; Steenrod, Steven; Pawson, Steven; 2003; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

One key application of atmospheric chemistry and transport models is prediction of the response of ozone and other constituents to various natural and anthropogenic perturbations. These include changes in composition, such as the previous rise and recent decline in emission of man-made chlorofluorcarbons, changes in aerosol loading due to volcanic eruption, and changes in solar forcing. Comparisons of hindcast model results for the past few decades with observations are a key element of model evaluation and provide a sense of the reliability of model predictions. The 25 year data set from Total Ozone Mapping Spectrometers is a cornerstone of such model evaluation. Here we report evaluation of three-dimensional multi-decadal simulation of stratospheric composition. Meteorological fields for this off-line calculation are taken from a 50 year simulation of a general circulation model. Model fields are compared with observations from TOMS and also with observations from the Stratospheric Aerosol and Gas Experiment (SAGE), Microwave Limb Sounder (MLS), Cryogenic Limb Array Etalon Spectrometer (CLAES), and the Halogen Occultation Experiment (HALOE). This overall evaluation will emphasize the spatial, seasonal, and interannual variability of the simulation compared with observed atmospheric variability.
Author
Total Ozone Mapping Spectrometer; Ozone; Stratosphere; Atmospheric Chemistry; Aerosols; Microwave Sounding

20040075042 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Intercontinental Transport of Tropical Ozone from Biomass Burning: Views from Satellite and SHADOZ (Southern Hemisphere Additional Ozonesondes)
Thompson, A. M.; Witte, J. C.; FROM; Chatfield, R. B.; Guam, H.; 2003; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy

There has been interest in the connection between tropical fires and ozone since about 1980. Photochemically reactive gases released by fires (e.g. NO, CO, volatile organic carbon) interact as they do in an urban environment to form ozone. Interacting with chemical sources, tropical meteorology plays a part in tropospheric ozone distributions in the tropics, through large-scale circulation, deep convection, and regional phenomena like the West African and Asian monsoons. An overview of observations, taken from satellite and from ozone soundings, illustrates regional influences and intercontinental- range ozone transport in the tropics. One of the most striking findings is evidence for impacts of Indian Ocean pollution on the south Atlantic ozone maximum referred to as the "ozone paradox" [Thompson et al., GRL, 2000; JGR, 2003; Chatfield et al., GRL, 20031.
Author
Tropical Meteorology; Fires; Satellite Sounding; Photochemical Reactions; Ozone; Troposphere

20040075070 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Verification of the Mountain Wave Forecast Model's Stratospheric Turbulence Forecasts Using Sounding Data and Pilot Reports
Miller, Scott M.; Mar. 2004; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422911; AFIT/GM/ENP/04-10; No Copyright; Avail: CASI; A04, Hardcopy

Since stratospheric turbulence (Stratoturb) is becoming an increased concern to the Air Force, the threat of damage to aircraft must be addressed. Therefore, the Air Force Weather Agency (AFWA) requests an accurate Stratoturb forecast model. In 2002, The Mountain Wave Forecast Model (MWFM) was modified in order to develop a Stratoturb forecast tool. Turbulence forecasts generated twice daily by the MWFM for locations over East Asia over a period of thirty days were compared to output from the Rawindsonde Observation (RAOB) program to determine if the model agreed with the program

output. Although the results were promising, verification by aircraft crews flying through the stratosphere would improve the confidence of this forecast model, improving the forecaster s ability to warn pilots and alleviate the potential danger associated with flying through areas of Stratoturb. This thesis continues that research. Three major changes were made. Pilot reports (PIREPs) were collected for verification of MWFM forecasts, the model s time resolution was increased for better comparison to PIREPs, and data were collected for nearly a year to determine season performance. Model performance at ten sounding locations was analyzed to determine if performance improved over a certain terrain type. Model performance at three atmospheric levels (100-70mb, 70- 50mb, and 50-30mb) was also compared to determine if the model performed better at a certain altitude. Results suggest that the MWFM is superior to previous methods of detecting Stratoturb. Therefore, the MWFM is recommended to AFWA for operational use.
DTIC
Forecasting; Mathematical Models; Meteorology; Mountains; Stratosphere; Turbulence; Weather Forecasting

20040075098 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Statistically-Based Method for Predicting Fog and Stratus Dissipation
Lussier, Louis L., III; Mar. 2004; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422962; AFIT/GM/ENP/04-09; XC-15WS/IL; No Copyright; Avail: CASI; A05, Hardcopy

The method is a success in producing forecasts for ceiling and visibility criteria that had never previously been examined. It is suggested that the 15 OWS incorporate this methodology into their operational forecasting routine. Ceiling forecasts at Dover AFB and McGuire AFB show improvements over conditional climatology ranging from 1-51% with an average improvement of 19.2% when verified against an independent data set. McGuire AFB visibility forecasts show an average improvement over conditional climatology of 3%. These findings are of particular importance to the Air Force in general and specifically to the 15th Operational Weather Squadron (15 OWS) who produces forecasts for these airfields. Demonstrating a method superior to conditional climatology is expected to provide improved forecasts and flight operations in this region. The two forecasts for Andrews AFB show relatively low mean square errors, but are unable to consistently improve on conditional climatology, demonstrating an average decrease in forecasting skill of 42%. Small samples of data could be the reason for the decrease in skill. The Dover visibility forecast also shows negative forecast skill, with an average decrease of 39%. The method is a success in producing forecasts for ceiling and visibility criteria that had never previously been examined. Further research into the forecasts could produce a powerful tool consistently able to defeat conditional climatology. It is suggested that the 15 OWS incorporate this methodology into their operational forecasting routine.
DTIC
Fog; Fog Dispersal; Meteorological Parameters; Predictions; Stratus Clouds

20040075099 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Forecasting Advective Sea Fog with the Use of Classification and Regression Tree Analyses for Kunsan Air Base
Lewis, Danielle M.; Mar. 2004; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422963; AFIT/GM/ENP/04-08; XC-15WS/IL; No Copyright; Avail: CASI; A06, Hardcopy

Advective sea fog frequently plagues Kunsan Air Base (AB), Republic of Korea, in the spring and summer seasons. It is responsible for a variety of impacts on military operations, the greatest being to aviation. To date, there are no suitable methods developed for forecasting advective sea fog at Kunsan, primarily due to a lack of understanding of sea fog formation under various synoptic situations over the Yellow Sea. This work explored the feasibility of predicting sea fog development with a 24-hour forecast lead time. Before exploratory data analysis was performed, a geographical introduction to the region was provided along with a discussion of basic elements of fog formation, the physical properties of fog droplets, and its dissipation. Examined in this work were data sets of Kunsan surface observations, upstream upper air data, sea surface temperatures over the Yellow Sea, and modeled analyses of gridded data over the Yellow Sea. A complete ten year period of record was examined for inclusion into data mining models to find predictive patterns. The data were first examined using logistic regression techniques, followed my classification and regression tree analysis (CART) for exploring possible concealed predictors. Regression revealed weak relationships between the target variable (sea fog) and upper air predictors, with stronger relationships between the target variable and sea surface temperatures. CART results determined the importance between the target variable and upstream upper air predictors, and established specific criteria to be used when forecasting target variable events. The results of the regression and CART data mining analyses are summarized as forecasting guidelines to air forecasters in predicting the evolution of sea fog events and advection over the area.
DTIC
Advection; Airports; Classifications; Fog; Forecasting; Marine Environments; Marine Meteorology; Regression Analysis; Seas

20040075117 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Developing a Forecast Tool for Cloud-to-Ground Lightning in the North Central and Northeastern USA

Folsom, Manuel I., Jr; Mar. 2004; 134 pp.; In English

Report No.(s): AD-A422988; AFIT/GM/ENP/04-05; XC-15WS/IL; No Copyright; Avail: CASI; A07, Hardcopy

Cloud-to-ground (CG) lightning is a hazard to the Air Force for both air and ground operations Forecasting CG lightning is a necessary and extremely important requirement for Air Force meteorologists and forecasters. The 15th Operational Weather Squadron requested a forecast tool capable of predicting CG lightning within a 25 and 10 nautical mile radius of the 13 military locations in their area of responsibility. To fulfill their request, forecast decision tools were created using a Classification and Regression Tree (CART) data analysis program. Four decision trees were produced for each location using the period of record from March through September, 1993 to 2002, CART compared the upper air stability indices and surface data at 12-hour intervals with CG lightning data occurring within the next 12 hours to determine prediction rules. Data from 2003 were used as independent verification of the decision trees. The CART decisions trees were examined using contingency tables and verification tests to determine the value of the products created. The straight forward forecast rules and verification test results confined that the decision trees would be a valuable prediction tool. Combined with forecaster knowledge, forecast models and other tools, the decision trees would provide an excellent forecast method for determining the occurrence of CG lightning. Therefore, the results are recommended to the 15th Operational Weather Squadron for use as a CG lightning forecast tool.

DTIC

Cloud-to-Ground Discharges; Forecasting; Lightning; United States; Weather Forecasting

20040075134 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Theoretical Models for Aircraft Availability: Classical Approach to Identification of Trends, Seasonality, and System Constraints in the Development of Realized Models

Wall, David B.; Mar. 2004; 214 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423009; AFIT/GLM/ENS/04-20; No Copyright; Avail: CASI; A10, Hardcopy

This research provides forecasting models that will enable the AMC directorate of Logistics analysis section to predict aircraft availability and provide the TACC with a monthly forecast of the number of aircraft that will be available to fulfill AMC mission requirements.

DTIC

Aircraft Models; Forecasting; Mathematical Models; Models; Systems Engineering; Trends

20040075165 Air Force Research Lab., Hanscom AFB, MA

Multipoint Observations of Equatorial Plasma Bubbles

Burke, W. J.; Huang, C. Y.; Valladares, C. E.; Machuzak, J. S.; Gentile, L. C.; May 31, 2003; 8 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A423049; AFRL-VS-HA-TR-2004-1080; No Copyright; Avail: CASI; A02, Hardcopy

This paper compares evening sector measurements by the Jicamarca unattended long-term studies of the ionosphere and atmosphere (JULIA) radar, the Ancon scintillation monitor, and plasma density sensors on Defense Meteorological Satellite Program (DMSP) satellites. During more than half of the 110 nights of JULIA operations in 1998 and 1999, backscatter was observed from plumes extending above the layer of bottomside spread F. On 98% of the nights with no plumes, the S index measured at Ancon was <0.8. On -90% nights with plumes, S > 0 8. DMSP F14 crossed the magnetic equator within 7.5 deg longitude of Ancon near the 2100 local time (LT) meridian on 61 nights. During 32 overpasses, DMSP detected no equatorial plasma bubbles (EPBs) and JULIA detected no plumes. DMSP encountered EPBs on only 9 of the remaining 29 nights when JULIA observed plumes. Two plumes detected by JULIA on 15 Apr 99 did not coincide with nearby EPBs crossed by the two satellites on the same evening. We compared the seasonally average percent of nights with S > 0.8 at Ancon with the percent of orbits in which a DMSP satellite detected EPBs..

DTIC

Meteorological Satellites; Plasma Bubbles; Plasma Oscillations

20040075514 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Comparison of a Conceptual Model and Objective Indicators of Extratropical Transition in the Western North Pacific

Fox, Gregory D.; Mar. 2004; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422964; AFIT/GM/ENP/04-06; No Copyright; Avail: CASI; A05, Hardcopy

The primary purpose of this research is to provide guidance to forecasters from the Joint (Air Force/Navy) Typhoon Warning Center (JTWC) in Pearl Harbor to use in differentiating between the stages of extratropical transition (ET) of tropical cyclones (TCs). Not only is ET relevant to the Department of Defense, since JTWC stops providing TC warnings once they have undergone ET, but it is also applicable to the meteorological community since there currently "is no commonly accepted definition of ET" (Jones et al 2003). This research compares the results of a conceptual model of ET using subjective satellite analysis with the results of objective indicators based on Navy Operational Global Atmospheric Prediction System (NOGAPS) model analyses. The ultimate goal is to find a way to reduce the negative impact of incorrect TC forecasting by providing tools which are more objective in defining stages of ET. This work discusses the birth, growth, and death of TCs by describing what energy sources are necessary for their growth and dissipation. Recent studies provide a conceptual model of ET with definitions of two stages and ways to use satellite analysis to identify them (Klein et al. 2000). While this conceptual model was being analyzed with data from the western North Pacific Ocean, TCs were also being analyzed using data from the Atlantic Ocean (Hart and Evans 2001). The research from the Atlantic led to the exploitation of objective indicators in a hodograph-like display (Evans and Hart 2003).
DTIC
Cyclones; Tropical Storms; Weather Forecasting

20040075517 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Feasibility of Using Classification Analyses to Determine Tropical Cyclone Rapid Intensification
Leffler, Jonathan W.; Mar. 2004; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422910; AFIT/GM/ENP/04-07; No Copyright; Avail: CASI; A06, Hardcopy

Tropical cyclone intensity techniques developed by Dvorak have thus far been regarded by tropical meteorologists as the best identification and forecast schemes available using satellite imagery. However, in recent years, several ideologies have arisen which discuss alternative means of determining typhoon rapid intensification or weakening in the Pacific. These theories include examining channel outflow patterns, potential vorticity superposition and anomalies, tropical upper tropospheric trough interactions, environmental influences, and upper tropospheric flow transitions. It is now possible to data mine these atmospheric parameters thought partly responsible for typhoon rapid intensification and weakening to validate their usefulness in the forecast process. Using the latest data mining software tools, this study used components of NOGAPS analyses along with selected atmospheric and climatological predictors in classification analyses to create conditional forecast decision trees. The results of the classification model show an approximate R2 of 0.68 with percent error misclassifications of 13.5% for rapidly weakening typhoon events and 21.8% for rapidly intensifying typhoon events. In addition, a merged set of suggested forecast splitting rules was developed. By using the three most accurate predictors from both intensifying and weakening storms, the results validate the notion that multiple parameters are responsible for rapid changes in typhoon development.
DTIC
Amplification; Classifications; Cyclones; Tropical Storms; Weather Forecasting

20040075540 NASA Langley Research Center, Hampton, VA, USA
New Particle Formation in Anthropogenic Plumes Advecting from Asia Observed During TRACE-P
Weber, R. J.; Lee, S.; Chen, G.; Wang, B.; Kapustin, V.; Moore, K.; Clarke, A. D.; Mauldin, L.; Kosciuch, E.; Cantrell, C., et al.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D21, pp. 35-1 - 35-13; In English
Contract(s)/Grant(s): NCC1-411; Copyright; Avail: Other Sources

The characteristics and sources of what are believed to be newly formed 3 to 4 nm particles in anthropogenic plumes advecting from Asian are reported. Airborne measurements were made from March to April 2001 as part of the NASA TRACE-P experiment at latitudes ranging from North of the Philippines to Northern Japan (20 to 45 deg. N). In the more polluted plumes, high concentrations of 3 to 4 nm diameter particles (less than 100/qu cm) were observed both within and along the upper outer edges of plumes that were identified by enhanced carbon monoxide and fine particulate sulfate concentrations. The results from two research flights are investigated in detail. Three to four-nm particle concentrations are generally correlated with gas phase sulfuric acid and found in regions of low surface areas relative to the immediate surroundings or where there are steep transitions to lower surface areas. Sulfuric acid and surface area concentrations in the most polluted plume reached 6 x l0(exp 7) and 750 micro sq m/qu cm, respectively, in regions of particle formation. In contrast to these anthropogenic plumes, few 3 to 4 nm particles were observed in the clean background and few were detected within a volcanic plume where the studies highest H2SO4 concentrations (less than lO(exp 8)/qu cm) were recorded. Enhanced SO2 concentrations in the range of approximately 2 to 7 ppb, in conjunction with other unidentified, possibly coemitted species, appear to be the driving factor for nucleation. (0345, 4801); 0322 Atmospheric Composition and Structure: Constituent sources

and sinks; 0345 Atmospheric Composition and Structure: Pollution-urban and regional (0305); 4801 Oceanography: Biological and Chemical: Aerosols (0305).
Author
Advection; Aerosols; Atmospheric Composition; Carbon Monoxide; Nanoparticles; Particulates

20040075652 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: February 2004
February 2004; In English; In Japanese; Copyright; Avail: Other Sources

The CD-ROM concerning the February 2004 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
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20040075669 NASA Marshall Space Flight Center, Huntsville, AL, USA
Range Commanders Council Meteorology Group 88th Meeting: NASA Marshall Space Flight Center Task Report, 2004
Roberts, Barry C.; [2004]; 3 pp.; In English; Range Commanders Council Meteorology Group 88th Meeting, 10-12 May 2004, Silver Springs, MD, USA
Report No.(s): RCC-MG88thTask; No Copyright; Avail: CASI; A01, Hardcopy

Supported Return-to-Flight activities by providing surface climate data from Kennedy Space Center used primarily for ice and dew formation studies, and upper air wind analysis primarily used for ascent loads analyses. The MSFC Environments Group's Terrestrial and Planetary Environments Team documented Space Shuttle day-of-launch support activities by publishing a document in support of SSP Return-to-Flight activities entitled "Space Shuttle Program Flight Operations Support". The team also formalized the Shuttle Natural Environments Technical Panel and chaired the first special session of the SSP Natural Environments Panel meeting at KSC, November 4-7,2003.58 participants from NASA, DOD and other government agencies from across the country attended the meeting.
Derived from text
Meteorology; Upper Atmosphere; Planetary Environments; Climate

20040075676 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tropical Cyclone Precipitation Types and Electrical Field Information Observed by High Altitude Aircraft Instrumentation
Hood, Robbie E.; Blakeslee, Richard; Cecil, Daniel; LaFontaine, Frank J.; Heymsfield, Gerald; Marks, Frank; [2004]; 1 pp.; In English; 26th AMS Conference on Hurricanes and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

During the 1998 and 200 1 hurricane seasons of the Atlantic Ocean Basin, the Advanced Microwave Precipitation Radiometer (AMPR), the ER-2 Doppler (EDOP) radar, and the Lightning Instrument Package (LIP) were flown aboard the National Aeronautics and Space Administration (NASA) ER-2 high altitude aircraft as part of the Third Convection And Moisture Experiment (CAMEX-3) and the Fourth Convection And Moisture Experiment (CAMEX-4). Several hurricanes and tropical storms were sampled during these experiments. A rainfall screening technique has been developed using AMPR passive microwave observations of these tropical cyclones (TC) collected at frequencies of 10.7, 19.35,37.1, and 85.5 GHz and verified using vertical profiles of EDOP reflectivity and lower altitude horizontal reflectivity scam collected by the National Oceanic and Atmospheric Administration (NOM) P-3 radar. Matching the rainfall classification results with coincident electrical field information collected by the LIP readily identifl convective rain regions within the TC precipitation fields. Strengths and weaknesses of the rainfall classification procedure will be discussed as well as its potential as a real-time analysis tool for monitoring vertical updrafl strength and convective intensity from a remotely operated or uninhabited aerial vehicle.
Author
Tropical Storms; Hurricanes; Data Acquisition

20040075698 NASA Marshall Space Flight Center, Huntsville, AL, USA
Strong Updraft Feature Associated with Hurricane Earl During Landfall
Roberts, Barry C.; Knupp, Kevin R.; [2004]; 2 pp.; In English; 26th Conference on Hurricanes and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy

On 2-3 September 1998 hurricane Earl made landfall along the Gulf of Mexico coast, east of Panama City, FL. The University of Alabama in Huntsville Mobile Integrated Profiling System (MIPS) was located at the airport in Tallahassee, FL and made measurements of Earl with a 915 MHz Doppler wind profiler as the system moved across the Florida panhandle. As the center of Earl approached MIPS, a particularly strong updraft feature, having a magnitude of approx. 15 m/s within the lowest 3.0 km above ground level was associated with a rain band. An analysis of the changes hurricane Earl underwent as it made landfall are presented. Measurements used include surface thermodynamic and pressure observations, lightning data, National Weather Service Doppler Weather Surveillance Radar (WSR-88D) data, and Geostationary Earth Orbiting Satellite (GOES) data. Then an analysis focusing on the boundary layer properties and the updraft feature's depth, intensity and duration as measured by the MIPS 915 MHz Doppler wind profiler are presented.
Author
Hurricanes; Mesoscale Phenomena; Vertical Air Currents

20040075724 NASA Ames Research Center, Moffett Field, CA, USA
Hot Water Decoded
Schwenke, David W.; Research and Technology 1997; September 1998, pp. 119; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A detailed knowledge of the rotation-vibration spectrum of water vapor is required in a wide variety of disciplines, from atmospheric chemistry, observations through Earth's atmosphere, and the search for water-based life, to the modeling of cool oxygen-rich stars. This i s because spectroscopy, the analysis of light intensity as a function of frequency, is the only means available for the study of distant objects, and water has ubiquitous presence in the Universe. Every molecule has a unique set of frequencies at which it absorbs light, and the pattern of line positions and line strengths allows precise identification and concentration analyses from afar.
Derived from text
Atmospheric Chemistry; Water Vapor; Luminous Intensity; Oxygen; Decoding

20040075756 NASA Ames Research Center, Moffett Field, CA, USA
Spreading and Growth of Contrails in a Sheared Environment
Jensen, Eric; Research and Technology 1997; September 2004, pp. 169-171; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The evolution of persistent contrails (condensation trails) has been modeled over time scales of 15-180 minutes using a large-body simulation model with detailed microphysics. Model results have been compared to satellite and in situ measurements of persistent contrails from the Subsonic Aircraft: Contrail and Cloud Effects Special Study. In particular, the evolution of the persistent contrail observed on May 12, 1996, was simulated. In simulations with large ambient supersaturations and moderate wind shear, crystals with lengths greater than 200 microns ate generated within 35 minutes by depositional growth. In situ measurements in the May 12 contrail case showed that these large crystals did in fact form. The large crystals fall rapidly and the contrail s horizontal extent increases as a result of wind shear. Strong radiative heating (with rates up to 30 kelvin per day) drives a local updraft and lofts the contrail core several hundred meters. The observed rate of contrail spreading and maintenance of optical depths larger than 0.1 can be explained simply by the growth and precipitation of ice crystals that nucleate during the initial contrail formation if the environmental humidity is high enough (relative humidity with respect to ice greater than 125%). This result is consistent with the high humidities observed in regions where the persistent contrails formed on May 12. Also, the simulations indicate that the humidity must be high throughout a depth of at least several hundred meters below the contrail to allow the crystals to continue growing as they fall.
Derived from text
Contrails; Simulation; Spreading; Wind Shear

20040075765 NASA Ames Research Center, Moffett Field, CA, USA
The Roles of Aerosols in Stratospheric Ozone Chemistry
Strawa, Anthony W.; Pueschel, Rudolf F.; Ferry, Guy V.; Research and Technology 1997; September 1998, pp. 171-172; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A main objective of the study was to determine the amount of aerosol surface area, particularly that of black carbon aerosol (BCA), available for reaction with stratospheric constituents and to assess, if possible, the importance of these reactions. The AWI collect aerosol and BCA particles on thin palladium wires that are exposed to the ambient air in a controlled manner. The samples are returned to the laboratory for subsequent analysis. The product of the AWI analysis is the size, surface area, and volume distributions, and the morphology and elemental composition of the aerosols and BCA. Modifications to the AWI data analysis procedures were required i n which the collection of BCA is modeled as a fractal aggregate. The new analysis results in an increase in BCA surface area of approximately 24 and an increase in mass of 10 from the previous method. The character of the BCA and its area distributions measured during POLARIS are compared with those made by the AWI on past missions; the comparisons show trends in the spatial and temporal distribution.
Derived from text
Aerosols; Atmospheric Composition; Ozone

20040075771 NASA Ames Research Center, Moffett Field, CA, USA
Developing and Validating an Aerosol Model for the Upper Troposphere
Tabazadeh, Azadeh; Research and Technology 1997; September 1998, pp. 172-173; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The main purpose of this research was to develop and validate an upper tropospheric aerosol model (UTAM). With this model it is possible to calculate the following quantities: (1) the equilibrium partitioning of various species between the gas and aqueous phases for a wide variety of environmental conditions, (2) the variation in the inorganic aerosol composition as a function of temperature and relative humidity, (3) the solution compositions at which inorganic salt precipitation might occur in upper tropospheric aerosols, and (4) the deliquescence relative humidity (in the atmosphere this is the ambient relative humidity at which a completely dry aerosol becomes thermodynamically unstable and will transform into an aqueous solution droplet) of ammoniated or nitrated aerosols under upper tropospheric conditions. Predicting the equilibrium partitioning has important applications in both gas- and aqueous-phase chemistry modeling calculations, and determining the aerosol composition and salt precipitation can play a significant role in predicting the frequency of cirrus cloud occurrence in the upper troposphere.
Derived from text
Aerosols; Atmospheric Models; Troposphere; Vapor Phases; Cirrus Clouds; Drops (Liquids)

20040075789 NASA Ames Research Center, Moffett Field, CA, USA
Measuring Tropospheric Nitrogen
Podolske, James R.; Research and Technology 1997; September 1998, pp. 164; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Assessing the effect of the current fleet of commercial subsonic aircraft on Earth's atmosphere requires detailed knowledge of the nitrogen chemistry of the upper troposphere and lower stratosphere. Understanding of this problem has been hampered by large uncertainties both in the abundances of the odd-nitrogen reservoir species and in the partitioning of reactive nitrogen between nitric oxide (NO) and nitrogen dioxide (NO2). Among the nitrogen reservoir species, nitric acid (HNO3) is expected to be one of the predominant compounds. Current instrumentation is inadequate for measuring HNO3 and NO2 with the speed and accuracy required to advance understanding in this area.
Derived from text
Troposphere; Nitrogen Oxides; Nitrogen Dioxide; Nitrogen; Commercial Aircraft; Earth Atmosphere

20040075804 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of Stratosphere-Troposphere Exchange
Pfister, Lenny; Research and Technology 1997; September 1998, pp. 162-163; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

This project has provided meteorological coordination for the ER-2 aircraft POLARIS field mission along with the computer support for project scientists. (The POLARIS acronym stands for Photochemistry of Ozone Loss in the Arctic Region in Summer.) Meteorological satellite products, both imagery and cloud parameters along ER-2 flight tracks, were also provided. The POLARIS mission undertook three major field campaigns in FY97, each with a duration of about 3.5 weeks. Work has continued on the analysis of lidar data from the Tropical Ozone Transport Experiment. An important result is evidence that subvisible cirrus clouds near the tropical tropopause can be formed by local cooling because of a combination of large-scale uplift and inertia-gravity waves. This is in addition to the well-established convective outflow mechanism for

forming subvisible cirrus clouds. The figure shows the back trajectories on the 380-kelvin isentropic surface from 16 points along the flight track on February 13, 1996. Subvisible cirrus clouds were observed near the tropopause at north latitude 5 and 10 degrees. Most of the parcels have originated in the western Pacific where convection is prevalent, have been transported northward and eastward and warmed as a result of adiabatic descent, and then cooled by adiabatic ascent as they travel southward. The warming is about 5 degrees, implying a doubling of the saturation mixing ratio. This means that any cloud particles left after convective outflow are unlikely to have survived. Thus, the observed thin cirrus clouds are almost certainly a result of recondensation in response to cooling.
Derived from text
Stratosphere; Troposphere; Atmospheric Circulation; Gravity Waves; Photochemical Reactions

20040075828 NASA Ames Research Center, Moffett Field, CA, USA
Convectively Generated Gravity Waves
Pfister, Lenny; Research and Technology 1997; September 1998, pp. 163; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Convectively generated gravity waves are one of the major uncertainties in the momentum budget of the stratosphere. Recent momentum budget studies have shown that several phenomena, including the polar night jet in the Antarctic winter stratosphere, the zonal winds in the summer midlatitude stratosphere, and the quasibiennial oscillation, cannot be explained by topography gravity-wave forcing and planetary-wave forcing alone. It is clear that convection generates significant gravity-wave energy; the problem is that convection is a sufficiently complex phenomena, and the data sufficiently sparse, that a clear picture of the amplitudes and phase speeds of convectively generated gravity waves has yet to emerge. Progress on the research is described.
Derived from text
Gravity Waves; Convection; Planetary Waves; Momentum Transfer

20040075853 National Environmental Satellite Service, Washington, DC, USA, NASA Langley Research Center, Hampton, VA, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA, Colorado Univ., Boulder, CO
Satellite Instrument Calibration for Measuring Global Climate Change. Report of a Workshop at the University of Maryland Inn and Conference Center, College Park, MD. , November 12-14, 2002
Ohring, G.; Wielicki, B.; Spencer, R.; Emery, B.; Datla, R.; Mar. 2004; In English
Report No.(s): PB2004-105175; NISTIR-7047; No Copyright; Avail: National Technical Information Service (NTIS)

Measuring the small changes associated with long-term global climate change from space is a daunting task. To address these problems and recommend directions for improvements in satellite instrument calibration some 75 scientists, including researchers who develop and analyze long-term data sets from satellites, experts in the field of satellite instrument calibration, and physicists working on state of the art calibration sources and standards met November 12 - 14, 2002 and discussed the issues. The workshop defined the absolute accuracies and long-term stabilities of global climate data sets that are needed to detect expected trends, translated these data set accuracies and stabilities to required satellite instrument accuracies and stabilities, and evaluated the ability of current observing systems to meet these requirements. The workshop's recommendations include a set of basic axioms or overarching principles that must guide high quality climate observations in general, and a roadmap for improving satellite instrument characterization, calibration, inter-calibration, and associated activities to meet the challenge of measuring global climate change. It is also recommended that a follow-up workshop be conducted to discuss implementation of the roadmap developed at this workshop.
NTIS
Climate Change; Measuring Instruments; Satellite Instruments; Calibrating

20040076963 NASA Marshall Space Flight Center, Huntsville, AL, USA
Classification of Tropical Oceanic Precipitation Using High Altitude Aircraft Microwave and Electric Field Measurements
Cecil, Daniel J.; LaFontaine, Frank J.; Hood, Robbie E.; Blakeslee, Richard; Mach, Douglas; Heymsfield, Gerald; 2004; 1 pp.; In English; 26th AMS Conference on Hurricanes and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

A physically intuitive and computationally simple precipitation mapping algorithm has been developed for use with the airborne Advanced Microwave Precipitation Radiometer (AMPR). The algorithm is based on microwave emission and scattering properties of precipitation. Specifically, emission by liquid water allows increasing brightness temperatures at low

frequencies to be interpreted as increasing rain rates. Scattering by large hydrometeors (particularly graupel and hail) causes relative minima in the brightness temperatures, with progressively larger hydrometeors scattering progressively longer wavelengths. The vigor of convection is therefore ascertained according to which wavelengths are being significantly scattered. The combination of emission and scattering information from four microwave channels is used to assign a precipitation category, which is related to the liquid rain rate, the vertical extent of precipitation, and the vigor of convection. The qualitative precipitation categories output by the passive microwave algorithm have been verified using coincident radar (ER-2 Doppler Radar - EDOP) and electric field measurements (Lightning Instrument Package - LIP). These coincident measurements can subsequently be used to quantify rain rates, hydrometeor contents, and vertical profiles that are typical for each precipitation category. This algorithm has been developed using an airborne platform. Comparisons are being made with other airborne, satellite, and ground-based radar and radiometer data. This technique shows promise both as a research tool and potentially as a real-time analysis tool, which could be applied to either traditional or uninhabited aerial vehicles.
Author
Electrical Measurement; Microwave Emission; Precipitation; Remote Sensing; Airborne Radar; Brightness Temperature

20040076968 Houston Univ., TX, USA
Winds, Water Budgets and Stable Isotopes in Tropical Cyclones using TRMM and QUICKSCAT
Lawrence, James R.; 2003; 5 pp.; In English
Contract(s)/Grant(s): NAG5-7827; No Copyright; Avail: CASI; A01, Hardcopy

Water vapor is the most abundant greenhouse gas in the atmosphere. Changes in its concentration and distribution are controlled by the hydrologic cycle. Because of its capacity to absorb and emit long wave radiation, release latent heat during condensation in storms and reflect short wave radiation when clouds form it has a major impact on Global climate change. The stable isotope ratios of water are H20 H2l6O and H0 H2l6O. These ratios change whenever water undergoes a phase change. They also change in both rain and water vapor whenever an air parcel is exposed to rain. In addition the relative changes in the two ratios differ as a &nction of the relative humidity. In short, the stable isotope ratios in water vapor in the atmosphere contain an integrated history of the processes affecting the concentration and distribution of water vapor in the atmosphere. Therefore the measurement and interpretation of changes in these stable isotope ratios are a powerful tool matched by no other method in tracing the transport history of water in the atmosphere. Our initial studies under this grant focused on the changes of the stable isotope ratios of precipitation and water vapor in tropical cyclones. The changes in time and space were found to be very large and to trace the transport of water in the storms reflecting changes in basic structural features. Because the stable isotope ratios of rains from tropical cyclones are so low flooding associated with land falling tropical cyclones introduces a negative isotopic spike into the coastal surface waters. In addition the stable isotope ratios of water vapor in the vicinity of tropical cyclones is anomalously low. This suggests that carbonate shelled organisms such as ostracoda living in coastal waters have the potential to record the isotopic spike and thereby provide a long term record of tropical storm activity in sediment cores containing fossil shells. Likewise, tree rings in coastal environments offer a similar potential. We have analyzed the oxygen isotopic composition of ostrcoda shells formed in the floodwaters of Tropical Storm Allison (2001) and discovered the negative isotopic 1 16 spike. Because we had learned that storm activity has a major impact on the stable isotope ratios of water vapor in the tropics and sub-tropics we decided to analyze the isotopic compositions of water vapor in different locations in the tropics. We did this in Puerto Escondido, Mexico in July 1998, near Kwajalein Island in the Pacific in 1999 as part of a TRMM summer field program and in 2001 in Key West, Florida as part of the CAMEX 4 summer field program. Our isotopic studies along with our earlier tropical cyclone studies showed that the low isotopic ratios in water vapor induced by exposure to rains the storms persisted for 48 hours often far away from the original storm site. We also noted that positive isotopic spikes were introduced into atmospheric water vapor if winds were high and extensive sea spray was present. These findings have a significant impact on the interpretation of the stable isotope studies of tropical ice cores found in the high mountain regions of the tropics. The assumption made in interpreting the ice core record is that the source water vapor evaporated from the sea surface is in near isotopic equilibrium with the seawater and undergoes a decrease during its transport that reflects the change in temperature from the sea surface to the site of the ice core. Because an additional isotopic depletion occurs at the sea surface source area that depends on the intensity, duration and size of the tropical rain system the isotopic variations found in the ice cores must take into account changes in past storm activity in the tropics. These systems must be an important source of water vapor to the ice cores because they charge the troposphere with water vapor to a far greater vertical height than evaporation in quiescent regions. Finally, an interest in increased heat transfer in thnterior of tropical cyclones resulting from greater amounts of sea spray is a topic of considerable interest to the research community. Increases in sea spray may be related to rapid changes in the intensity of hurricanes, a feature of hurricanes that currently is very poorly forecast. Project CBLAST of the Hurricane Research Division of NOAA is an active program that uses P3 research aircraft to evaluate this problem. An instrument has been designed and built at the University of Houston that will

be placed on the P3 research aircraft during the 2004 hurricane season. It continuously measures the salt content of rain in hurricanes. Changes in the salt content of the rains should reflect the abundance of sea spray at the sea surface. In this way maps of sea spray intensity in hurricanes may be forthcoming. This should help computer modelers who simulate hurricanes to better understand the potential of changes in sea spray to change the intensity of hurricanes. The cost of designing, building and installing this instrument was borne largely by funding from this NASA grant. A list of presentations at national meetings and publications that were as the result of funding from this NASA grant are found in the report.
Derived from text
Isotopes; Atmospheric Moisture; Cyclones; Hurricanes; Trmm Satellite

20040076972 NASA Marshall Space Flight Center, Huntsville, AL, USA
Classification of Tropical Oceanic Precipitation Using High Altitude Aircraft Microwave and Electric Field Measurements
Cecil, Daniel J.; LaFontaine, Frank J.; Hood, Robbie E.; Blakeslee, Richard; Mach, Douglas; Heymsfield, Gerald; 2004; 1 pp.; In English; 26th AMS Conference on Hurricanes and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

A physically intuitive and computationally simple precipitation mapping algorithm has been developed for use with the airborne Advanced Microwave Precipitation Radiometer (AMPR). The algorithm is based on microwave emission and scattering properties of precipitation. Specifically, emission by liquid water allows increasing brightness temperatures at low frequencies to be interpreted as increasing rain rates. Scattering by large hydrometeors (particularly graupel and hail) causes relative minima in the brightness temperatures, with progressively larger hydrometeors scattering progressively longer wavelengths. The vigor of convection is therefore ascertained according to which wavelengths are being significantly scattered. The combination of emission and scattering information from four microwave channels is used to assign a precipitation category, which is related to the liquid rain rate, the vertical extent of precipitation, and the vigor of convection. The qualitative precipitation categories output by the passive microwave algorithm have been verified using coincident radar (ER-2 Doppler Radar - EDOP) and electric field measurements (Lightning Instrument Package - LIP). These coincident measurements can subsequently be used to quantify rain rates, hydrometeor contents, and vertical profiles that are typical for each precipitation category. This algorithm has been developed using an airborne platform. Comparisons are being made with other airborne, satellite, and ground-based radar and radiometer data. This technique shows promise both as a research tool and potentially as a real-time analysis tool, which could be applied to either traditional or uninhabited aerial vehicles.
Derived from text
Electrical Measurement; Microwave Emission; Radiometers; Oceanography; Hydrometeors; High Altitude

20040077085 NASA Ames Research Center, Moffett Field, CA, USA
Calculation of Global Warming Potentials
Lee, Timothy J.; Research and Technology 1999; December 2000, pp. 176-177; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this project are to (1) calculate the global warming potential (GWP) of various halons that are either currently used or may be used in the semiconductor industry, and to (2) compare and contrast the GWP for these various halons in order to evaluate their relative merits with respect to their potential effect on the global environment. In order to accomplish these objectives, there was a need to calculate two quantities reliably: (1) the rovibrational transition energies, and (2) the integrated infrared (IR) band intensities.
Derived from text
Computation; Global Warming; Environment Effects; Infrared Radiation

20040077088 NASA Ames Research Center, Moffett Field, CA, USA
Physical and Chemical Properties of Aerosols and Cloud Particles
Strawa, Anthony W.; Pueschel, Rudolf F.; Drdla. Katja; Ferry, Guy V.; Lowenstein, Max; Bui, Paul; Research and Technology 1999; December 2000, pp. 187-188; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Recent modeling studies have suggested a link between black carbon aerosol (BCA) and ozone chemistry via the reduction of nitric acid, nitrogen dioxide, and ozone on BCA particles. The ozone reaction converts ozone to oxygen molecules, while nitric acid can react to form nitrogen oxide (NO,). Also, a buildup of BCA could reduce the single-scatter albedo of aerosol below a value of 0.98, a critical value that has been postulated to change the radiative effect of stratospheric

aerosol from cooling to warming. Correlations between measured BCA amounts and aircraft usage have been reported.
Derived from text
Aerosols; Chemical Properties; Stratospheric Warming; Carbon; Nitrogen Oxides

20040077118 NASA Ames Research Center, Moffett Field, CA, USA
Reduction of Trade-Cumulus Cloud Cover Due to Solar Heating by Dark Haze
Ackerman, Andrew; Research and Technology 1999; December 2000, pp. 189-190; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The radiative forcings of aerosols represent a leading source of uncertainty in recent assessments of radiative forcings due to industrial activity. Although aerosol residence times are short (approximately one week or less, compared to approximately 50 years for carbon dioxide molecules), and they influence the radiation budget only during the day, it is estimated that by increasing reflection of sunlight, the cooling effects of aerosols may offset the radiative forcing (globally averaged). The traditional radiative forcings due to aerosols are (1) direct, by which aerosols directly scatter and absorb sunlight (cooling and heating effects, respectively), and (2) indirect, by which aerosols increase cloud albedo, thereby reflecting more sunlight back to space (a cooling effect). Globally integrated, these forcings are estimated to range between 1 and 2 watts per square meter (W/m2). A primary objective of the Indian Ocean Experiment (INDOEX) was to quantify the indirect forcing of aerosols. Although a murky haze covered the Arabian Sea (during the northeast monsoon, with predominant flow off the Indian subcontinent), few clouds were found. Perhaps the presence of dark haze and the lack of clouds are not merely coincidental, but are connected. Under current evaluation is the possibility that absorption of solar energy by the dark haze dries the air sufficiently to dissipate the clouds.
Derived from text
Cloud Cover; Cumulus Clouds; Haze; Solar Heating; Cloud Physics

20040077164 NASA Ames Research Center, Moffett Field, CA, USA
TRMM/Large-Scale Biosphere Atmosphere Experiment in Amazonia (LBA)
Hipskind, Steve; Craig, Michael; Kalaskey, Tom; Research and Technology 1999; December 2000, pp. 183-184; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The TRMMILBA mission was conducted in January and February, 1999, from several sites in the lower Amazonian region of Brazil. TRMM i s the Tropical Rainfall Measuring Mission satellite. The experiment was conducted as part of the larger umbrella mission, Large-Scale Biosphere/Atmosphere Experiment in Amazonia (LBP,). TRh?,WLB.*. was one in a series of global field experiments that were planned to obtain ground validation measurements in support of the TRMM satellite mission. The objective of the field campaign was to obtain measurements for a tropical continental site, which would provide for the validation of the physical assumptions required for the retrieval of precipitation data from the satellite. To obtain these measurements, TRMM/LBA employed a large and complex suite of measurement platforms deployed to Brazil. The instrumentation consisted of two ground-based Doppler radars, two research aircraft, special radiosonde sites, a vertical profiler, tethersonde, meteorological flux tower, and an array of radiometers, rain gauges, and disdrometers for measuring rainfall drop size distributions. The TRMM satellite carries two primary instruments for obtaining precipitation measurements from space: a passive microwave instrument, the TRMM Microwave Imager (TMI), and the Precipitation Radar (PR). These are the primary instruments for which validation data are required.
Derived from text
Biosphere; Precipitation Measurement; Amazon Region (South America)

20040077175 NASA Ames Research Center, Moffett Field, CA, USA
How Effectively Can Freeze-Drying by Optically Thin, Laminar Cirrus Dehydrate Air Rising Slowly Across the Tropical Tropopause
Jensen, Eric; Ackerman, Andrew; Pfister, Leonhard; Research and Technology 1999; December 2000, pp. 185-186; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Over the past 20 years, many theories have been proposed to explain the extreme dryness of air in the tropical lower stratosphere. Recent observations suggest that the flux of air into the stratosphere may be dominated by slow ascent across the tropopause throughout much of the tropics. In this study, cloud model simulations were used to show that laminar, optically thin cirrus clouds (frequently observed near the tropopause) can effectively freeze-dry air entering the tropical stratosphere. A detailed ice cloud microphysical model coupled to a large-eddy simulation dynamical model was used for these simulations. As shown in the top panel of the figure, if no cloud forms, the slow ascent across the tropopause will eventually increase the

water vapor mixing ratio above 5 parts per million by volume (ppmv). These values are much higher than observed water vapor mixing ratios. However, if we include cloud formation, then the slow ascent drives adiabatic cooling and nucleation of a small number of ice crystals (<10/liter). These crystals grow rapidly and precipitate out within a few hours. The ice crystal nucleation and growth prevents the relative humidity (with respect to ice) from rising above the threshold of ice nucleation (130-160%) and limits the water vapor mixing ratio above the tropopause to 3-4 ppmv (bottom panel of figure). The nucleation threshold depends upon the aerosol composition in the tropopause region, which is not well known. Simulations including gravity waves propagating through the model were also done. Temperature oscillations driven by the waves drive nucleation of larger ice number densities and more complete dehydration of the rising air.
Author
Freeze Drying; Dehydration; Cloud Physics; Cirrus Clouds; Tropopause; Clouds (Meteorology)

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20040075639 Norwegian Defence Research Establishment, Kjeller, Norway
Experience from the NATO Exercise STRONG RESOLVE 2002
Olsen, Richard; Bjerke, Pal; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 5-1 - 5-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For the NATO exercise STRONG RESOLVE 2002, FFI established a Rapid Environmental Assessment Support Centre (REA-SC) in collaboration with the Norwegian Meteorological Institute (met.no), primarily to provide detailed ocean analyses and forecasts to the meteorology/oceanography cell at NATO s Joint Headquarters North in Stavanger, Norway. Forecast and analysis products were based on outputs from ocean circulation models, ocean spectral wave models and from satellite images, and were primarily aimed at supporting the anti-submarine warfare component of the exercise. Products included profiles and sections of sound speed, as well as detailed maps of ocean circulation features indicating the presence of fronts and eddies that can be expected to influence acoustic propagation in the ocean. Some of the key issues facing the oceanographer/analyst are: Models provide a wealth of parameters describing the state of the sea and atmosphere in four dimensions (space and time), although not usually at a resolution required for littoral operations. At high latitudes and in winter conditions, cloud cover and light conditions as a general rule are not amenable to surface observation with optical or IR instruments, so we have emphasized the use of imaging radar. Imaging radar provides very detailed views of the ocean surface, but oceanographic structures are visualized through highly non-linear mechanisms, which sometimes poses difficult challenges for the analyst, and other supporting data becomes very useful. Analyses often need to be prepared within short time frames in preparation for handover briefs, as these are never timed to fit with synoptic schedule that the meteorological community works to or to satellite overpass times. Making sense of large, multi-parameter, data sets for battlefield environmental assessment therefore becomes a time critical problem, and effective means of analysis, visualization and production are a necessity. The complexity of oceanographic and meteorological processes generally require a great deal of operator analysis to arrive at a product that can be utilized by the warfighter.
Derived from text
Oceanography; Meteorology; Forecasting; Satellite Imagery; Ocean Models; Water Waves

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*.

20040075045
Radiobiology, Volume IV, No. 6
Kuzin, A. M., Editor; Lebedinskii, A. V., Editor; FROM, Editor; 1964; 183 pp.; In English; First National Symposium on Radioecology, 10-15 Sep. 1961, Fort Collins, USA
Report No.(s): AEC-tr-6409; Copyright; Avail: CASI; A09, Hardcopy

This issue includes papers, brief communications, letters to the editor, and book reviews. Some of the subjects addressed in the issue include: radiation genetics, radiation effects upon animal, human, and other cells, low radiation doses and chemical protection, mutagens and antimutagens, radiation effects upon chromosomes, and ultraviolet radiation effects.
CASI
Radiation Effects; Radiobiology; Genetics; Cells (Biology); Chromosomes

20040075055 Army Aviation and Missile Command, Redstone Arsenal, AL
Joint Program Planning for Australia/U.S. Robot Medical Assistant on the Battlefield
Potthoff, Thomas O.; Apr. 2004; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422446; AMCOM-MRDEC-TR-AMR-AS-04-02; No Copyright; Avail: CASI; A03, Hardcopy

Recent advances in both medical technologies and teleoperated robotics have presented opportunities for taking advanced medical care into battlefield situations. Research and development, as well as field ready capabilities, are reviewed to identify appropriate functional areas for formulation of an advanced integrated medical care system for battlefield casualties. Areas of special interest to the Australians are identified as are areas of special interest to the USA (U.S.). A Draft Program Plan (DPP) is formulated based on civilian, and military need, and Australian and U. S. materiel development interests. The DPP is presented as a working document to be revised as more data is acquired and additional coordination is performed.
DTIC
Australia; Management Planning; Medical Services; Project Planning; Robotics; Robots; Teleoperators

20040075064 Oregon Univ., Eugene, OR
Novel Strategies for the Identification and Characterization of Selective Estrogen Receptor Modulators (SERMs)
Darimont, Beatrice D.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0359
Report No.(s): AD-A422895; No Copyright; Avail: CASI; A03, Hardcopy

Estrogens promote growth of certain breast endometrial cancers. Selective estrogen receptor modulators (SERMs), ligands that block the activity of estrogen in only selective tissues, allow to control the growth of these cancers while avoiding the many unwanted side effects associated with the use of antiestrogens. The goal of our work is to identify the mechanisms that control the activity of SERMs and to develop efficient high-throughput strategies for the identification of novel SERMs. SERMs exert their activities by binding to the two estrogen receptors, Era and ERb. Ligand binding changes the position of a-helix 12 (H12) in the ER ligand-binding domain and regulates the interaction of ERs with cellular coactivators and corepressors. Previously, we identified that the F-domain, a receptor-specific domain that follows H12, contributes to coactivator binding and specificity of Era but not ERb. We have continued these studies by analyzing the role of the F-domain in SERM-and corepressor binding and in modulating the transcriptional response to hormone. Moreover, we have identified and optimized a strategy to introduce fluorescence labels into H12 or the F-domain. These fluorescent receptors will allow us to monitor the dynamics and structural reorganization of ER upon SERM binding.
DTIC
Cancer; Estrogens; Mammary Glands; Modulators

20040075067 BJC Health Systems, Saint Louis, MO
A Quantitative Analysis of BJC Health System Managed Care Contract Reimbursement for Major Joint and Limb Reattachment Procedures of the Lower Extremities (DRG 209)
Hyde, Eric E.; Jul. 2000; 91 pp.; In English
Report No.(s): AD-A422907; AMDCS-34-00; No Copyright; Avail: CASI; A05, Hardcopy

Healthcare organizations are currently losing millions of dollars each year because of errors in billing processes. Many problems arise due to a lack of information, about and comprehension of; managed care contracts, terms, and requirements. As managed care continues to penetrate healthcare markets, these problems are likely to magnify. Given that BJC Health System's survival is dependent upon managed care revenue, and the negotiated contract language is structured to maximize return, it is imperative BJC faculties bill for all reimbursable items allowable in their managed care contracts. However, there is suspicion among BJC Managed Care Executives that BJC facilities may not be accurately billing for all reimbursable items, specifically prosthetics and implants devices The purpose of this study is to examine internal processes culminating in the patient's bill to determine if BJC is properly billing for prosthetics and implants. This study focuses on DRG 209 cases (Total Hip Replacement, Partial Hip Replacement, and Total Knee Replacement procedures) as a potential area of lost revenue. Overall, 8.6% ($202,000) of all charges for total knee and hip prosthetic and implant devices are not captured on bills being

sent to managed care plans. Therefore, BJC is not capturing all possible revenue.
DTIC
Health; Implantation; Knee (Anatomy); Management Systems; Medical Services; Quantitative Analysis

20040075069 Dartmouth Coll., Hanover, NH
A Novel Method for Producing Transgenic Enzymes and Peptides
Gerngross, Tillman U.; Mar. 4, 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0180
Report No.(s): AD-A422909; ARO-40409.3-LS; No Copyright; Avail: CASI; A03, Hardcopy

See report. We have successfully developed a novel a protein expression system based on the bacterium Raistonia eutropha. This system has been developed in our laboratory to overcome some of the shortcomings associated with recombinant protein expression in other bacteria (e.g. poor fermentation performance, inclusion body formation and proteolysis). High level expression of organophosphohydrolase (OPH), an enzyme prone to inclusion body formation in Escherichia coli has been demonstrated. A proteomics approach identified the promoter of the p(exp haP) gene as a strong, inducible promoter. By creating a translational fusion between the phaP promoter and oph gene and introducing this fusion into the chromosome, OPH titers of greater than 1 g/L were achieved in high cell density fermentations. Multiple copies of the P(exp phaP)::oph translational fusion were introduced into the chromosome to further increase expression. A proportional increase in OPH titer was found with increasing copy number. An OPH titer of approximately 4.3 g/L was measured in high cell density fermentation using a strain containing three copies of P(exp phaP)::oph) translational fusion This represents the highest titer reported to date for OPH (approximately 30 times greater than previously reported expression levels). Results have reported in two publications (Srinivasan et al. 2003; Srinivasan et al., 2002).
DTIC
Enzymes; Escherichia; Peptides

20040075074 Stanford Univ., Stanford, CA
Oral Contraceptives and Bone Health in Female Runners
Kelsey, Jennifer L.; Oct. 2003; 18 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8518
Report No.(s): AD-A422917; No Copyright; Avail: CASI; A03, Hardcopy

This is a two-year randomized trial of the effects of oral contraceptives on bone mass and stress fracture incidence among 150 female competitive distance runners in the age range 18-25 years. The Coordinating Center is at Stanford University and bone mass is being measured at five sites: Massachusetts General Hospital, University of California Los Angeles, University of Michigan, Stanford University/Palo Alto VA Medical Center, and Helen Hayes Hospital in West Haverstraw NY. Athletes were recruited from the areas around these five clinical sites. To date, over all five clinical sites, 152 have been randomized. Final results of the study will not be available until 2005.
DTIC
Athletes; Bones; Females; Health

20040075077 Oregon Health Sciences Univ., Portland, OR
IGF-Regulated Genes in Prostate Cancer
Roberts, Charles; Feb. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0122
Report No.(s): AD-A422920; No Copyright; Avail: CASI; A02, Hardcopy

We hypothesize that genes that are differentially expressed as a result of the decreased IGF-I receptor gene expression seen in metastatic prostate cancer contribute to prostate cancer progression, and include metastasis-regulating genensthat could constitute valuable diagnostic markers or therapeutic targets. We initially proposed three specific aims: 1)Identification of differentially expressed genes in isogenic metastatic vs. non- metastatic prostate epithelial cells; 2)Identification of proteins that are differentially secreted in these cell lines, and 3) Assessment of he differential expression of these genes and proteins in laser- mircrodissected samples. We have used microarray gene profiling to characterize differentially expressed genes and have used SELDI-TOF mass spectrometry to identify proteins that are differentially secreted into conditioned media. We have additionally initiated a 3 dimensional culture system to grow prostate cells in a microgravity environment that more accurately replicates in vivo cell organization and phenotype. We have discovered that elevated IGF-I receptor expression controls survival in adult human male serum, which may explain the relationship between IGF action and metastasis. We propose to

take advantage of these new findings by investing the molecular mechanisms underlying this effect and the cell- surface molecules expressed in metastatic and non-metastatic cells responsible for the differential sensitivity to serum.
DTIC
Cancer; Genes; Prostate Gland

20040075078 Sloan-Kettering Inst. for Cancer Research, New York, NY
Phase I and II Trial of Huanglian, a Novel Botanical Against Breast Cancer That Enhances Taxol Activity
Schwartz, Gary K.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0486
Report No.(s): AD-A422921; No Copyright; Avail: CASI; A02, Hardcopy

Huanglian is a botanical agent prepared as a tea form the roots of Coptis chinensis. We reported that huanglian potently inhibits the growth of a number cancer cells in vitro in a dose-dependent manner, with maximal inhibition at low micromolar concentrations (Li x. et al. Molecular Pharmacology, 58:1287-1293, 2000). MCF-7 and MDA-468 breast cancer lines were particularly sensitive to huanglian. In addition, huanglian was also shown to enhance the effect of palitaxel, supporting the future development of huanglian in combination with paclitaxel for the treatment of patients with metastatic breast cancer. The overall goal for this grant is to develop new therapeutic approaches in the treatment of patients with metastatic breast cancer based utilizing the Chinese botanical huanglian. The specific aims are to (1) conduct a phase I clinical trial of huanglian with both toxicity and efficacy endpoints, and (2) following the single agent trial, conduct a phase I/Il clinical trial of huanglian in combination with paclitaxel in the treatment of patient with metastatic breast cancer. To date, we have entered 22 patients to the single agent trial of huanglian. We are currently evaluating a dose of 8.25 gm/day. We encouraged by preliminary evidence of clinical and biological activity.
DTIC
Cancer; Clinical Medicine; Mammary Glands; Medical Services; Metastasis; Plants (Botany); Toxicity

20040075079 Nebraska Univ., Lincoln, NE
Process Research and Development of Antibodies as Countermeasures for C. botulinum
Meagher, Michael; Mar. 2004; 38 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0659
Report No.(s): AD-A422922; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the project to fill out shell space on the third floor of Othmer Hall, the new home for the University of Nebraska-Lincoln Biological Process Development Facility. Construction is 90% completed and all research laboratories of the BPDF will be functional in May 2004. Detailed design of the cGMP basement has been initiated and is expected to be completed by Fall 2004. The third floor will house all of the process research capabilities, i.e. molecular biology, fermentation, cell culture, analytical methods, quality control, purification development and media prep. This report also describes research on the expression of antibodies in Chinese Hamster Ovary (CHO) cells against serotype A botulinum neurotoxin. We have been able to clone and successful express the full intact S-25 antibody provided by Dr. Jim Marks of UCSF at 30 mg/L in 250 mL spinner shake flasks. A manuscript has been submitted on this work.
DTIC
Antibodies; Bacteria; Clostridium Botulinum; Countermeasures; Toxins and Antitoxins

20040075080 Ernest Gallo Clinic and Research Center, Meryville, CA
Identification of Alcoholism Susceptibility Genes
Wilhelmsen, Kirk C.; Oct. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0800
Report No.(s): AD-A422923; No Copyright; Avail: CASI; A02, Hardcopy

Genetic epidemiological analysis provides convincing data that a significant portion of the liability for developing alcoholism is inherited. The identity and mechanism by which genes contribute to inherited susceptibility to alcoholism are unknown. If genes that affect susceptibility to alcoholism can be identified, they are logical targets for the development of pharmacological agents to modify susceptibility and treat alcoholism. Primarily, the meiotic gene mapping approach has been used in an effort to identify genes that affect susceptibility to alcoholism. This approach may be insensitive to genes that have common alleles with modest effects on susceptibility. An alternative approach, allelic association analysis, may be far more powerful for detecting these genes, but requires that analysis of individual candidate genes. This proposal examines a large number of genes implicated in the biology of alcoholism to see whether common alleles of these genes affect susceptibility.

Two hundred and fifty polymorphisms, in 21 candidate genes were genotyped in 1200 subjects from the UCSF family study and 600 subjects in 120 families with nicotine dependence have been successfully genotyped. An additional 140 previously reported polymorphism were found not to be informative in these populations. The most promising observation are that a common haploytpe of the adenylate cyclase type 2 gene is associated with a series of addiction related phenotypes (p^0. 001-0.00001).
DTIC
Genes

20040075082 Georgetown Univ., Washington, DC
Genetics Risk Factor for Prostate Cancer
Gelmann, Edward P.; Jan. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0056
Report No.(s): AD-A422932; No Copyright; Avail: CASI; A03, Hardcopy

NKX3.l is a homeoprotein with prostate-specific expression in adults. Loss of NKX3.l correlates with prostate cancer progression. NKX3.l protein expression is reduced to varing degrees in virtually all primary prostate cancers. The NKX3.l gene is affected by deletion and/or promoter hypermethylation in 90% of primary prostate cancers. NKX3.l acts as a transcription factor by binding directly to DNA. NKX3.l also complexes and coactivates other transcription factors such as serum response factor. We have now found that NKX3.l complexes with the DNA unwinding enzyme toposiomerase I. NKX3.l binds to toposiomerase I in a stoichiometric relationship and enhances scissile strand DNA cleavage by toposiomerase I. NKX3.l does not affect religation of relaxed DNA by toposiomerase I. Toposiomerase I is involved in DNA replication, transcription, and repair and may be nder significant control of NKX3.1 in prostate epithelial cells.
DTIC
Cancer; Genetics; Prostate Gland; Risk

20040075091 Fox Chase Cancer Center, Philadelphia, PA
Preferences and Utilities for Prostate Cancer Screening and Assessment of the Underlying Decision Making Process
Watkins-Bruner, Deborah; Jan. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0055
Report No.(s): AD-A422948; No Copyright; Avail: CASI; A03, Hardcopy

The proposed study will evaluate two different populations, a community sample without prostate cancer, and a group of men diagnosed and treated for prostate cancer. The study is designed to evaluate the decision-making mechanism (i. e., risk attitude versus risk- perceptions) and processes (i.e. , cognitive versus affective) that influence their preference for specific treatments (e.g., surgery and radiotherapy) and associated health states (i.e., sexual impotence and urinary incontinence). In order to assess risk-attitude versus risk- perception two variables must be considered, the point of reference of the subject (i.e. person with prostate cancer versus person without prostate cancer) and the way the treatment alternatives are communicated or framed (loss-framed message versus gain-framed message). Understanding the decision making process driving preferences is important because it gives us information on how best to communicate or framed messages. It would also give us insight into how preferences may be manipulated and how different populations may have different preferences for the same treatment (e.g. surgery) or health state (e.g. impotence). Further, an analysis of how and what processes lead to group differences would assists in improved message framing, risk communications and possibly more relevant cost-utility analyses.
DTIC
Cancer; Decision Making; Prostate Gland; Utilities

20040075092 North Carolina Univ., Chapel Hill, NC
A Population-Based Investigation of the Role of Focal Adhesion Kinase (FAK) and E-Cadherin Expression in Breast Cancer Promotion, Progression and Therapeutic Response
Deming, Sandra L.; Oct. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0349
Report No.(s): AD-A422949; No Copyright; Avail: CASI; A02, Hardcopy

Presented within this annual report are the details of the second year's progress and the preliminary results of the grant entitled "A population based investigation of the role of Focal Adhesion Kinase (FAK) and E- cadherin expression in breast cancer promotion, progression, and therapeutic response. In regards to the specific aims of the grant, immunohistochemical staining has been completed for both FAK and E-cadherin expression. Scoring has been completed on

all 629 samples stained for FAK, providing information regarding the prevalence and pattern of FAK expression as well as its association with other known risk and prognostic factors for breast cancer. Scoring has been completed on all sample for E-cadherin following the development of a more- comprehensive scoring system. Collection of survival data is ongoing. Completing the proposed aims should elucidate the role of FAK and E-cadherin expression as a verifiable marker of disease aggressiveness, and will provide a better understanding of the biological behavior thus allowing for a more tailored treatment of breast cancer.
DTIC
Adhesion; Cancer; Mammary Glands; Populations; Therapy

20040075101 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD
Domestic Preparedness Program: Sarin (GB) and Distilled Sulfur Mustard (HD) Vapor Challenge Testing of Commercial Self-Contained Breathing Apparatus
Lins, Raymond R.; Campbell, Lee E.; Hyre, Aaron M.; Apr. 2004; 16 pp.; In English
Report No.(s): AD-A422967; ECBC-TR-367; No Copyright; Avail: CASI; A03, Hardcopy

Results of performance testing of six National Institute for Occupational Safety and Health approved commercial self-contained breathing apparatus (SCBA) facepiece designs are described. A series of tests was performed to determine sarin (GB) and distilled sulfur mustard (HD) vapor breakthrough of SCBA facepieces using manikin head form and simulated breathing.
DTIC
Breathing Apparatus; Distillation; Sulfur; Vapors

20040075103 California Univ., San Francisco, CA
Outcomes of Screening Mammography in Elderly Women
Smith-Bindman, Rebecca; Oct. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9112
Report No.(s): AD-A422971; No Copyright; Avail: CASI; A03, Hardcopy

There is uncertainty about whether women older than age 65 should undergo screening mammography. Although screening mammography may benefit some elderly women through the detection of early breast cancers, it may harm other women through the detection of early breast cancers, it may harm other women through false positive diagnoses and the detection of clinically insignificant lesions. This research study involves the design and implementation of a data analysis of HCFA Medicare billing claims linked with national tumor registry data from the Surveillance Epidemiology and End Results (SEER) program. The specific aims of this research will evaluate 1) differences in breast cancer mortality, 2) differences in breast cancer treatment and 3) differences in breast cancer tumor attributes between women who were screened and those who were not. In the second year of this grant the PI focused on validating that the Medicare claims are accurate for determining screening mammography. She obtained data form the three Breast Cancer SurVeillance Consortium Registries (New Mexico, Seattle, and San Francisco) that prospectively collect screening information, has linked this with the Medicare/SEER data, and is currently determining whether Medicare claims accurately assess mammography utilization. Following completion of this validation study, the PI will analyze differences in breast cancer treatments, tumor characteristics and mortality based on screening.
DTIC
Age Factor; Cancer; Females; Mammary Glands

20040075104 South Carolina Univ., Columbia, SC
Phase I Induction and Estrogen Metabolism in Women with and Without Breast Cancer and in Response to a Dietary Intervention
Hebert, James R.; Oct. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9279
Report No.(s): AD-A422972; No Copyright; Avail: CASI; A03, Hardcopy

The combined case-comparison study and randomized controlled trial (RCT) of 90 women is based on our prior edpidemiologic work (1-6) indicating that vegetables in the Brassica genus (e.g., broccoli, cauliflower, brussel sprouts) can modify estrogen metabolism by causing l7beta- estradiol (E2) to be metabolized to 2-hydroxyestrone (2HE) rather than 16alpha-hydroxyestrone (l6HE) thus producing a cascade of effects protective against breast cancer (2). Our plan is to enroll 45 postmenopausal women with breast cancer and 45 age- matched disease-free women and to compare them on: 1) AhR

activation and its various protein products relevant to cancer including CYPlBl, PAZ- 2, and IL-l; and 2) levels of relevant estrogens-, E2, 2HE, and l6HE. The RCT will examine the effect of an intensive Brassica-rich diet intervention on AhR activation, its protein products, and estrogen metabolites in these women. This study is completing its third year of (no- cost) activity. All protocols for the collection of data are finalized and we have recruited 83 participants. The baseline data have been collected for case-comparison study and the last intervention cycle for the RCT will be in September 2003.
DTIC
Cancer; Diets; Estrogens; Females; Mammary Glands; Metabolism; Metabolites

20040075105 Brigham and Women's Hospital, Boston, MA
Enhanced T Cell Attack of Brain Micro-Metastases
Lampson, Lois A.; Jul. 2003; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0167
Report No.(s): AD-A422973; No Copyright; Avail: CASI; A03, Hardcopy

Brain-metastasizing breast cancer is a major clinical problem. Cell-mediated immuno- therapy is well-suited to attack it, but the efficacy must be increased. Our work addresses two basic research problems: A) The need for appropriate small animal models for blood-borne brain metastases, and B) the need for greater basic understanding of immune modulation in the brain. In year 1, we reported initial characterization of a novel rat model. In year 2, we reported identification, analysis, and solutions for a series of technical problems. Now, in year 3, we report : A) Further work in the tumor model, including: 1) Methods for quantitative analysis and depiction of micro-tumor distribution, 2) the distribution of blood-borne micro- metastases in untreated control rats, 3) provocative evidence that a simple needle wound can change the distribution; S) Further work on our proposed immunotherapy (injection of gamma interferon (IFN-g), including: 1,) New basic findings on immune modulation and delivery routes, 2) our approach to further probing the functional consequences of attempted immunotherapy; C) Related efforts, including a comprehensive special issue of the Journal of Neuro-Oncology on Brain Tumor Immunotherapy, co-edited and with an introductory overview by the PI.
DTIC
Brain; Cancer; Mammary Glands; Metastasis

20040075106 Columbia Univ., New York, NY
Interactions Between Cell Cycle Control Proteins and the Androgen Receptor in Prostate Cancer
Winstein, I. B.; Mar. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0042
Report No.(s): AD-A422974; No Copyright; Avail: CASI; A03, Hardcopy

Studies carried out during the past year have confirmed and extended our novel discovery that the cell cycle control protein cyclin dependent kinase 6 (CDK6) can bind to the androgen receptor (AR) and markedly stimulate its transcriptional activity in human prostate cancer cells. Furthermore, this effect does not require the kinase activity of CDK6. In studies with variants of the AR we found that short CAG repeats in exon 1 of the AR, which occur more frequently in African American (AR) men with prostate cancer, were more responsive to the stimulatory effects of CDK6 than an AR with long CAG repeats. In addition, a point mutated AR (T877A), known to frequently occur in human prostate cancer, displayed dramatic stimulation by CDK6 in cells treated with dihydrotestosterone DHT, b- estradiol or progesterone. Taken together, these results suggest that CDK6 may play an important role in enhancing the development and progression of prostate cancer. It may therefore provide a prognostic marker and potential target for the prevention and therapy of prostate cancer.
DTIC
Cancer; Cells (Biology); Hormones; Males; Prostate Gland; Proteins

20040075107 Miami Univ., FL
Hyaluronic Acid and Hyaluronidase in Prostate Cancer: Evaluation of Their Therapeutic and Prognostic Potential
Lokeshwar, Vinata B.; Jan. 2004; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0095
Report No.(s): AD-A422975; No Copyright; Avail: CASI; A03, Hardcopy

The limited knowledge about which clinically localized prostate cancer (Cap) would progress, and when it will recur severely impedes individualization of therapy and prediction of outcome. Several molecules that function in cancer growth and progression can serve prognostic indicators. Treatment modalities that target the functions of these molecules could effectively control CaP progression. We have studied two such molecules hyaluronic acid (HA) and HYALl type hyaluronidase (HAase).

HA is a glycosaminoglycan and HAase is an enzyme that degrades HA into angiogenic fragments. Immunohistochemical analysis using archival radical prostatectomy CaP specimens from patients on whom theree is minimum 6-year follow-up (range: 72 - 131 months) show that HYALl and combined HA-HYALl staining are independent predictors for biochemical recurrence. Functional analysis of HYALl by stable cDNA transfection and in vitro and in vivo studies show that both over and under production of HYALl severely inhibits CaP growth and its invasive potential. Use of 3 HAase inhibitors show that inhibition of HAase activity also inhibits CaP cell proliferation. The degree of inhibition show that inhibition of HAase activity also inhibits CaP cell proliferation. The degree of inhibition of cell proliferation is dependent on the degree of inhibition of HAase activity. Ongoing studies are examining the effect of HAase inhibition on gene expression by cDNA microarray analysis.
DTIC
Cancer; Prostate Gland; Therapy

20040075108 Cold Spring Harbor Lab., New York, NY
Synthetic Lethality in Breast Cancer Cells: Genes Required for Tumor Survival
Hannon, Gregory J.; Jul. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0208
Report No.(s): AD-A422976; No Copyright; Avail: CASI; A03, Hardcopy

The conversion of a normal cell into a cancer cell proceeds through a series of genetic and epigenetic alterations. We have proposed to use well-established genetic methodologies to identify novel anti-cancer targets via their specific, genetic interactions with common cancer mutations. In short, we will identify genetic alterations that are neutral in normal cells, but that are lethal when combined with cancer mutations. This "synthetic lethality" approach may identify potential therapeutic targets that are highly specific to the cancer cell. In the past year, we have created tools that will permit such screens to be undertaken for the first time in mammalian cells and have validated those tools in a model genetic screen.
DTIC
Cancer; Cells (Biology); Genetics; Lethality; Mammary Glands; Oncogenes; Survival; Tumors

20040075110 Georgetown Univ., Washington, DC
Downstream Signaling Mechanism Underlying MAPK- Induced Generation of the ER-Negative Phenotype
Holloway, Jamie N.; Jul. 2003; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0247
Report No.(s): AD-A422979; No Copyright; Avail: CASI; A03, Hardcopy

Estrogen receptor a (ERalpha) negative breast tumors often overexpress growth factor receptors, resulting in increased growth factor signaling and hyperactivation of MAPK (ERK1 and ERK2). We have previously shown that ERalpha- positive MCF-7 cells engineered to stably overexpress various signaling molecules leading to MAPK hyperactivation lose expression of ERalpha without inducing its transcriptional activation. The downregulation of ERalpha in these cells is transcriptional and is a specific action of MAPK hyperactivation that is reversible by MAPK abrogation. Here, we show that downregulation of ERalpha is not mediated specifically by either ERK-1 or 2. TAM67, a construct preventing AP-1 transcriptional activity, was used to determine that AP-1 activity does not play a role in ER downregulation. AP-1 activity is upregulated in response to MAPK activation, and increased AP-1 activity has been observed in ERalpha negative and hormone independent breast cancers. However, these are the first data indicating mechanistically that despite data correlating increased AP-1 activity with hormone independence/ERalpha-negativity, increased AP-1 activity is not responsible for ERalpha downregulation. Use of a dominant negative RSK1 construct indicates that RSK1 activity does not downregulate ERalpha. Transfection of ERK2A19-25, which is dominant negative for nuclear MAPK substrates while allowing activation of cytoplasmic substrates, revealed that a cytoplasmic substrate of MAPK is responsible for the generation of the ERalpha-negative phenotype in these cells. Collectively, these data reveal that the association between increased AP-1 activity and the ERalpha- negative phenotype is correlative, not causative, and that a cytoplasmic MAPK substrate other than RSK1 is responsible for ERalpha downregulation in our cell line models.
DTIC
Cancer; Cells (Biology); Mammary Glands

20040075111 Sloan-Kettering Inst. for Cancer Research, New York, NY
Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer
Robson, Mark E.; Jul. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0325
Report No.(s): AD-A422981; No Copyright; Avail: CASI; A03, Hardcopy

Women with breast cancer arising as a consequence of germline mutations in BRCA1 or BRCA2 are at significant risk of contralateral breast cancer (CBC). Examination of factors influencing contralateral risk will provide insight into prevention strategies for unaffected women with BRCA mutations. A combined analysis performed with the JGH indicates tamoxifen may reduce CBC risk by 53% (attached). To evaluate CBC risk factors, the funded study is assessing the impact of tamoxifen and radiotherapy on CBC risk. In the present funding period, in accordance with the Statement of Work, continued review of clinical records was performed, with identification of pathology blocks that will be cut to provide the samples for genotyping. Medical records from 1990 and 1991 were not reliably retrievable, leading us to expand the cohort eligibility dates to 199E. As of this report, we have reviewed 692 records in this interval, of whom 453 are eligible and for whom data has been entered. Data cleaning is in process and acquisition of tissue samples will begin shortly, followed by genotyping after anonymization. Combining these data with our original cohort of 329 cancers in 305 patients (JNCI 1999), we will have achieved 78% of our accrual goal of 1000 cases.
DTIC
Cancer; Females; Genetics; Mammary Glands; Radiation Therapy; Risk

20040075112 Johns Hopkins Univ., Baltimore, MD
Molecular Changes in pp32 in Prostate Cancer
Pasternack, Gary R.; Sep. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9030
Report No.(s): AD-A422982; No Copyright; Avail: CASI; A02, Hardcopy
Our previous work demonstrated that prostate cancers differ from benign prostatic epithelium by expressing oncogenic members of the pp32 gene family. Whereas benign prostatic epithelium solely expresses pp32, prostate cancers express pp32r1 and pp32r2, which are oncogenic. The purpose of the study was to confirm and extend these preliminary results, to develop practical means to assay pp32 gene family members in clinical samples, and to determine the clinical significance of their presence. The approved proposal encompassed four broad tasks: 1 characterization of the pp32 expression phenotype of a larger sample of 40 prostatic adenocarcinomas; 2 development of a practical molecular pathology assay for altered pp32 transcripts; 3 adaptation of the assay to paraff in- embedded tissue; and 4 preliminary determination of the clinical utility of pp32r1 and pp32r2 expression in prostatic adenocarcinoma. In the course of developing these previously reported assays, a mutation in pp32r1 was detected in a human prostatic cancer cell line in pp32r1 involving a T to C transversion at position 418; transfection studies showed this to cause increased cell proliferation. A PCR assay is now being used to determine the frequency of the pp32r1 mutation in prostate cancers. Antibodies will be used to examine pp32 gene family expression in prostate cancers.
DTIC
Cancer; Prostate Gland

20040075113 Georgetown Univ., Washington, DC
Mechanisms for C-Myc-Induced TGF - Prevented Mouse Mammary Tumors
Dickson, Robert B.; Oct. 2003; 56 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0251
Report No.(s): AD-A422984; No Copyright; Avail: CASI; A04, Hardcopy
Many clinical studies have shown that apoptosis may be related to various pathological parameters of breast cancer, such as tumor size, histologic features, metastasis, and survival. Over 50% of human breast cancer biopsies show amplification or overexpression of c-myc, an oncogene that is known to play a crucial role in cell proliferation, apoptosis, and transformation. Female c-myc transgenic mice also develop mammary cancer that is characterized by a large number of apoptotic cells, thus serving as a good in vivo model for study on the role of c-Myc in both mammary carcinogenesis and apoptosis. On the other hand, TGFa, a growth factor also frequently overexpressed in human breast cancer, has been shown in MT-tgfa/MMTV-c-myc double transgenic mice to enhance c-Myc-induced mouse mammary carcinogenesis, probably in part by blocking apoptosis. Our proposal set out to examine the c- Myc mechanisms of mediated apoptosis in our mouse mammary tumor model. In addition, we examined the survival-promototing effect of the TGFa-EGF receptor pathway in this model. We initially provided evidence for TGFa-EGF receptor emediated cell survival by a calcium/calmodulin mediated pathway regulating Akt. Subsequent studies have focused on the role of a recently discovered kinase, PNCK, and P55g, a p13 kinase subunit to mediate the EGF survival signal.
DTIC
Cancer; Mammary Glands; Mice; Tumors

20040075114 Georgetown Univ. Hospital, Washington, DC
DNA Binding of the Prostate Homeobox Protein NKX3.1
Yin, Yuzhi; Gelmann, Edward; Sep. 2001; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9519
Report No.(s): AD-A422985; No Copyright; Avail: CASI; A02, Hardcopy

NKX3.1 is a homeoprotein with prostate-specific expression in the adult mouse and human. We have identified the hexanucleotide DNA binding domain of NKX3.1. NKX3.1 gene targeting studies in mice have shown that the protein is a differentiating factor and suppress or of epithelial cell growth. We have described a genetic polymorphism, C154T, in humans that alters the amino acid sequence of the protein from arginine to cysteine at amino acid 52 (R52C). This polymorphism is present in 11% of the population. The variant protein has altered phosphorylation of serine 48, adjacent to R52C. The R52C variation results in a 7O% decrease in in vitro phosphorylation of NKX3.1 by protein kinase C. Moreover, whereas DNA binding of wild type protein is regulated by phosphorylation, binding of NKX3.1 R52C to DNA is not affected by phosphorylation. The polymorphic site and an adjacent serine are critical for the activity of the C-terminal inhibitory region of NKX3.l and may mediate binding of C- and N-terminal domains of the protein. Mutations of either R52 to C or S48 to A results in loss of C-terminal region inhibition of transcriptional activation by NKX3.1.
DTIC
Cancer; Cells (Biology); Deoxyribonucleic Acid; Epithelium; Prostate Gland; Proteins

20040075115 Georgetown Univ., Washington, DC
Fas/FasL System in c-Myc Expressing Mammary Carcinoma Cells
Coticchia, Christine M.; Dickson, Robert B.; Jun. 2003; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0246
Report No.(s): AD-A422986; No Copyright; Avail: CASI; A03, Hardcopy

PNCK, a novel pregnancy upregulated CaM kinase is upregulated in the mouse mammary gland during pregnancy, particularly in late pregnancy when alveolar epithelial cells exit the cell cycle and differentiate. PNCK is also upregulated in cultured over- confluent and serum-starved cells compared to actively growing mammary epithelial cells, suggesting that PNCK expression is inversely related to proliferation. Interestingly, PNCK is expressed in a subset of human breast tumor samples, but not in adjacent normal breast tissue. In mouse mammary carcinoma cell lines derived from MMTV-c-Myc driven tumors, PNCK expression is prominent, while no association is found between PNCK and MMTV- neu or MMTV-ras tumors. Recently, our lab discovered that a prominent survival pathway incident from the EGFR required calcium and calmodulin for the activation of Akt and the inhibition of c-Nyc mediated apoptosis in c-Nyc overexpressing mammary carcinoma cells. We hypothesize that PNCK (a calcium and calmodulin dependent protein) opposes the Akt activation properties of CaM in c-Nyc overexpressing cells and in mammary carcinoma cells in general. We successfully cloned and expressed the human PNCK transiently in epithelial cells. Our aim to functionally characterize PNCK in stable mammary carcinoma cells has been prevented by technical problems. We will now focus on optimizing a transient model of PNCK expression to uncover its function in mammary carcinoma cells.
DTIC
Cancer; Cells (Biology); Mammary Glands

20040075119 Case Western Reserve Univ., Cleveland, OH
Estrogen Regulation of Prothymosin Alpha
Montano, Monica M.; Sep. 2003; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9116
Report No.(s): AD-A422990; No Copyright; Avail: CASI; A03, Hardcopy

Prothymosin a (PTa) is a small highly acidic protein found in the nuclei of virtually all mammalian tissues. Its high conservation in mammals and wide tissue distribution suggest an essential biological role. While the exact mechanism of action of PTa remains elusive, the one constant has been its relationship with the proliferative state of the cell and its requirement for cellular growth and survival. Recently PTa was found to promote transcriptional activity by sequestering the anticoactivator, REA from the Estrogen Receptor (ER) complex. We now report that Estradiol (E2) upregulates PTa mRNA and protein expression. Further studies indicate that ERa regulates PTa gene transcriptional activity. We have also delimited the region of PTa gene promoter involved in ERa mediated transcriptional regulation and identified a novel ERa-binding element. Increased intracellular PTa expression in the presence of estrogen is accompanied by increased nuclear/decreased cytoplasmic localization. Increased nuclear expression of PTa in correlated with increased proliferation as measured by expression. of Ki67 nuclear antigen. Conversely, inhibition of nuclear PTa expression in breast cancer cells using antisense

methodology resulted in the inhibition of E2-induced breast cancer cell proliferation. Overall these studies underscore the importance of PTa in estrogen-induced breast cell proliferation.
DTIC
Cancer; Estrogens; Mammary Glands

20040075132 Saint Francis Coll., Loretto, PA
Rural Health
Owens, Kathleen; Bates, James F.; Aug. 1998; 6 pp.; In English
Contract(s)/Grant(s): N00014-94-1-1134
Report No.(s): AD-A423007; No Copyright; Avail: CASI; A02, Hardcopy

Test and evaluate the most effective and efficient methods, procedures, and technologies that will improve access to education and healthcare services in remote, isolated, and medically under-served areas through the use of advanced off-the-shelf computing and telecommunications technologies.
DTIC
Health; Management Systems; Medical Services

20040075139 Beth Israel Deaconess Medical Center, Boston, MA
Optical Coherence Tomography of the Breast: A Feasibility Study
Connolly, James L.; Pantanowitz, Liron; Herz, Paul; Hsiung, Pei-Lin; Raze, Sughra; Oct. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0156
Report No.(s): AD-A423017; No Copyright; Avail: CASI; A03, Hardcopy

Optical Coherence Tomography (OCT) is an emerging high-resolution imaging technology that can perform high resolution, real-time cross-sectional imaging of tissue. OCT can be used as a type of "optical biopsy" to perform minimally- invasive imaging up to a depth of 2-3 mm with transverse resolutions as high as 10 um in commercially available systems. OCT uses near-infrared light which can be used in fiber optic devices such as catheter probes and imaging needles. This novel imaging technology has the potential to improve cancer detection and diagnosis. The aim of this study was to determine the feasibility of applying OCT imaging to normal and pathologic human breast tissue, as well as other human tissues. OCT was used to image samples of breast tissue from core biopsy and surgical specimens. Architectural changes such as stromal hyperplasia and fat necrosis were detected with OCT. Normal lactiferous ducts were visible. However, normal glandular and ductal structure as well as pre-malignant and neoplastic epithelial changes did not have sufficient contrast to be consistently visible. We are currently improving OCT resolution and applying spectroscopic and microscopy techniques to enhance tissue contrast. These improvements should allow better visualization of micro structural features in normal and pathologic breast tissue. Studies were performed imaging other tissues with better defined architectural morphology including thyroid and lower GI tissues, and good correlation of OCT images and histology was obtained.
DTIC
Cancer; Epithelium; Feasibility; Fiber Optics; Mammary Glands; Microscopy; Optical Equipment; Tomography

20040075141 Wisconsin Univ., Madison, WI
Role of Cdc37 in Overcoming p16 Mediated Growth Arrest in Prostate Cancer
Schwarze, Steven R.; Jan. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0165
Report No.(s): AD-A423019; No Copyright; Avail: CASI; A03, Hardcopy

Cdc37 is a co-chaperone protein that recruits several immature client kinases to Hsp90 for proper folding. Cdc37 up-regulation is a common early event in localized prostate cancer as is p16 induction. While targeted overexpression in mice leads to prostate epithelial cell hyperplasia, the function of Cdc37 in human prostate cancer is unclear. Here I examined the role of Cdc37 in the growth regulation of prostate cells. Using laser capture microdissection, Cdc37 and p16 are both concomitantly induced in moderately differentiated prostate cancer tissue. However, Cdc37 overexpression was unable to overcome p16 induced growth arrest in prostate cancer cells. I demonstrated that Cdc37 overexpression drives proliferation in normal prostate epithelial cells, while loss of Cdc37 function arrests growth and leads to apoptosis. Molecular analysis of Cdc37 client pathways indicated enhanced Raf-1 activity, up-regulated Cdk4 levels and reduced p16 expression with Cdc37 overexpression. These findings suggest increased Raf-1 and/or Cdk4 activity might underlie the proliferative enhancement. Induced Raf-1 activation, however, slowed growth, while cyclin D1 overexpression was sufficient to promote proliferation.

These data further suggest that Cdc37 may play an active role in the progression of prostate cancer through accelerating proliferation and preventing apoptosis.
DTIC
Cancer; Prostate Gland

20040075142 Texas Univ., Houston, TX
Novel Paclitaxel Copolymer for Treatment of Androgen-Independent Prostate Cancer Bone Metastases
Klostergaard, Jim; Feb. 2004; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0086
Report No.(s): AD-A423020; No Copyright; Avail: CASI; A03, Hardcopy

The human prostatic carcinoma cell lines, PC-3 and bone metastases-derived NDA-PCa-2a and MDA-PCa-2b, are susceptible to apoptotic induction in vitro by Taxol, poly-L- (glutamic acid)-paclitaxel (PGA-TXL) and hyaluronic acid-paclitaxel (HA-TXL). Paclitaxel-induced activation of apoptosis can be blocked at the leel of caspase-3 induction by sphingosine-1-phosphate (S-I-P). Dimethyl-sphingosine (DMSP) effectively inhibits sphingosine kinase (SpK), reducing cellular S-I-P levels, and thereby facilitating maturation of apoptotic signals. DMSP causes rapid expression of Annexin in PC-3 cells, and induces TUNEL-positive cells; the latter, but not the former, is inhibited by the broad-spectrum inhibitor, Z-VAD. We have also shown that the mitochondria are proximal targets of DMSP-mediated apoptosis in PC-3 cells, resulting in rapid loss of mitochondrial membrane potential, rapid cytochrone C mobilization, and rapid caspase activation, including caspase-9, these responses are unaffected by BCL-2, of significant relevance to apoptosis induction in metastatic prostate cancer. We will continue with the planned tasks, but will also attempt to merge them with strategies to systemically deliver DMSP to prostatic tumor xenografts, and thereby enhance paclitaxel-induced apoptosis and reverse tumor angiogenesis.
DTIC
Bones; Cancer; Copolymers; Membranes; Metastasis; Prostate Gland

20040075143 Georgetown Univ., Washington, DC
The Regulation of the Angiogenic Factor FGF Binding Protein (FGF-BP) by the APC/Beta-Catenin Signaling Pathway in the Progression of Breast Cancer
Stylianou, Dora; Riegel, Anna T.; May 2003; 36 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0253
Report No.(s): AD-A423021; No Copyright; Avail: CASI; A03, Hardcopy

Fibroblast growth factor binding protein (FGF-Bp) releases immobilized FGF's form the extracellular matrix and can function as an angiogenic switch molecule in cancer. We have determined that FGF-BP is upregulated in a portion of breast cancer and this upregulation is correlated with increased expression of beta-catenin. In this grant, we hypothesized that beta-cantenin can initiate angiogenesis in mammary carcinoma through FGF-BP. The aims were 1) to study the expression of FGF-BP in mammary tumorigenesis% progression of the APC/+ mouse and 2) to determine the mechanism of regulation of FGF-BP by the APC/beta-catenin signaling pathway in breast cancer. To date, we have shown a positive correlation of upregulation% of beta-catenin expression and FGF-Bp in breast and other tumors in the APC/+ mice. We have also shown that beta-catenin can directly induce FGF-BP gene expression through a transcriptional mechanism and that a.TCF site in the FGF-BP promoter is responsible for a major portion of this effect.
DTIC
Cancer; Fibroblasts; Mammary Glands; Proteins

20040075144 Ohio State Univ., Columbus, OH
Genetic Alterations in Epithelial and Stromal Compartments of Prostate Adenocarcinomas
Eng, Charis; Jan. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0118
Report No.(s): AD-A423023; No Copyright; Avail: CASI; A03, Hardcopy

Genetic analyses on prostate cancer has been occurring for over a decade. However, such studies were uniformly performed on the entire tumor without regard to its components despite the fact that a few groups were quite aware of both epithelial and stromal components of tumors, and the cell biology of the tumor "microenvironment" has been described for the last 20 years. Thus, until now, when a genetic alteration, be it intragenic mutation, regional amplification, or deletion manifested by loss of heterozygosity of markers (LOH) is attributed to a prostate cancer, it is unclear if the alteration is actually occurring in the epithelial compartment, the surrounding stromal compartment or both. Our own

preliminary data on breast carcinomas demonstrate that LOH and even somatic mutations can occur in surrounding stromal fibroblasts. Therefore, this proposal proposes to search for genetic alterations in the stroma of prostate cancers and to determine if such alterations can influence clinical outcome.
DTIC
Cancer; Compartments; Genetics; Prostate Gland

20040075145 Brigham and Women's Hospital, Boston, MA
BRCA2 Mediated Ubiquitination: Identification of Targets for Destruction
Starita, Lea M.; Parvin, Jeffrey D.; Sep. 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0306
Report No.(s): AD-A423024; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer can be a genetic disease passed from mother to daughter. BRCA1 is the gene that when mutated is responsible for half of inherited breast cancer cases and about 80% of the combined breast and ovarian cancer kindreds. Therefore, the function of the protein product of BRCA1, which is still unknown, must be extremely important in mammary and ovarian cells because when it is no longer there the cells become cancerous. This project aims to determine how the BRCA1 protein performs its protective function. We have set up a biochemical analysis of BRCA1, which should reveal key pathways regulated by BRCA1. Specifically, this project assays how BRCA1 directs the ubiquitination of cellular proteins, which influence the growth of the cell. In cells in which BRCA1 is mutated, perhaps the loss of the ubiquitination results in cancerous transformation.
DTIC
Cancer; Destruction; Genes; Mammary Glands; Targets

20040075151 Johns Hopkins Univ., Baltimore, MD
Erbium: YAG Laser Incision of Urethral Strictures for Treatment of Urinary Incontinence after Prostate Cancer Surgery
Fried, Nathaniel; Feb. 2004; 50 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0087
Report No.(s): AD-A423032; No Copyright; Avail: CASI; A03, Hardcopy

Urethral and bladder neck strictures occur in 5 to 20 percent of all prostate cancer surgery patients, resulting in urinary incontinence. Conventional treatments for stricture (including balloon dilation, cold knife incision, electrocautery, and Holmium laser incision) have widely variable success rates with suboptimal long-term results. The failure of these conventional stricture treatments is presumably due to mechanical and/or thermal damage to the urethral wall during the procedure. The purpose of this research project is to test a new laser, the Erbium:YAG laser, which is capable of precisely incising the urethral stricture with minimal peripheral damage to adjacent healthy tissue. The author hypothesizes that the minimal side effects caused during Erbium laser incision should translate into limited scarring and improved procedural success rates. The first year of this project was devoted to optimization of the laser and optical fiber delivery system for rapid and precise cutting of urethral tissue. Task 1 of the Statement of Work for Year 1 was the Modification of the Erbium:YAG laser system (Months 1- 6). This task entailed two subtasks: (a) Modify electronics in laser power supply to produce shorter laser pulses, more uniform temporal beam profile, and higher pulse repetition rates; and (b) Optimize laser ablation parameters (laser energy, pulse duration, repetition rate, and irradiation time) using in vitro tissue samples. Task 2 for Year 1 was to determine the optimal optical fiber delivery system (Months 7- 12). This task entailed three subtasks: (a) Test fiber optic damage thresholds with chemical and microscopic analysis of fiber tips after laser ablation with fiber in contact with tissue, (b) Design side-firing laser fibers with varying delivery angles for incision of urethral wall, and (c) Build hybrid fibers combining flexible germanium oxide trunk fiber with durable sapphire probe tip to prevent fiber damage. (4 tables, 7 figures, 13 refs.)
DTIC
Bladder; Cancer; Erbium; Fiber Optics; Lasers; Prostate Gland; Surgery; Urology; Yag Lasers

20040075152 State Univ. of New York, Stony Brook, NY
Integrated Cancer Research in Five Thematic Areas of Interest
Malbon, Craig C.; Jul. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0754
Report No.(s): AD-A423033; No Copyright; Avail: CASI; A02, Hardcopy

During the last Fiscal Year of the award, the Cancer Institute of Long Island benefited from CPMRP funding in a manner consistent with the proposed activities of the award. In the area of core instrumentation acquisition, the Applied Biosystems, Inc. Q-Star LC/MS/MS Mass Spectrometer that was acquired in Year 1 became fully operational and has supported research for 21 cancer investigators from 7 different departments. Data for several publications and new grants are being organized and the instrumentation is a widely accepted successful edition to the Cancer Proteomics initiative. Additionally, another research grade ABI MALDI-ToF was acquired, as well as preparatory robots to aid in spot excision and gel digestion. More recently, as specified in Year 2, much time was spent investigating and considering the best option for a 2-photon confocal microscope. Upon the conclusion of this process a Carl Zeiss Inc. Inverted Multi- Photon system was selected. The instrument is to be sited and operated in a class 100,000 clean room and located in a shared instrument facility contiguous to the cancer marker diagnostics laboratory as well as many other cancer research groups. The technology offers a new and exciting platform for cancer imaging and has been equipped to enable the imaging of living cells. Leading this project is the thematic program director, and now chair of the Department of Molecular Genetics and Microbiology, Dr. Dafna Bar-Sagi. A faculty member skilled in 2-Photon Microscopy will provide daily oversight for the instrument, and a PhD-level optical physicist will be recruited to operate the instrument. The instrument will be installed in September 2003. Consistent with the funding for this initiative was the granting of Research Support Units. These units serve to assist in the recruitment of new, well-trained cancer researchers. Each package provided support for laboratory personnel, small or specialized research equipment, and supplies.
DTIC

Cancer; Medical Personnel; Medical Science; Personnel Development

20040075155 Chicago Univ., Chicago, IL

Inhibitors of XRCC3p

Bishop, Douglas K.; Connell, P. P.; Oct. 2003; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0196

Report No.(s): AD-A423036; No Copyright; Avail: CASI; A03, Hardcopy

DNA repair via the homologous recombination (HR) pathway requires the recombinase RAD51 and, in vertabrates, five RAD51 paralogs. The paralogs form two complexes in solution, a XRCC3/RAD51C heterodimer and a RAD51B/RAD51C/ RAD51/ XRCC2 heterotetramer. Mutation of any one of the five paralogue genes prevents subnuclear assembly of recombinase at damaged sites and renders cells 30-100 fold sensitive to DNA cross-linking drugs. Here we used phage display to isolate peptides that bind the paralog XRCC3. Sequences of binding peptides showed similarity to residues 14- 25 of RAD51C protein. Point mutations in this region of RAD51C altered its interaction with both XRCC3 and RAD51B in a two-hybrid system. A synthetic peptide composed of residues 14-25 of RAD51C fused to a membrane transduction sequence (PTD4) inhibited subnuclear assembly of RAD51 recombinase and sensitized Chinese hamster ovary (CHO) cells to cisplatin when added to growth medium. These results suggest that residues 14- 25 of RAD51C contribute to a hot spot' utilized in both xRCC3- RAD51C and RAD51B-RAD51C interactions. Peptide-based inhibition of HR may prove useful for improving the efficacy of existing cancer therapies.
DTIC

Cancer; Deoxyribonucleic Acid; Inhibitors; Mammary Glands; Membranes

20040075157 Wistar Inst. of Anatomy and Biology, Philadelphia, PA

From Healer Mouse to Healer Soldier. The Blastema Project

Heber-Katz, Ellen; Apr. 26, 2004; 4 pp.; In English

Contract(s)/Grant(s): DAAD19-03-1-0008

Report No.(s): AD-A423039; ARO-44567.1-LS-DRP; No Copyright; Avail: CASI; A01, Hardcopy

Our studies in the MRL mouse have shown that this mouse has unusual healing properties. This includes the closure of ear hole wounds which is not seen in any other mouse strain. This form of healing has many features that are similar to those seen in the regeneration of amphibian limbs. In amphibian models, it was shown that de-differentiation of mature cells contributes to the blastema and the growth of a new limb. It was of interest to determine if similar processes were at work in this mammalian model of regeneration. We explored several issues: 1) the ability of the regenerate environment to induce de-differentiation and re- differentiation of mature cells, 2) the ability of factors from the regenerate tissue to affect differentiation of cells in vitro, and 3) the induction of a blastema or events leading to blastema formation in a non-regenerating strain of mouse. Results in all of the experiments indicated that many of the same processes were in fact important in this mouse and its healing response.
DTIC

Cells (Biology); Healing; Mice; Protoplasm; Tissues (Biology)

20040075161 Wayne State Univ., Detroit, MI

Cell Surface Regulation of Matrix Metalloproteinases in Breast Cancer Cells

Fridman, Rafael A.; Aug. 2003; 110 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9440

Report No.(s): AD-A423044; No Copyright; Avail: CASI; A06, Hardcopy

Metastasis is the major cause of death in breast cancer patients and is partly caused by the action of proteolytic enzymes that degrade extracellular matrix (ECM). We have focused on the gelatinases, MMP-2, and MMP-9, two ECM- degrading enzymes that are members of the matrix metalloproteinase (MMP) family of proteases. The gelatinases are associated with the surface of breast cancer cells. MMP-2 surface binding plays a role in activation by MT1-MMP, a membrane-bound MMP that is also expressed in breast cancer cells. MMP-2 activation is mediated by the action of TIMP-2, a metalloproteinase inhibitor. We characterized in detail the process of pro-MMP-2 activation by MT1-MMP and demonstrated the role of TIMP-2 in this process. The regulation of MT1-MMP on the cell surface was also investigated. These studies demonstrated that MT1-MMP undergoes autocatalytic processing and ectodomain shedding, which serve to control the level of MT1-MMP on the cell surface and produce active enzyme at both the cell membrane and in the extracellular space. MT1- MMP initiates a cascade of zymogen activation on the cell surface that leads to the generation of active MMP-2 and active MMP-9. This process is regulated by TIMP-2. A novel mechanism-based inhibitor for the gelatinases that binds with high affinity and irreversible has been characterized. Together, these studies have defined some key aspects that regulate the function of the MT1-MMP/gelatinase axis on the surface of breast cancer cells and develop new approaches to counteract their action in tumor tissues.

DTIC

Cancer; Cells (Biology); Enzymes; Mammary Glands; Metastasis

20040075162 Wisconsin Univ., Madison, WI

Mechanisms through which Rat Mammary Gland Carcinogenesis is Preferentially Initiated by H-Ras Over K-Ras Signaling Pathways

McFarlin, Daniel R.; Jul. 2001; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8357

Report No.(s): AD-A423045; No Copyright; Avail: CASI; A03, Hardcopy

This research distinguishes mechanisms through which activated Ras induces rat mammary gland carcinogenesis. Experiments expressing H-Ras and K-Ras chimeric proteins in mammary gland (Aim 1A) investigate hypothesis one: greater frequency of H-Ras carcinogenesis than K-Ras carcinogenesis in rat mammary gland results from differences in the last 20 amino acids of H-Ras and K-Ras. K-Ras with an H-Ras c-terminus is as tumorgenic as H-Ras, supporting hypothesis one: however, H-Ras with a K-Ras c-terminus is also as tumorgenic as H-Ras, suggesting a unique characteristic of intact K-Ras limits mammary carcinogenesis. Expression of Raf-Caax (Aim 1B), does not induce tumors, suggesting hypothesis two: individual Ras effectors won't initiate rat mammary carcinogenesis, rather multiple effectors must act synergistically. However, each Ras effector loop mutant (G37-Ras activates RalGDS, E38-Ras activates Raf, and C40-Ras activates PI3K) (Aim 2A), individually induces mammary carcinomas. Carcinoma induction from n-terminus truncated Raf (DELTA-Raf) confirms Raf activation alone will induce carcinomas, eliminating hypothesis two. To investigate the apparent inconsistency that E38-Ras and DELTA-Raf cause tumors but Raf-Caax does not, these Raf mutations were combined (DELTA-Raf-Caax). Since DELTA-Raf-Caax constructs also fail to induce mammary carcinomas, we conclude that c-terminal lipid modification of Raf is not oncogenic in rat mammary gland.

DTIC

Cancer; Carcinogens; Mammary Glands; Rats

20040075167 New York Univ., New York, NY

Hypo-Fractionated Conformal Radiation Therapy to the Tumor Bed after Segmental Mastectomy

Formenti, Silvia C.; Roses, Daniel; Harris, Matthew; Shapiro, Richard; Guth, Amber; Jul. 2003; 20 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0345

Report No.(s): AD-A423053; No Copyright; Avail: CASI; A03, Hardcopy

The current trial tests a regimen of conformal hypo-fractionated radiotherapy (5 fractions) directed to the original tumor bed with margins in a selected subset of post- menopausal women with breast cancer with a very low risk for local recurrence elsewhere in the breast. We are currently reporting the feasibility results and DVH analysis of the first 4% patients accrued. After planning CT is conducted in the prone position the breast tissue and tumor bed are contoured on a 3D planning system and a 2 cm margin added to determine the PTV. A plan is generated to treat the PTV to 90% of the prescription dose. Six Gy

per fraction are delivered to the 95% isodose surface in 5 fractions over ten days weeks to a total dose of 30 Gy. All patients appeared to tolerate treatment very well. DVH varied based on the position of the original tumor bed and the size of the breast. In most cases it was possible to successfully plan and treat a quadrant of the breast with parallel opposed tangent fields without exceeding 50% of the dose to 50% of the breast volume. We continue accrual as planned, to a total of 99 patients.
DTIC
Cancer; Mammary Glands; Radiation Therapy; Tumors

20040075172 Texas Univ., Arlington, TX
Assessing Vascular Oxygen Dynamics for Breast Tumor Prognosis: Comparison Between MR BOLD and Near Infrared Method
Gu, Yueqing; Sep. 2003; 87 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0423
Report No.(s): AD-A423064; No Copyright; Avail: CASI; A05, Hardcopy

The goal of this research is to investigate breast tumor vascular oxygenation, HbO2, and total hemoglobin concentration, Hbtotal, with respect to different interventions by correlating the results of Near Infrared Spectroscopy (NIRS) with BOLD in MRI. Up to now, I have demonstrated the capability and accuracy of NIRS as a non- invasive real time monitoring tool for tumor vascular oxygenation and blood volume by comparing the simultaneous measurements among three oxygen-related indicators and using 19F MRS of PFOB for blood volume measurement, respectively. Hyperoxic gases and hydralazine interventions have been intensively investigated by NIRS. Results showed that carbogen and oxygen breathing significantly elevate breast tumor oxygenation without difference in terms of magnitude, but with sluggish response in carbogen breathing. CO2 contributes a small portion to the elevation of DeltaHbO2. Only -40% of the breast tumors have good response in DeltaHbtotal with respect to Hyperoxic intervention. Administration of hydralazine effectively reduced both DeltaHbO2 and DeltaHbtotal in all the breast tumors. Meanwhile, I performed simultaneous measurements of tumor vascular oxygenation by NIRS and BOLD MRI, respectively. Results indicated the consistency of tumor global oxygenation obtained form the two simultaneous, independent measurements, with heterogeneous response displayed inside breast tumors in BOLD MR images, which may help us better understand, and further, interpret the mechanism of BOLD MRI.
DTIC
Cancer; Cardiovascular System; Infrared Spectroscopy; Mammary Glands; Near Infrared Radiation; Oxygen; Tumors

20040075173 Virginia Univ., Charlottesville, VA
Aromatase Overexpression and Breast Cancer Development
Yue, Wei; Aug. 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0444
Report No.(s): AD-A423065; No Copyright; Avail: CASI; A03, Hardcopy

Estrogen can be metabolized to hydroxylated catechol estrogen, a genotoxic metabolite of estrogen, which causes DNA damage and tumors in animal models. In situ synthesis of estrogen in the breast through aromatase results in high tissue estrogen concentrations. We hypothesized that overexpression of aromatase in breast tissue increases tissue estradiol concentrations and consequent genotoxic metabolites, and eventually causes breast cancer. To test our hypothesis, we stably expressed aromatase cDNA in MCF-l0A cells, a benign breast epithelial cell line. During this funding period, we initially characterized the stable line, MCF-l0Aarom using tritiated water release assay and products isolation by thin layer chromatorgraphy. We demonstrated that MCF-l0Aarom cells expressed functional aromatase. We then conducted in vitro study for transformation using soft agar growth assay and in vivo tumorigenesis in nude mice. Our pilot studies allowed us to set up standards (growth time and colony size) for the soft agar assay. There is no palpable tumor formed in nude mice in which MCF-l0Aarom cells were inoculated. We also treated the MCF-l0Aarom cells in the culture with androstenedione, estradiol, and aromatase inhibitor letrozole. The samples were sent to Dr. Cavalieri for metabolites measurement.
DTIC
Cancer; Catecholamine; Deoxyribonucleic Acid; Estrogens; Hormones; Mammary Glands; Toxicity

20040075174 Utah Univ., Salt Lake City, UT
Optimization of Breast Cancer Treatment by Dynamic Intensity Modulated Electron Radiotherapy
Leavitt, Dennis D.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0435
Report No.(s): AD-A423066; No Copyright; Avail: CASI; A03, Hardcopy

Five specific projects were developed during the current work period: 1) The Photon Multi- Leaf Collimator was characterized for electron beams. This considered the difference in collimation between the x-direction (rounded leaf ends) and the y-direction (divergent leaf sides) . 2) The Monte Carlo code was parallelized for Utah Beowulf cluster. Twenty- five PCs were linked together to simultaneously calculate BEAM and DOSEXYZ. 3) The BEAM and DOSEXYZ modules were modified to calculate multiple beams in parallel and to display the does distributions 0 a dose phantom defined by Utah CT data. 4) Differences between measured and calculated dose profiles in the long axis of the MLC were resolved by a mathematical construct that modified the scattering foil segments by including a "flare" in each segment of the scattering foil. Failure of the unmodified MC code to predict the long axis profiles will be of interest to the whole community. 5) The transfer of CT data from the Utah CT to the Monte Carlo phantom was developed such that actual patient data can now be used directly in the Monte Carlo calculations. Simultaneously, multiple-angle, dual energy dose calculations were demonstrated on the Utah CT data sets. These items are significant, and keep us on track to finish the work in a timely manner.
DTIC

Beams (Radiation); Cancer; Electron Beams; Mammary Glands; Radiation Therapy

20040075175 Thomas Jefferson Univ., Philadelphia, PA

An Anti-Oncogenic Role for Decorin in Mammary Carcinoma

Iozzo, Renato V.; Oct. 2003; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0425

Report No.(s): AD-A423067; No Copyright; Avail: CASI; A02, Hardcopy

A significant proportion of human breast cancers overexpress ErbB2, a member of the receptor tyronsine kinase gene family that also includes the epidermal growth factor receptor (EGFR). Overexpression of ErbB2 correlates with increased metastatic potential and poorer prognosis. Agents that antagonize the activity of ErbB family members have obvious clinical implications. We have previously discovered that decorin causes a functional inactivation of the oncogenic ErbB2 in mammary carcinoma cells overexpressing ErbB2. This leads to growth inhibition and cytodifferentiation of mammary tumor cells and a concurrent suppression of their tumorigenic potential in vivo. We have successfully demonstrated decorin's cytostatic effect both in vitro and in vivo with a metastatic breast cancer cell model. Thus, decorin gene therapy helps in retarding the growth of human tumors in immunocompromised animals and could represent a new independent or adjuctive therapeutic modality against cancer. We have additionally created a breast cancer cell line that contains the decorin transgene under the control of an inducible promoter. We plan on using this cell line to study decorin's temporal effects on both primary tumor development as well as on tumor spread and metastases. Our ultimate goal is to prove decorin's efficacy as a tumor suppressor and possible means of therapy fir breast cancer.
DTIC

Cancer; Carcinogens; Epidemiology; Mammary Glands; Metastasis; Proteins; Tumors; Viruses

20040075176 Utah Univ., Salt Lake City, UT

Telephone-Linked Care: Enhancing Self-Care for Women With Breast Cancer

Mooney, Kathleen H.; Sep. 2003; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0695

Report No.(s): AD-A423068; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this pilot study is to develop informational messages about managing 6 common symptoms (nausea/vomiting, trouble sleeping, fatigue, trouble thinking, fever/hills, and pain), integrating them with a computer-based telephone symptom monitoring system, Telephone Linked Care (TLC) and then evaluating the usefulness of the TLC system and the informational messages during a cycle of chemotherapy for breast cancer. Using an experimental design with random assignment to the TLC program or standard care, participants in the experimental group will call the TLC system daily. Descriptive statistics and t-test will be used for analysis. The specific aims of the study are: 1. To test the feasibility of a computer-based telephone communication system (TLC) to provide informational messages about symptom management self care strategies for breast cancer patients during a cycle of chemotherapy. 2. To assess participant satisfaction, level of acceptability and the degree of difficulty in using the informational messages from the patient's perspective. 3. To compare the use of self care strategies, their perceived effectiveness and the source of information about the self care strategy between patients utilizing the TLC system and a control group receiving standard care.
DTIC

Cancer; Chemotherapy; Computer Techniques; Females; Mammary Glands; Telecommunication; Telephones

20040075177 TRUE Research Foundation, San Antonio, TX
Hepatitis C Virus Infection: Mechanism of Disease Progression
Sjogren, Maria H.; Huntley, Brooke M.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0719
Report No.(s): AD-A423069; No Copyright; Avail: CASI; A02, Hardcopy

An estimated 4 million individuals in the USA are chronically infected with the hepatitis C virus. Annually 8, 000 to 10,000 of these subjects will die of liver-related complications and approximately 1,000 will require liver transplantation. The USA military high rates of HCV infection similar to the general US population (1.6%). However, it is a younger population and its natural history of HCV infection has not been studied. Therefore, the clinical outcome of HCV-infected military subjects and risk factors contributing to disease progression are largely unknown. Such knowledge is essential for decisions regarding optimal management and prevention of the disease. This study%focuses on 200 active duty military subjects infected with HCV, who will be enrolled and observed prospectively over-four years. Liver biopsies are to be performed at initiation if needed and at completion of study to observe for disease progression. Lab evaluation of virologic and biochemical indicators of the disease and detailed information about risk factors, and quality of life are collected by questionnaire every six months. Currently, it is too early to analyze the data in terms of disease progression and potential contributing factors to disease progression specific to this population, as no subjects have completed the study. Therefore, the data presented in this report will be confirmed to descriptive statistics of the sample to date.
DTIC
Diseases; Hepatitis; Liver; Viral Diseases; Viruses

20040075179 Wisconsin Univ., Madison, WI
Relaxation of Insulin-Like Growth Factor II Imprinting in Prostate Cancer Development
Jarrard, David F.; Jan. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0163
Report No.(s): AD-A423078; No Copyright; Avail: CASI; A02, Hardcopy

A marked propensity for prostate cancer arises in the peripheral prostate with aging. The insulin-like Growth Factor-II (IGF-II) gene is an auto-paracrine growth stimulator that is an important positive modulator of cancer development. IGF-II typically demonstrates monoallelic, or imprinted, expression in adult tissues and indeed this pattern is maintained in the periurethral zone, a region where cancer development is rare. In addition, IGF-II loss of imprinting (LOI), as well as increased IGF-II expression, are common attributes of prostate cancer. It is our hypothesis to be tested that an age- dependent loss of IGF-II imprinting, resulting from age-dependent changes in DNA methylation, occurs specifically in the peripheral zone of he prostate and contributes to the increased risk for cancer development. To examine temporally when this loss of IGF-II imprinting occurs and the mechanisms underlying it we propose 3 Specific Aims: (1) To determine if IGF-II LOI in he peripheral prosate derives form stromal and/or epithelial cells; () To determine whether IGF-II LOI occurs as an age-dependent process inhuman prostate tissue that are uninvolved with cancer; and (3) To examine DNA methylation as a mechanism for any observed changes in eh imprint status in prostate tissues. This proposal is significant and unique in testing whether regional expigenetic changes occur in histological normal prostate tissues that are destined to become neoplastic, We expect to determine whether specific age-related, peripheral zone changes in methylation and imprinting occur in the general population and whether these changes are linked to prostate cancer development.
DTIC
Cancer; Epithelium; Insulin; Prostate Gland

20040075181 Wayne State Univ., Detroit, MI
DNA Vaccination to Overcome Peripheral Tolerance
Wei, Wei-Zen; Aug. 2003; 47 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0455
Report No.(s): AD-A423080; No Copyright; Avail: CASI; A03, Hardcopy

The vaccination efficacy of DNA encoding autologous rat ErbB-2 (neu) or heterologous human ErbB-2 (Her- 2) is compared in rat neu transgenic mice (BALB neuT). Cross reactivity between Her-2 and rat neu was tested initially by immunizing normal mice twice, i.m. with pEFBosGM-CSF and pCMVE2TM orpCDneuTM. E2TM and neuTM encodes the extracellular (ECD) and transmembrane (TM) domains of Her-2 and neu, respectively. Immunized mice were challenged with mammary tumor D2F2 expressing Her-2 (D2F2/E2) or neu (D2F2/neu). All mice immunized with E2TM or neuTM rejected tumors expressing the corresponding antigen. There is significant cross- protection against tumors expressing the non-corresponding ErbB-2, although the antibodies demonstrated little cross- reactivity. When tested in neuT mice which are

tolerant to rat neu, neuTM but not E2TM delayed spontaneous tumorigenesis. Therefore, Her-2 and rat neu are cross-reactive antigens in normal mice, but only autologous neu, not heterologous Her-2 induced protective immunity in NeuT transgenic mice. This may indicate a lack of cross-reactivity of antibodies which are critical in inhibiting NeuT tumor. To enhance the immunogenicity of autologous ErbB-2, an adjuvant sequence of Pan DR Reactive Epitope (PADRE) has been cloned into human ErbB-2 and the immunogenicity is being tested.
DTIC
Deoxyribonucleic Acid; Tolerances (Physiology); Transcription (Genetics); Vaccines

20040075182 Scripps Institution of Oceanography, La Jolla, CA
Supplemental Equipment Request for Advanced Marine Mammal Acoustic Localization
Thode, Aaron M.; May 20, 2004; 4 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0460
Report No.(s): AD-A423081; No Copyright; Avail: CASI; A01, Hardcopy

OBJECTIVE: This award is supplemental support for a larger three-year $300K award from ONR Ocean Acoustics(N00014-03-l- 0215). The overall project goal is to modify flash-memory recorders, originally developed for marine mammal acoustic tags, into modular, portable, and rugged array systems that can be deployed in multiple configurations from inexpensive deployment platforms (i.e. boats), and even from autonomous underwater vehicles (AUVs) These arrays have been used to test various acoustic localization techniques on several marine mammal species that produce vocalizations in the 10-10000 Hz range, with an emphasis on matched-field processing (MFP) methods. MFP methods have the potential of permitting 3-D passive acoustic tracking of sound sources using a collection of sensors deployed at one location, instead of being deployed over multiple locations.
DTIC
Acoustics; Animals; Marine Biology; Marine Mammals; Position (Location); Sound Generators

20040075183 Scripps Institution of Oceanography, La Jolla, CA
Analysis of Acoustic Data Under Response of Sperm Whales to Air Gun Sounds in the Gulf of Mexico
Thode, Aaron M.; May 21, 2004; 4 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0187
Report No.(s): AD-A423082; No Copyright; Avail: CASI; A01, Hardcopy

To field-test an automated procedure for passively tracking sperm whales in three-dimensions, using natural vocalizations recorded on two towed arrays, deployed either alone or in conjunction with dive tags. The algorithms would permit automated tracking of multiple animals over complete dive cycles, producing statistically significant sample sizes for evaluation of controlled-exposure studies. When used in conjunction with a dive tag, the algorithm would permit better resolution tracking of animals detected on both the tag in array, effectively increasing the number of animals tracked by the tag.
DTIC
Acoustic Properties; Automatic Control; Gas Guns; Gulf of Mexico; Tracking (Position); Whales

20040075184 Scripps Institution of Oceanography, La Jolla, CA
Analysis of Sperm Whale Acoustic Signals in the Gulf of Mexico and the Mediterranean
Thode, Aaron M.; May 20, 2004; 4 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0448
Report No.(s): AD-A423084; No Copyright; Avail: CASI; A01, Hardcopy

To design, develop, and simulate an automated procedure for passively tracking sperm whales in three- dimensions, using natural vocalizations recorded on two towed arrays, deployed either alone or in conjunction with dive tags. The algorithms would permit automated tracking of multiple animals over complete dive cycles, producing statistically significant sample sizes for evaluation of controlled-exposure studies. When used in conjunction with a dive tag, the algorithm would permit better resolution tracking of animals detected on both the tag in array, effectively increasing the number of animals tracked by the tag.
DTIC
Animals; Automatic Control; Gulf of Mexico; Marine Biology; Signal Transmission; Sound Waves; Tracking (Position); Whales

20040075186 Johns Hopkins Univ., Baltimore, MD

Enzymatic Activation of Peptide Prodrugs by Prostate-Specific Membrane Antigen (PSMA) as Targeted Therapy for Prostate Cancer

Denmeade, Samuel R.; Jan. 2004; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0076

Report No.(s): AD-A423088; No Copyright; Avail: CASI; A03, Hardcopy

The majority of our present chemotherapeutic agents only kill cells effectively when they are proliferating; this may explain why these agents have been of such limited success in patients. In contrast to these ineffective agents, we have chemically modified a plant toxin, Thapsigargin (TG), to produce primary amine-containing analogs that are potent, cell proliferation independent, inducers of apoptosis in prostate cancer cells. These TG-analogs, however, are not prostate cancer-specific cytotoxins. The hypothesis is that a potent TG analog can be converted to an inactive prodrug by coupling to a peptide carrier that is a substrate for Prostate Specific Membrane Antigen (PSMA). Since PSMA is expressed in high levels only by prostate cancer cells and not by normal cells, this should allow specific targeting of the TG-analog's killing ability to prostate cancer cells thus minimizing toxicity to normal tissue. Two enzymatic activities for PSMA have been described: an N-acetyl-a Jinked acid dipeptidase (NAALADase) activity and a pteroyl poly-y-glutamyl carboxypeptidase (folate hydrolase) activity. On the basis of preliminary data, the ideal TG prodrug should consist of either an aspartate or glutamate containing TG analog coupled via to a peptide containing a series of 0:- and y-linked glutamates and ending in an a-linked aspartyl-glutamate "cap". This substrate would be readily cleaved by FSMA but would be stable to hydrolysis by proteases such as garnma-glutamyl hydrolase present in serum and extracellular fluid of some normal tissue types.

DTIC

Antigens; Cancer; Enzyme Activity; Enzymes; Membranes; Peptides; Prostate Gland; Therapy

20040075202 Alphatech, Inc., Burlington, MA

Decomposition Techniques for Temporal Resource Allocation

Wu, Cynara C.; Castanon, David A.; Apr. 2004; 8 pp.; In English

Contract(s)/Grant(s): F33615-01-C-3149; Proj-ARPF

Report No.(s): AD-A423115; AFRL-VA-WP-TP-2004-311; No Copyright; Avail: CASI; A02, Hardcopy

We consider the problem of allocating a set of heterogeneous resources with availability constraints to maximize a given value function. The problem arises in a wide variety of military and industrial situations. We formulate the problem as a discrete- state decision process. We consider two instances of the problem that is applicable in situations where persistent coverage over all stages is desired. While we were able to solve the first example using dynamic programming, the computational requirements are significant and not scalable to larger instances. We consider an approximate technique using decomposition combined with dynamic programming. Our experiments show that this approach requires very little computation time and produces near-optimal results for the examples considered.

DTIC

Decomposition; Dynamic Programming; Resource Allocation; Resources Management

20040075205 Rochester Univ., NY

A Murine Model of Genetic and Environmental Neurotoxicant Action

Richfield, Eric K.; Sep. 2003; 294 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-98-1-8628

Report No.(s): AD-A423121; No Copyright; Avail: CASI; A13, Hardcopy

The Parkinson's disease phenotype (PDP) should be considered a complex/ quantitative/threshold trait in humans and modeled as such in rodents. It is complex because many risk factors contribute to the likelihood of the disease, including interactions between genetic background, age, diet, life-style, and exposure to xenobiotics. It is quantitative because the symptoms and causative pathology vary in severity, usually progressing over time due to loss of neurons. It is a threshold trait because individuals will only seek medical attention when symptoms reach a threshold of severity that may vary among people. This project studies interactions between genes, the environment, and age in causing mouse Parkinsonism. We use mice overexpressing a wild-type or a doubly mutated form of human alpha-synuclein (h-alpha-SYN). We created and characterized these two constructs on DNA, RNA, and protein levels. Both types express functional h-alpha-SYN in dopaminergic terminals. All mice have age-related progressive loss in locomotor function. The two transgenic have greater declines in locomotor behavior, levels of dopamine (DA) and metabolites, and number of TH(+) neurons in the substantial nigra pars compacts throughout their life-span than do nontransgenic littermates. These changes resemble those seen in human Parkinsonism The model we have created meets many features of the PDP and will continue to be refined to meet additional

criteria. It will prove useful for identifying mechanisms of toxicity related to alpha-SYN and for therapeutic interventions. We have continued our work on neurotoxicants, particularly man-made xenobiotics and their role in the PDP. We have demonstrated effects both in vitro and in vivo. These studies implicate a role for transporters in controlling influx, efflux, and duration of exposure to adverse molecules including dopamine_and neurotoxicants.
DTIC
Diseases; Dopamine; Environment Models; Genetics; Nervous System; Rodents

20040075207 Georgetown Univ., Washington, DC
Periscopic Spine Surgery
Cleary, Kevin R.; Feb. 2004; 69 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9022
Report No.(s): AD-A423123; No Copyright; Avail: CASI; A04, Hardcopy

This project is aimed at improving the state of the art of image-guided and minimally invasive procedures by developing a new generation of clinical techniques along with the computer-based hardware and software needed for their implementation. Key research accomplishments for this year are: 1)Received FDA approval to continue the clinical trail for robotically assisted spinal blocks with an additional 80 patients. 2) Demonstrated the feasibility of fluoroscopy serving for automatically positioning a needle driver robot at the skin entry point. 3) Began a%new study of robotically assisted lung biopsy and demonstrated the ability to frame grap BT fluoroscopy images and display them on the robot controller. 4) Gathered skin motion data on four patients during CyberKnife stereotactic radiosurgery treatments under an IRB-approved protocol. 5) Developed a respiratory motion simulator with two 3 degree of freedom platforms to evaluate CyberKnife treatments which compensate for internal organ motion.
DTIC
Clinical Medicine; Computer Techniques; Robotics; Spine; Surgery

20040075208 Virginia Univ., Charlottesville, VA
PSA Converts Parathyroid Hormone-Related Protein (PTHrP) from an Osteolytic to an Osteoblastic Factor: Role in Bone Metastasis
Chirgwin, John M.; Dec. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0043
Report No.(s): AD-A423124; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer metastases cause disorganized new bone formation, despite expressing the bone- destructive factor, PThrP. We report a molecular basis for this paradox: residues 6-9 LMDK of ET- 1 and PTHrP residues 8-11 LHDK share sequence similarity. PTHrP is cleaved at residues 22 and 23 by the serine protease, prostate-specific antigen (PSA). The fragments generated by PSA are too short to activate the PTH1 receptor but stimulate new bone by activating the ETA receptor. We tested PTHrP peptides on bone formation in 4-day neonatal mouse calvariae. PTHrP(1-16) (100nM) caused a 2.5-fold stimulation of new bone area (p<0.001). Osteoblast numbers were correspondingly increased. The response was equivalent to ET-1 (100nM). PTHrP(1-20) (25nM) also increased bone formation. The actions of PTHrP(1-16 & 1-23) were blocked by ABT627 (0. 01nM), a selective ETAR antagonist. We found a strong bone anabolic response to PTHrP(1-23) (1nM; p<0.01 vs control), while PTHrP(1-34) instead caused extensive osteolysis. Structural mimicry of ET-1 by PTHrP peptides provides a molecular basis for the osteoblastic phenotype of PTHrP- positive prostate cancer bone metastases. ETAR antagonists should be effective against PTHrP fragments, in treating osteoblastic bone metastases due to prostate cancer.
DTIC
Bones; Cancer; Cells (Biology); Hormones; Metastasis; Parathyroid Gland; Prostate Gland; Proteins

20040075209 Arizona State Univ., Tempe, AZ
Job Characteristics in the USA Air Force and Mental Health Service Utilization
Baumgarten, Victor A.; Apr. 2004; 144 pp.; In English
Report No.(s): AD-A423128; CI04-350; No Copyright; Avail: CASI; A07, Hardcopy

Data from the 2000 Air Force Community Needs Assessment were used to assess the significance and strength of the effects of job characteristics and social supports on mental health service utilization. In this study, mental health services included anger management, mental health, stress management and substance abuse services. Job stressors were hypothesized to increase service utilization. Social support was hypothesized to decrease service utilization and buffer the effects of job stressors. Four job stressors were used: shift work, long work hours, frequency of deployments, and length of deployments.

Social support was evaluated on five levels: family support, community integration, co-worker support, supervisor support, and support by superiors. Family support was measured in terms of being accompanied by family members and family instability (conflict and doubt). Co-worker support was measured in terms of co- worker conflict. Logistical regression was used in analyzing the predictive strength of job stressors and social supports on mental health service utilization. No main effects were found for job stressors. For social support, significant predictors of service utilization were family instability (OR = 1.293), co- worker conflict (OR = 0.975), community integration (OR = 1. 208) and supervisor support (OR = 0. 813). High family instability and high co-worker conflict emerged as the strongest risk factors for using mental health services. Additional analysis using ordinary least squares regression showed job stressors to have small direct effects on social support and marginal indirect effects on mental health service utilization. Additional risk factors included being female, being enlisted, and being first-term personnel.
DTIC
Drugs; Medical Services; Mental Health; Tasks; United States

20040075210 Fox Chase Cancer Center, Philadelphia, PA
Tailored Communication to Enhance Adaptation Across the Breast Cancer Spectrum
Miller, Suzanne M.; Oct. 2003; 79 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0238
Report No.(s): AD-A423129; No Copyright; Avail: CASI; A05, Hardcopy

Breast cancer represents a serious health concern for women, across the disease spectrum. First, despite advances in technology used for intensive disease surveillance and innovative preventive options, interest in and utilization of these technologies is less than optimal, especially among low-income, African-American women and first-degree relatives. Second, among women who have completed cancer treatment, psychological after-effects that can have a negative impact on adjustment and adherence to screening practices are prevalent. Finally, for those cancer patients whose disease has metastasized, clinically relevant psychosocial adjustment problems need to be recognized and managed. It is for these reasons that research leading to improvements in quality of life throughout the disease spectrum is necessary. The Behavioral Center for Excellence, through the coordination of four projects, seeks to understand and evaluate psychosocial approaches for promoting psychological and physical adaptation to cancer risk, treatment and survival. Each project systematically assesses and addresses barriers to, and facilitators of, adjustment and adherence and evaluates interventions designed for this cause. With support from four core facilities, the BCE has assembled a multi-disciplinary research team to conduct an interrelated set of studies that are theoretically-guided, thematically convergent. and synergistic in the impact on the behavioral aspects of breast cancer.
DTIC
Cancer; Mammary Glands; Psychology; Spectra

20040075211 New Mexico Univ., Albuquerque, NM
Selective Inhibitors of 17beta-Hydroxysteroid Dehydrogenase
Vander, David L.; Jul. 2003; 45 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0372
Report No.(s): AD-A423130; No Copyright; Avail: CASI; A03, Hardcopy

Human Type I 17 Beta-HSD, also known as 17 Beta- estrndiol dehydrogenase, catalyzes the reduction of the weak estrogen, estrone, to the strong estrogen, 17 Beta estradiol, which is the biologically active estrogen involved in the development of human breast cancer. Type I 17Beta-HSD is therefore a very attractive target for drug development. Objectives: Recently, we developed a new class of dehydrogenase inhibitors that are targeted at the NAD(P)/NAD(P)H binding sites (Rossmann fold) of dehydrogenses. Surprisingly, these inhibitors exhibit selectivity for different dehydrogenases. The goal of this project is to develop selective inhibitors of human Type I 17 Beta-HSD as "lead compounds" for stmcture-based drug design. The crystal structure of human Type I 17 Beta-HSD is available to aid in structure-based drug design. The concept that the Rossmann fold may represent a useful drug target is a new concept in drug design.
DTIC
Cancer; Enzymes; Estrogens; Inhibitors; Mammary Glands

20040075217 Pennsylvania State Univ., University Park, PA
Optimized Hyperthermia Treatment of Prostate Cancer Using a Novel Intracavitary Ultrasound Array
Smith, Nadine B.; Jan. 2004; 129 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0124
Report No.(s): AD-A423146; No Copyright; Avail: CASI; A07, Hardcopy

The eventual goal this research is to produce an ultrasound hyperthermia array which will uniformally heat the prostate to clinical temperatures for the treatment of prostate disease. This goal can be achieved by accounting for the physical differences between the prostate gland and surrounding tissue structures. It was therefore possible to design and construct as a transducer to produce uniform heating within the prostate while causing minimal damage to surrounding tissue. The second year of this three year research project was focused on the construction of the array based on our Year 1 results of computer simulations of the ultrasound energy interactions with the prostate. Three major areas accomplished during this term were: (a) transducer construction (b) optimization of the transducer array design, and (c) MRI thermometry experiments (in vitro and in vivo) using the hyperthermia ultrasound array. Specifically, a clinical applicator of the phased array has been constructed and is being used for MRI experiments. Additional information from the tissue modeling during Year 2 will be used to refine the heating pattern and can easily be incorporated in the current design. To summarize, there are no deviations from the original research plan and this research is progressing on schedule.
DTIC
Cancer; Clinical Medicine; Hyperthermia; Phased Arrays; Prostate Gland; Ultrasonics

20040075221 Stanford Univ., Stanford, CA
A Multileaf Collimator for Modulated Electron Radiation Therapy for Breast Cancer
Song, Yulin; Apr. 2003; 176 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0443
Report No.(s): AD-A423150; No Copyright; Avail: CASI; A09, Hardcopy

Irradiation is an effective adjuvant therapy to lumpectomy, mastectomy, and chemotherapy for breast cancers of different stages. However, the conventional tangential photon beam treatment has two major limitations. Firstly, part of the lung and heart (in the case of the left breast treatment) may be exposed to high radiation dose. Secondly, the contralateral breast may receive a significant amount of scatter dose. Consequently, irradiation-related complications such as arm edema, myocardial infarction, severe breast fibrosis, and secondary breast cancer may occur in the patients who have undergone conventional photon beam treatment. To reduce radiation dose to normal structures, we have investigated treating breast cancers using MERT. To deliver MERT plans effectively, we designed and manufactured a prototype EMLC based on the results of Monte Carlo simulations and a Varian 25 x 25 sq cm electron applicator. The performance of the EMLC was experimentally evaluated and the results were compared with those of Monte Carlo simulations and a PMLC. We have also developed a complete system of Monte Carlo-based inverse treatment planning system for MERT plans. The system incorporates the Monte Carlo simulated electron pencil beams into the inverse planning process. Additionally, we have characterized the EMLC using a multiple-source beam model for fast Monte Carlo simulation. Furthermore, we have also studied the effect of beam delivery on optimized modulated electron radiation therapy plans in the final dose calculation.
DTIC
Cancer; Collimators; Electron Radiation; Mammary Glands; Radiation Therapy

20040075225 Baylor Coll. of Medicine, Houston, TX
The Role of Steroid Receptor Coactivators in the Development of Prostate Cancer
Cho, Jang H.; Sep. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0020
Report No.(s): AD-A423157; No Copyright; Avail: CASI; A03, Hardcopy

In prostate cancer, androgen receptor (AR) supervises several key genes expressions. In the cell. AR exerts its regulatory control on a target cell only in the presence of its ligand, androgen. The regulatory functions of AR are more complex and are fine-tuned by accessory proteins. These proteins are required for the maximum biological impact by androgen. These modulators, called coactivators, provide a positive stimulus for receptor action. Our laboratory has cloned the first nuclear receptor coactivator SRC-1. SRC-1 and its related family members, SRC-2 and -3, have the capacity to activate the transcriptional activity of steroid receptor. However, the role of steroid receptor coactivators in prostate cancer is still unclear. To understand the function of these genes in the human prostate cancer, we have performed in situ hybridization on human prostate cancer, and generated SRC-3 overexpressing stable cell lines. During two years of this award, we have examined the SRC-3 is highly expressed in the prostate tumors and its expression is highly correlated with tumorigenesis by regulating the cell proliferation and cell growth.
DTIC
Cancer; Prostate Gland; Steroids

20040075226 Arizona Univ., Tucson, AZ
Chemoprevention Trial of Selenium and Prostate Cancer
Ahmann, Frederick R.; Dec. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8580
Report No.(s): AD-A423159; No Copyright; Avail: CASI; A02, Hardcopy

The principal purpose of this trial is to assess the potential for the essential nutrient selenium (Se) to modulate biomarkers of prostate cancer between initial diagnostic biopsy and radical prostatectomy. The scope of work is to randomize at lest 110 participants to either a placebo or Se dosages of 200ug, or 400ug/day. Recruitment is continuing as a result of a no-cost extension. A total of 90 subjects have been randomized. Of these, 82 have completed the study, 7 dropped before completing the study, and 1 is in the process of completing the study.
DTIC
Cancer; Prostate Gland; Selenium

20040075233 Centro de Investigaciones Biologicas del Noroeste, La Paz
Coping With Repeated Ischemia and Reperfusion: Physiology of Free Radicals in Diving Birds and Mammals
Zenteno-Savin, Tania; May 20, 2004; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0314
Report No.(s): AD-A423194; No Copyright; Avail: CASI; A01, Hardcopy

The specific mechanisms involved in protecting marine bird and mammal tissues from generation of free radicals and their deleterious effects are not known and are the subject of this research. The short-term objectives of this study are to analyze the rate of production of superoxide radical as an index of synthesis of free radicals, in tissues from marine birds and mammals; to examine the degree of lipid peroxidation as an index of free radical-induced damage, in tissues from marine birds and mammals; and to do a selective analysis of the antioxidant defenses which may endow marine birds and mammals with the tolerance to repeated cycles of ischemia/reperfusion associated to diving.
DTIC
Birds; Diving (Underwater); Free Radicals; Ischemia; Mammals

20040075234 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Insecticide Exposure in Parkinsonism
Bloomquist, Jeffrey R.; Klein, Bradley G.; Jan. 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8633
Report No.(s): AD-A423195; No Copyright; Avail: CASI; A03, Hardcopy

The EGFR receptor tyrosine kinase is dysfunctional in a wide range of solid human tumors including prostate carcinomas. The EGFR gene product is a transmembrane glycoprotein belonging to the epidermal growth factor receptor family and its cytoplasmic domain is responsible for sending the mitogenic signals into cells. We discovered that this domain of EGFR interacts with Tidl protein, a human counterparts of Drosophila tumor suppressor Tid56. Tid56 null mutation causes lethal tumorigenesis during larvae stage. Tidl is also known as a cochaperone of the heat shock protein 70 (Hsp70) and binds to Hsp70 through its conserved DnaJ-domain. We found that Increased expression of Tidl in human carcinoma attenuate's the EGFR-dependent oncogenic ERK1/2 and BMKl signaling pathways. Importantly, the functional DnaJ-domain of Tidl is required for consequent suppression of oncogenic signaling of carcinoma cells resulting from increased Tidl expression. Together, these results suggest that Tidl deterring controlled proliferation of carcinoma cells through reducing the downregulating the cancerous signaling from EGFR. Moreover, the cochaperonic and regulatory function of Tidl on Hsp70 most likely play an essential role of this anti- proliferation function of Tidl in carcinoma cells.
DTIC
Diseases; Exposure; Insecticides; Nervous System

20040075244 California Univ., Berkeley, CA
The Involvement of Human Cyr61 in Heregulin Induction of Breast Tumor Progression
Oketch-Rabah, Hellen; Aug. 2003; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9169
Report No.(s): AD-A423205; No Copyright; Avail: CASI; A04, Hardcopy

This fellowship, originally granted to Dr. M. Tsai and later transferred to Dr. H. Oketch-Rabah in the laboratory of Dr. R. Lupu, was initially concerned with the role of the cytokine heregulin, in the regulation of hormone receptor status in breast

cancer. Three projects were accomplished during the fellowship. The first based on the original SOW yielded information that demonstrated that Cyr61 is a downstream effector of Heregulin (HRG) action and suggested that Cyr61 is necessary for HRG-mediated chemomigration. Furthermore the work showed that Cyr61 plays a functional role in breast cancer progression, possibly through its interactions with the alpha(v)beta3 receptor (see attached publications). The findings of Dr. Oketch-Rabab on the Black Cohosh project demonstrated that BC has no estrogenic activity and therefore is safe to use for the treatment of menopausal symptoms by women at risk of developing breast cancer and in whom estrogen replacement therapy is contraindicated for other reasons (see attached Abstracts). In the final year we requested a modified SOW due to Dr. Lupu's relocation. Dr. Oketch-Rabah began a project in the Barcellos-Hoff laboratory to examine TGF-(beta)1 regulation of the proliferation of estrogen receptor positive (ER+) cells during mouse mammary development. To our knowledge this is the first mouse model to demonstrate a mechanism controlling the size of the ER+ subpopulation and a means of investigating how the dysregulation of this population contributes to the risk of developing breast cancer.
DTIC
Cancer; Estrogens; Mammary Glands; Neoplasms; Tumors

20040075245 Boston Univ., Boston, MA
Alpha Synclein Aggreagation in a Neurotoxic Model of Parkinson's Disease
Kowall, Neil W.; Aug. 2003; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9540
Report No.(s): AD-A423207; No Copyright; Avail: CASI; A03, Hardcopy

The neurotoxin 1-methyl-4-phenyl- tetrahydropyridine (NPTP) inhibits mitochondrial oxidative phosphorylation and replicates the pattern of neuronal neurodegeneration found in Parkinson's disease (PD). Neurons that degenerate in PD develop inclusions containing a synaptic protein, alpha synuclein. We examined how MPTP and other neurotoxins affect cytoskeletal and synaptic proteins and studied the relationship between oxidative damage and synuclein aggregation in NPTP-treated mice. Oxidative injury is evident in dopaminergic neurons 4 days after toxin administration followed 3-6 days later by increased synuclein and ubiquitin immunoreactivity. Double staining studies show that oxidative markers are increased in neurons that develop increased alpha synuclein staining. Paraquat treatment causes nigral degeneration and alpha synuclein aggregation that is more prominent than that produced by MPTP. The proteasomal inhibitors lactacystin and epoxomicin protect mice form the neurotoxic effects of MPTP but may paradoxically increase alpha synuclein aggregation. Alpha synuclein knockout mice resist the neurotoxic effects of MPTP and other mitochondrial toxins including malonate, 3-nitropropionic acid and paraquat. Our studies show that MPTP-induced oxidative injury precedes increased neuronal alpha synuclein staining and suggest that alpha synuclein and abnormal proteasomal function could contribute to neurotoxin and PD-related neuronal cell death. Reducing synuclein expression may be a novel approach to the treatment of PD.
DTIC
Diseases

20040075246 Virginia Commonwealth Univ., Richmond, VA
Molecular Mechanisms of Prostate Cancer Progression
Holt, Shawn E.; Jan. 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423208; DAMD17-02-1-0152; No Copyright; Avail: CASI; A03, Hardcopy

In studios to define the mechanisms involved in the progression of immortal non tumorigenic prostate cells to a tumorigenic state, we have found that molecular chaperones are elevated along with telomerase activity. Elevated chaperone function results in an increase in telomerase assembly and is associated with prostate cancer progression. In order to determine the importance of the chaperone increase, we are investigating, both genetically and pharmacologically, whether ectopic chaperone expression results in transformation and whether chaperones are targets for prostate cancer therapy. The hsf-1 transcription factor has been over-expressed in non- tumorigenic prostate cells, resulting in increased hsp90 and hsp70 expression and an upregulation of telomerase. Preliminary data suggests that exogenous hsf-1 has little effect on tumorigenic growth. Using both a pharmacologic (radicicol, a specific hsp90 inhibitor) and genetic (siRNA to hsp90) approaches, malignant prostate cancer cell lines show only a transient decline in telomerase activity but a significant decrease in telomere length, suggesting that chaperones function at the telomere independent of their interaction with telomerase.
DTIC
Cancer; Prostate Gland

20040075247 Massachusetts General Hospital, Boston, MA

Enabling Technologies for Advanced Soft Tissue Modeling

Dawson, Steven L.; Howe, Robert; Ottensmeyer, Mark P.; Kerdok, Amy; Galea, Anna M.; Sep. 2003; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0677

Report No.(s): AD-A423209; No Copyright; Avail: CASI; A03, Hardcopy

Soft tissue properties represent a major and significant unknown in the domain of medical modeling and simulation. This program presents a 4-year research effort in defining tissue characteristics of three distinct organs (liver, spleen, and kidney) in vivo. Over the course of this program, we will use novel methods of tissue interrogation to characterize non-linear behavior during slow deformations, as would commonly be seen during surgical manipulations. We will then develop mathematical models that can be optimized to permit near real-time representations of organ behaviors, including the boundary characteristics of organs in situ. In year two we developed an in vitro experimental setup to approximate in vivo conditions; revised year one's testing instruments; devised a new large external indentation device for creep measurements; tested perfused porcine livers using these instruments; investigated a non-invasive technology for determining vessel characteristics; and began incorporating our results into finite element models. Collaborative efforts have allowed us to explore 30 real-time ultrasound as a means of investigating tissue mechanics; compare noninvasive forms of tissue property measurements (harmonic elastography) with our measurements; design a vocal fold tissue property measuring device; and develop a new optical testing modality that can later be used for whole organ validation.

DTIC

Tissues (Biology); Blood Vessels; Mathematical Models; Liver; Spleen; Kidneys

20040075248 Pittsburgh Univ., Pittsburgh, PA

Increased Illegitimate V(D)J Recombination as a Possible Marker for Breast Cancer Predisposition

Grant, Stephen G.; Mar. 2003; 26 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0605

Report No.(s): AD-A423210; No Copyright; Avail: CASI; A03, Hardcopy

It is widely presumed that environmental exposures play a role in the development of breast cancer, but only ionizing radiation, has been identified as a risk factor for the disease. Individual susceptibility to the types of genotoxic damage and mutagenesis caused by ionizing radiation should therefore be a modulator of breast cancer risk. A number of inborn human disease syndromes characterized by ioning radiation sensitivity have been identified, including ataxia telangiectasia, which has also been linked with breast cancer risk through molecular and epidemiological studies. The V(D)J recombinase assay exploits the known association of specific; chromosome aberrations with the AT phenotype; chromosome aberrations caused by the inappropriate "illegitimate" interrecombination of elements of different genes that normally undergo V(D)J recombination during maturation of the immunological system, the immunoglobulin and T-cell receptor genes. This PCR-based assay has the advantages of being simple, rapid and relatively inexpensive, allowing for feasible application in population screening to detect individuals at increased risk of breast cancer prior to the onset of overt disease. This assay will now be applied within the larger context of a study measuring overall genotoxic exposure and response in newly diagnosed breast cancer patients using blood cell-based somatic mutation as says.

DTIC

Cancer; Mammary Glands; Markers

20040075250 Mayo Clinic, Rochester, MN

CHK2, A Candidate Prostate Cancer Susceptibility Gene

Liu, Wanguo; Jan. 2004; 27 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0093

Report No.(s): AD-A423213; No Copyright; Avail: CASI; A03, Hardcopy

To identify prostate cancer susceptibility genes, we applied a mutation screening of candidate gene approach. In our last year's reporter, we identified a total of 28 (4.8%) germline CHEK2 mutations in 178 clinic tumors, 149 familial prostate cancer (HPC) families, and 400 sporadic cases. Sixteen of the 18 unique CHK2 mutations identified in this study were not detected among 423 unaffected men, suggesting a pathological effect of CHK2 mutations in prostate cancer development. In this year's reporter, we identified two somatic CHK2 mutations in 84 clinic prostate tumor samples indicating that CHK2 mutation in prostate cancer could be both germline or somatic. To investigate the function of these mutations in prostate tumorigenesis, we generated stable cell lines and analyzed the CHK2 kinase activities in 9 of the mutants before and after irradiation. While most of the mutations have modest reduced CHK2 kinase activity in comparison with wild-type CHK2, one somatic mutation

(Glu321Lys) totally abolishes kinase activity. Our data provide first evidence that the CHK2 mutations identified in prostate cancer, both germline and somatic, impair CHK2 kinase activity suggesting that mutations in CHK2 may contribute to the development of prostate cancer through altering CHK2 kinase activity.
DTIC
Cancer; Deoxyribonucleic Acid; Genes; Oncogenes; Prostate Gland

20040075683 NASA Marshall Space Flight Center, Huntsville, AL, USA
Biodosimetry as a New Paradigm for Determination of Radiation Risks and Risk-Mitigation in Astronauts Exposed to Space Radiation
Richmond, Robert; Cruz, Angela; Bors, Karen; 2004; 1 pp.; In English; 75th Annual Scientific Meeting, 2-6 May 2004, Anchorage, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Predicting risk of cancer in astronauts exposed to space radiation is challenging partly because uncertainties of absorption of dose and the processing of dose-related damage at the cellular level degrade the confidence of predicting the expression of cancer. Cellular biodosimeters that simultaneously report: 1) the quantity of absorbed dose after exposure to ionizing radiation, 2) the quality of radiation delivering that dose, and 3) the macromolecular profiles related to malignant transformation in cells absorbing that dose would therefore be useful. An approach to such a multiparametric biodosimeter will be reported, This is the demonstration of two dose-responsive field-effects of enhanced protein-expression. In one case, expression of keratin 18 (K18) in cultures of human mammary epithelial cells (HMEC) irradiated with cesium-137 gamma-rays is enhanced following exposure of log phase cells to relatively low doses of 30 to 90 cGy. K18 has been reported by a marker for tumor staging and for apoptosis. In the second case, expression of connexin 43 (Cx43) is increased in irradiated stationary phase cultures of HMEC, indicating enhanced formation of gap junctions. Gap junctions have been reported to be involved in bystander effects following irradiation. It is a biodosimeter for assessing radiogenic damage. It is suggested further that such biomolecular dosimetry may introduce a new paradigm for assessing cancer risk and risk-mitigation in individuals, a requirement for managing radiation health in astronauts during extended missions in space. This new paradigm is built upon the statistical power provided by the use of functional genomics and proteomics represented in combined gene- and protein-expression assays.
Author
Dosimeters; Biochemistry; Radiation Dosage; Radiogenic Materials; Risk

20040075752 NASA Ames Research Center, Moffett Field, CA, USA
Genetic Network Modeling
Liang, Shoudan; Szallasi, Zultan; Fuhrman, Stefanie; Somogyi, Roland; Research and Technology 1997; September 1998, pp. 98; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A cell processes genetic information through transcription and translation of its genes. Understand- ing the organization of the genetic network and its minimum complexity requirement is among the important theoretical questions about the origins and evolution of life. With the advent of large-scale gene recognition techniques such as GeneChip and MicroArray, theoretical modeling of the genetic networks will also have applications in the biotechnology industry. address complex problems in the cell cycle. First, a general strategy is formulated to generate Boolean genetic networks that incorporate all relevant bio-chemical and physiological parameters and cover all of their regulatory interactions in a deterministic manner. Second, "realistic Boolean genetic networks" are introduced that produce time-series measurements very similar to those detected in actual biological systems. This project will lead to a better understanding of constraints required for modeling a realistic gene network.
Derived from text
Mathematical Models; Network Analysis; Genetic Code; Biological Evolution

20040075759 NASA Ames Research Center, Moffett Field, CA, USA
Neurolab Technologies Enable Space Life Sciences Neuroscience Research
Connolly, James P.; Savage, Paul D.; Research and Technology 1997; September 1998, pp. 141-142; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Shuttle Spacelab mission, Neurolab, was the primary focus for the flight support elements of the Engineering Branch, and the Science Payloads Life Sciences Division, the Payload and Facilities Operations Branch. First conceived in 1993, and launched just five years later, Neurolab evolved into the most complex Spacelab mission ever developed by Ames Research Center (ARC). Though the major hardware units had flown previously (for example, the general purpose work station

(GPWS), the research animal holding facilities (RAHFs), and the animal enclosure modules (AEMs)), critical modifications were carried out to ensure that the hardware would meet the Neurolab science objectives and improve overall technical capabilities.
Derived from text
Life Sciences; Neurology; Research Facilities; Space Missions; Spacelab

20040075806 NASA Ames Research Center, Moffett Field, CA, USA
Ultraviolet Radiation Effects on Carbon Isotope Fractionation
Rothschild, Lynn; DesMarais, David; Tharpe, Anne; Research and Technology 1997; September 1998, pp. 157-158; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this project i s to determine if ultraviolet (UV) radiation affects stable carbon isotope ratios. If so, is there an ecologic (e.g., micro bial mat vs. phytoplankton) or taxonomic (e.g., prokaryote vs. eukaryote, alga vs. plant) correlation presenting the phenomenon to the scientific community, for estimating how widespread the phenomenon is, and for suggesting ways to begin to elucidate the mechanisms underlying the effect. Ultimately this work could lead to a re-interpretation of isotopic ratio studies, including a re-interpretation of the fossil record.An experiment was conducted to determine it UV could affect stable carbon isotope ratios in algal communities.
Author
Radiation Effects; Isotope Ratios; Carbon Isotopes; Algae

20040076851 State Univ. of Iowa, Iowa City, IA, USA
Effect of Ionizing Radiation on Mammals and Its Implications for Accelerator Shielding
Evans, T. C.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 127-141; In English; See also 20040076842; No Copyright; Avail: CASI; A03, Hardcopy

The biological effects of radiation are discussed. The effects on different cells and doses, with a time dependence, are described.
CASI
Ionizing Radiation; Radiation Effects

20040077058 NASA Ames Research Center, Moffett Field, CA, USA
Biogeochemistry of Early Earth Photosynthetic Ecosystems: Production of Hydrogen and Carbon Monoxide
Hoehler, Tori M.; Bebout, Brad M.; DesMarais, David J.; Research and Technology 1999; December 2000, pp. 92-93; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

For the first three-quarters of its history, Earth s biosphere consisted exclusively of microbial life. Most of this period was dominated by photosynthetic microbial mats, highly complex and organized communities of microorganisms that once covered the Earth. For two billion years, these mats were the primary biologic agents of global environmental change (for example, the oxygenation of the atmosphere) and the crucible for evolution of the complex macroscopic life forms we know today. Ames Early Microbial Ecosystems Research Group studies the biology, chemistry, and geology of closely related modern microbial mats in order to better understand the important role played by their ancient counterparts.A key focus is to understand how the chemistry of the mat influences, and is influenced by, the collective activities of the constituent bacteria.
Author
Biogeochemistry; Microorganisms; Bacteria

20040077075 NASA Ames Research Center, Moffett Field, CA, USA
NASA Technology Helps Patients on Earth and Addresses Fundamental Questions on Human Autonomic Function
Cowings, Patricia S.; Toscano, William B.; Rashed, Hani; Research and Technology 1999; December 2000, pp. 161-162; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Dysautonomia is a term used to describe a wide variety of disorders in the human autonomic nervous system (ANS). An example of one such condition is Chronic Intestinal Pseudo-Obstruction Syndrome (CIPS), a rare disease of gastric dysmotility - the cause of which is unclear and for which pharmaceutical treatments are often ineffective. Symptoms of CIPS including nausea, vomiting ness and abdominal pain, and hypotension (low blood pressure) leave many patients with a very

low quality of life. The primary purpose of this research is to determine if Autogenic-Feedback Training Exercise (AFTE) will provide relief from the symptoms of nausea and/or hypotension.
Derived from text
Autonomic Nervous System; Abdomen; Signs and Symptoms

20040077081 NASA Ames Research Center, Moffett Field, CA, USA
Synaptogenesis in Microgravity (NIH.Bl)
Reiss-Bubenheim, Deborah; Savage, Paul; Research and Technology 1999; December 2000, pp. 143-144; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The flight experiment National Institutes of Health.Biology 1 (NIH.B1) was flown on the space transport system (STS-93) in late July, 1999. NASA Ames Research Center collaborated with BioServe Space Technologies, a NASA-sponsored Commercial Space Center (CSC), to develop an enhancement to the Group Activation Package (GAP) and the Isothermal Containment Module (ICM), flown within the Commercial Generic BioProcessing Apparatus (CGBA) payload. The collaboration evolved from the needs of both organizations to fly middeck experiments on the STS-93 mission. The NIH.B1 experiment was entitled 'Effects ot Spaceflight on Drosophila Neural Development,' and was led by Principal Investigator, Haig Keshishian, Harvard. This experiment was designed to investigate the effects of microgravity on a transgenic fruit fly line that expresses green fluorescent protein (GFP) to visualize singly identified motoneurons and their muscle targets.
Author (revised)
Microgravity; Drosophila; Neurons; Spaceborne Experiments

20040077087 NASA Ames Research Center, Moffett Field, CA, USA
Prebiotic Peptide Synthesis
Weber, Arthur L.; Research and Technology 1999; December 2000, pp. 102-103; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Chemical processes occurring on the primitive Earth about four billion years ago yielded molecules that had the ability to make copies of themselves or replicate. These rudimentary replicating molecules eventually developed into contemporary life that uses both protein and DNA molecules for replication. Since the DNA of contemporary life appears to be too complex to have been chemically made on the primitive Earth, the first replicating systems may have been composed solely of small proteins-called peptides. Peptides are good candidates for the first rep1 icati ng molecules because they are constructed from very simple building blocks-activated amino acid molecules-which could have been made by chemical processes on the primitive Earth. for the origin of life could have been synthesized on the primitive Earth four billion years ago, a model chemical process was investigated. This model process has the potential to make peptides from very simple chemical ingredients-formaldehyde, ammonia, and hydrogen sulfide.
Derived from text
Peptides; Biological Evolution; Amino Acids

20040077092 NASA Ames Research Center, Moffett Field, CA, USA
Space Technology and CFD Applied to the Development of the DeBakey Heart Assist Device
Kiris, Cetin; Kwak, Dochan; Research and Technology 1999; December 2000, pp. 76-78; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Approximately 20 million people worldwide suffer annually from heart failure, a quarter of them in America alone. In the USA, only 2,500 donor hearts are available each year. The DeBakey Ventricular Assist Device (VAD) prolongs life until a suitable transplant heart i s available, and is used to boost blood flow in patients suffering from hemodynamic deterioration, that is, loss of blood pressure and lowered cardiac output. The use of computational fluid dynamics (CFD) technology led to major design improvements in the heart assist device, enabling its human implantation. The DeBakey VAD is a miniaturized heart pump designed to increase blood circulation in heart-failure patients awaiting a transplant. A ventricular assist device has to be small and efficient, generating a 5-liter-per-minute blood flow rate against 100 mm Hg pressure. Because blood i s the operating fluid, the design of a VAD requires that it propel the blood gently, that is, it must minimize damage to the red blood cells. In order to reduce red blood cell damage, the pumping device must be designed to avoid regions of high shear stress and separated flow in the pump. In addition, the blood must be properly washed out of the pump since the formation of blood clots may appear within stagnation regions as a result of previously damaged blood cells. Since the device is small and the operating conditions severe, instrumentation for making necessary flow measurements i s extremely difficult to design. Therefore it became necessary to look at the flow by computational means. The detailed computational flow analysis now

affords VAD designers with a view of the complicated fluid dynamic processes inside their devices.
Derived from text
Space Flight; Technology Assessment; Computational Fluid Dynamics; Blood Circulation; Miniaturization; Cardiac Output

20040077097 NASA Ames Research Center, Moffett Field, CA, USA
Exploring Evolution Without a Genome
New, Michael H.; Pohorille, Andrew; Research and Technology 1999; December 2000, pp. 97-98; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In modern organisms, many essential life functions are performed by proteins, which are synthesized using information encoded in a nucleic acid genome. Darwinian evolution proceeds through small, random changes in the genome of an organism. If the proteins produced by an altered genome improve the ability of the organism to survive, then that organism is more likely to reproduce and distribute the altered genome to future generations. Thus, the functioning and evolution of living organisms require both proteins and nucleic acids. It is, however, unlikely that both proteins and nucleic acids arose simultaneously on the early Earth, and immediately became interconnected. How, then, did the earliest living organisms, protocells, perform essential life functions, grow, and evolve? This study proposes that protocells initially functioned and evolved without nucleic acids and, instead, small proteins, called peptides, performed cellular functions. Since amino acids, the building blocks of peptides, cannot pair precisely as do nucleic acid bases, the transfer of information between generations via the exact replication of peptides is not possible. Thus a new concept of evolution independent of coded information storage-nongenomic evolution - is required.
Derived from text
Genome; Nucleic Acids; Proteins; Protobiology; Exobiology

20040077109 NASA Ames Research Center, Moffett Field, CA, USA
Trace-Gas Production and Consumption in Microbial Mats
Bebout, Brad M.; Research and Technology 1999; December 2000, pp. 90; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Ames Microbial Ecology/Biogeochemistry Research Lab has made contributions to determining the rates and conditions under which various trace gases are emitted and/or consumed by microbial mats and stromatolites. The most promising search strategy for the detection of life on extrasolar planets is the detection of possibly biogenic gases using infrared spectrometry. Space-based interferometers, such as the Terrestrial Planet Finder, should be able to resolve the spectra of several biologically important trace gases in the atmospheres of extrasolar planets, possibly within 10 to1 5 years. Therefore, it is important to provide a conceptual framework for the interpretation of the possible biogenicity of these gases. Measurements of the production and consumption of reduced gases have been made under current conditions on the Earth, and conditions that are not present now but have existed in Earth s past. To date these measurements indicate that: (1) there i s a significant escape of a variety of reduced gases from these communities, and (2) there is significant oxidation, but also significant production, of these gases in the surface (oxidized) layers of these com- munities. Of particular note is the finding of significant rates of methane production in the aerobic zone of microbial mats, because methanogenesis is thought to be an anaerobic process. consumption have been made in field-incubated microbial mats, in stromatolites, and in samples returned to Ames. Over the past year, the capability to incubate mats under natural conditions has been significantly enhanced with the modification of a greenhouse on the roof of Building N239. T
Derived from text
Biogeochemistry; Microorganisms; Bacteria; Measuring Instruments

20040077110 NASA Ames Research Center, Moffett Field, CA, USA
Search for the Upper Temperature Limit of Multicellular Organisms Not Seen by Traditional Environmental Researchers (MONSTERS)
Trent, Jonathan; Research and Technology 1999; December 2000, pp. 100-101; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Until fairly recently, it was widely believed that the highest temperature to which life on Earth could possibly adapt was about 60 degrees Centigrade (C). Above this temperature, it was assumed, essential biomolecules would be destroyed, and life of any kind would, therefore, also be destroyed. In the last two decades, however, this assumption has been proved to be wrong. Many new species of bacteria and archaea have been discovered in a wide range of habitats that have ambient temperatures well above 60 C. These organisms, known as "thermophiles" (heat lovers), are thriving in hot springs

around the world. The hottest of them are living in submarine hot springs that may reach temperatures of 113 C (hydrostatic pressure prevents boiling). The discovery of these hyperthermophilic microbes has had important scientific and practical consequences. Scientifically, it has expanded our knowledge of the diversity of organisms on Earth, and it has provided important insights into mechanisms for thermostabilization of essential biomolecules. This information is of interest to the NASA Astrobiology program goals of "establishing the limits for life in environments that provide analogues for conditions on other worlds" and "how life evolves on the molecular, organismic, and ecosystem levels." Derived from text

Temperature; Bacteria; Biochemistry; Exobiology; Life Sciences; Microorganisms

20040077111 NASA Ames Research Center, Moffett Field, CA, USA

Reduced Nitrogen for an Acidic Early Ocean

Summers, David P.; Research and Technology 1999; December 2000, pp. 98-99; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

This project studies how reduced nitrogen (nitrogen with a low oxidation state) may have been available for the origin of life on the Earth (and potentially on other planets such as Mars). Life today uses nitrogen in a relatively reduced state. Organisms produce that nitrogen biochemically. However, at the time of the origin of life, those biochemical mechanisms were not yet in place. Therefore, there must have been a non-biological mechanism to produce such nitrogen. Without the availability of reduced nitrogen for the formation of species such as amino and nucleic acids, life could not have started. Derived from text

Nucleic Acids; Oxidation; Organisms; Biological Evolution

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*.

20040075164 Advanced Information Engineering Services, Brooks City-Base, TX

Assessed Need: Aeromedical Training for Emerging Directed Energy

Scholl, Dennis; Peterson, Ric; Moreno, Cathy A.; Apr. 2004; 26 pp.; In English

Contract(s)/Grant(s): F41624-01-C-7002; Proj-7757

Report No.(s): AD-A423048; AFRL-HE-BR-TR-2004-0038; No Copyright; Avail: CASI; A03, Hardcopy

This study of a sample population of military healthcare providers characterizes military medics' current awareness of emerging Directed Energy (DE) systems and the implications of those systems for field medical management of real and suspected over- exposures to non-ionizing DE. Using a simple T/F survey instrument the research team found sufficient basis to encourage better education and training of military medics regarding DE systems and the hazards such systems can present. Results of this study help substantiate the need for improved military medical training in DE bioeffects. Cursory DE pertinent information for medics is provided. Recommendations include improving how the military services share, disseminate, and benefit from military lessons learned (MLL) databases. Furthermore, military medical training institutions are encouraged to integrate MLL tools into their delivery of up-to-date information about DE hazards, injuries, and medical interventions. Subject matter experts, such as those at the AFRL/DE Bioeffects Division, must be readily accessible to the leaders of medical training programs.

DTIC

Aerospace Medicine; Education; Medical Personnel; Medical Services; Military Operations; Radiation Effects

20040075219 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Active Duty Military Deployments: A Respite from Job Stressors and Burnout for Air Force Acquisition Support Personnel

Bronson, Tonya J.; Mar. 23, 2004; 74 pp.; In English

Report No.(s): AD-A423148; AFIT/GAQ/ENV/04M-02; No Copyright; Avail: CASI; A04, Hardcopy

To explore the possible respite effects of deployments, active duty Air Force acquisition support personnel who were either scheduled to deploy (n=74), or recently returned from deployment (n=34) were surveyed. Analysis of variance compared the pre- and post-deployment group's perceived levels of burnout, emotional exhaustion, role ambiguity, role

conflict, self-efficacy, organizational commitment, contingent rewards, operating conditions, co- worker satisfaction, and overall job satisfaction. Although the results indicated the differences were not large enough to be significant, many of the variables behaved as hypothesized. Specifically, burnout, emotional exhaustion, role conflict, contingent rewards, and co-worker satisfaction were all higher in the post- deployment group. Implications of the findings are discussed.
DTIC
Armed Forces (United States); Burnout; Military Personnel; Personnel; Stress (Physiology); Tasks

20040075720 NASA Ames Research Center, Moffett Field, CA, USA
Inducing Presyncope in Men: A Comparison of Two Stimuli
Cowings, Patricia S.; Toscano, William B.; Taylor, Bruce; Research and Technology 1997; September 1998, pp. 134-135; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

NASA has identified cardiovascular decondition- ing as a serious biomedical problem associated with long-duration exposure to microgravity in space. High priority has been given to the development of countermeasures for this disorder and the resulting orthostatic intolerance experienced by crewmembers upon their return to the unit gravity norm of Earth. Microgravity leads to cardiovascular deconditioning in humans, which is manifested by postflight reduction of orthostatic tolerance and upright exercise capacity. Recent studies tested the effects on orthostasis produced by combining 60 degree head-up tilt (HUT) with lower body negative pressure.The primary purpose of the present study was to directly compare two tests of orthostatic tolerance in normal adult men. The first was a LBNP test, and the second was a combined test of HUT and LBNP. In order to test countermeasures for postflight orthostatic intolerance, the investigators must understand the nature of physiological responses to a gravitational stress. They believe that each individual will produce a unique physiological response pattern that will reliably describe hidher own symptom levels. The investigators wanted to determine which of these types of tolerance test were best suited for subsequently evaluating treatments or countermeasures that will be used to help future astronauts adapt more readily to microgravity, as well as to facilitate readaptation to Earth.
Author
Orthostatic Tolerance; Astronauts; Gravitational Physiology

20040075722 NASA Ames Research Center, Moffett Field, CA, USA
Ultrasonic Measurement of Intracranial Pressure Waveforms
Ueno, Toshiaki; Ballard, Richard E.; Shuer, Lawrence M.; Yost, William T.; Cantrell, John H.; Hargens, Alan R.; Research and Technology 1997; September 1998, pp. 135-136; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Intracranial pressure (ICP) dynamics are important for understanding adjustments to altered gravity. ICP may increase during microgravity due to a fluid shift to the head. As widely observed in clinical settings, elevated ICP causes headache, nausea, and projectile vomiting, which are similar to symptoms of the space adaptation syndrome. At levels over 20 millimeters mercury, ICP may compromise cerebral circulation. However, there are no experimental results to support the hypothesis that ICP is actually altered during microgravity exposure, primarily because o i the invasiveness of currently available techniques. Ames has developed and refined an ultrasonic device that measures changes in intracranial distance noninvasively using a patented pulse phase locked loop (PPLL) technique. Although the skull is assumed to be rigid, many investigators report that the skull moves on the order of micrometers in association with ICP pulsation resulting from variations in arterial pressure. The new ultrasonic device records ICP waveforms noninvasively from skull movements, enabling an evaluation of ICP dynamics by analyses of pulsatile components of ICP waveforms. Amplitudes of pulsatile components of ICP yield information on intracranial compliance, representing the magnitude of ICP change with a change in volume of any intracranial component (brain, blood, or cerebrospinal fluid). Clinically, it is important to monitor intracranial compliance because it represents the volume-buffering capacity of the intracranial tissues and fluid. In addition, because the intracranial volume-pressure curve is generally exponential, an inverse relationship exists between intracranial compliance and pressure. Thus, changes in mean ICP level can also be estimated from pulsatile components of ICP waveforms.
Author
Aerospace Medicine; Intracranial Pressure; Ultrasonic Wave Transducers

20040075741 NASA Ames Research Center, Moffett Field, CA, USA
Eye Movement Metrics of Human Motion Perception and Search
Stone, Lee; Beutter, Brent; Mulligan, Jeffrey B.; Research and Technology 1997; September 1998, pp. 13-14; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Visual display systems provide critical information to pilots, astronauts, and air traffic controllers. The goal of this research project i s to develop precise and reliable quantitative metrics of human performance based on nonintrusive eye-movement monitoring that can be used in applied settings. The specific aims are (1) to refine the hardware, optics, and software of eye-trackers to allow the nonintrusive acquisition of high-temporal and high-spatial precision eye-position data: (2) to measure quantitatively the links between eve-movement data and perceptual-performance data during tracking and search tasks; and (3) to develop biologically based computational models of human perceptual and eye-movement performance. Validated quantitative models of human visual perception and eye-movement performance will assist in designing computer and other display systems optimized for specific human tasks, in the development of eye-movement-controlled machine interfaces, and in the evolution of artificial vision systems.
Derived from text
Computer Vision; Display Devices; Eye Movements; Human Performance; Motion Perception; Visual Perception

20040075790 NASA Ames Research Center, Moffett Field, CA, USA
US Army Application for NASA Technology
Cowings, Patricia S.; Toscano, William B.; DeRoshia, Charles; Research and Technology 1997; September 1998, pp. 144-146; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this project was to use NASA technology to assist the U.S. Army in the assessment of motion sickness incidences in the command and control vehicle (C2V). The NASA technology utilized is U.S. Patent No. 5,639,436, Autogenic-Feedback Training Exercise system and method. During this study we determined the frequency and severity of motion sickness in personnel during a field exercise in the C2V. This vehicle contains four workstations where military personnel are expected to perform command decisions in the field during combat conditions. Eight active duty military men (U.S. Army) at the Yuma Proving Grounds in Arizona participated in this study. On the first day, all subjects were given baseline performance tests while their physiological responses were monitored. On the second day of their participation, subjects rode in the C2V while their physiological responses and performance measures were recorded. Self-reports of motion sickness were also recorded, with only one subject experiencing two incidences of emesis. Seven out of the eight subjects reported other motion sickness symptoms; most predominant was the report of drowsiness, which occurred a total of 19 times. The table summarizes symptom reports, hours of sleep obtained on the previous night, seat position in the C2V, and previous experience in this or other tracked vehicles. Changes in physiological responses were observed relative to motion sickness symptoms reported and the different environmental conditions (i.e., level, hills, and gravel) during the field exercise. The subject who reported the most symptoms (subject 3), and the one who reported no symptoms at all (subject 61, both rode in the C2V on the same day.
Author (revised)
Military Personnel; Motion Sickness; Physiological Responses

20040075805 NASA Ames Research Center, Moffett Field, CA, USA
Evolutionary Adaptations of Intracranial Pressure to Gravity
Matsuyama, Masayuki; Ueno, Toshiaki; Yang, Christopher; Hsieh, Shi-Tong T.; Lillywhite, Harvey B.; Hargens, Alan R.; Research and Technology 1997; September 1998, pp. 137-138; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Snakes provide sensitive animal models for studying cardiovascular adaptation because of their long body form and diversification of behavioral investigating ICP regulation with altered posture. In general, arboreal snakes are tolerant against gravitational stress, whereas aquatic snakes have less ability to resist gravitational stress. Presently there is no knowledge of how species from differing gravitational habitats deal with postural effects in terms of their ecology. They also provide sensitive models for ICP. Therefore, the purpose of this study was to evaluate the gravitational adaptation of ICF in snakes.
Author
Aerospace Medicine; Cardiovascular System; Intracranial Pressure; Gravitational Physiology

20040075808 NASA Ames Research Center, Moffett Field, CA, USA
Human Immunology and Osmolality: A Hypothesis
Greenleaf, John E.; McKenzie, Meghan A.; Looft-Wilson, Robin; Barnes, Paul R.; Research and Technology 1997; September 1998, pp. 140-141; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Maintenance of efficient body immune function is essential for successful long-duration spaceflight. Physical exercise training is employed on extended flights to counteract some aspects of weightlessness deconditioning. Exercise also influences

the immune system: performance of moderate exercise increases many immune parameters in the blood, while heavy exercise depresses immune function. Experimental data from Ames Research Center have indicated that plasma osmotic concentration (Osm) is highly correlated with responses of the white blood cells (WBC) and platelets (Plat) during exercise, but not at rest. Derived from text

Blood; Immunology; Physical Exercise; Immune Systems; Osmosis

20040076857 Atomic Energy Commission, Oak Ridge, TN, USA

Future Trends in Maximum Permissible Radiation Levels

Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 157-164; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The Russians are progressing rapidly in the development of nuclear weapons based on scientific and technological advances. This means that we cannot waste time in carrying out research; we have to produce as much as possible and as rapidly as possible. Personally, I am opposed to imposing restrictions on the operation of accelerators to the extent that they will interfere with the scientific progress of this country. On the other hand, we must face the facts of life and realize that there are dangers in carrying out these experiments and that there are recommendations at present as to permissible levels and reasonably safe levels, and we must take these into consideration. The matter is not simple, and we have to take the advice of experts. If the geneticists tell us that a certain dose of radiation will produce deleterious mutations beyond what might be considered tolerable, then we must pay attention. As far as you are concerned, I think you should realize that you are the cream of the brains in this country in the scientific field, and it is not very good for you to shorten your life span or to accumulate deleterious mutations which will be transmitted to your children and lower their mental, as well as physical, capacities unduly. These things touch you very closely, and they also concern the future of the country as a whole. We must continue to have scientists who will keep ahead of the Russians. It has been recommended that the average accumulated dose for the general population be l0 r up to age 30. This is the average gonad dose for the whole population. For radiation workers, who are occupationally exposed, it is suggested that 50 r be allowed up to age 30. By this age most parents have had as many children as they want; the genetic situation is not so acute after that. The geneticists are not particularly concerned about the amount of radiation received by older people. The National Committee on Radiation Protection (NCRP) has converted this recommendation into a more practical form and suggests a limit of 5 rem/year in the critical organs (blood-forming organs, gonads, and lenses of the eyes) for occupationally exposed individuals of any age. Since by law no one is allowed to work with ionizing radiation before age 18, this means that the maximum accumulated dose by age 30 would be 60 rem but in a relatively small number of individuals. By age 70 the maximum accumulated dose would be 260 rem. The 5 rem/year is based on long-term effects resulting from exposure of the whole body such as cancer, leukemia, and life-span shortening.
Derived from text

Radiobiology; Radiation Dosage; Ionizing Radiation; Nuclear Radiation; Particle Accelerators; Radiation Effects

20040076868 Illinois Univ., IL, USA

Radiation-induced Cataracts

Brown, D. V. L.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 142-147; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The advent of the atomic age has posed many new and difficult problems to the practicing ophthalmologist as well as to the physicist. Many ingenious therapeutic and diagnostic procedures employing radioactive substances have been devised; however, not all of these are without hazard to the eye. You are aware of the ability of cyclotrons, etc., to cause eye injury. Ocular damage may be produced by the atomic bomb itself in one of three ways: by direct mechanical blast injury, by the thermal components causing chorioretinal burns at great distances, and by the more insidious ionizing radiation resulting in the characteristic radiation cataract. I shall limit this paper to the rather complex problem of radiation cataract. First, some terms should be defined. Just what is a cataract? Unfortunately, this is an all-inclusive term which can mean many different degrees of opacification of the crystalline lens. It may refer to a fully developed 'mature' lens opacity, which precludes any useful vision to the eye thus afflicted, or to a very early minimal change which does not really disturb vision at all. The literature on experimental radiation cataract is therefore confusing in regard to the actual degree of cataract employed as an end point in any given experiment or clinical study. Efforts have been made by Christenberry, Upton, and others to clarify and categorize these end points. Next, what is a radiation cataract? Some observers believe that radiation cataract, like other bodily effects following ionizing radiation, is merely a premature senility. It is now generally agreed that, in its early stages, ionizing radiation results in a characteristic clinical picture which differs from all other types of cataract. In its very late stages,

however, it cannot be differentiated from other more common varieties such as senile cataract or the so-called complicated cataract following ocular infections.
Author
Eye (Anatomy); Cataracts; Radiation Damage

20040077063 NASA Ames Research Center, Moffett Field, CA, USA
The Effect of Unloading on the Metatarsal Bone of the Rat
Arnaud, Sara B.; Grindeland, R. E.; Research and Technology 1999; December 2000, pp. 141-142; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The bones of the feet are likely to lose mineral during spaceflight because they are not functioning to support body weight in space. Although loss of bone from the heel bone (calcaneus) during spaceflight is well documented, loss of mineral from other bones in the feet of astronauts has not been quantified. A possibly vulnerable candidate is the metatarsal, which, as a weight-bearing bone in runners, is vu I nerable to stress fractures. To explore the potential for bones of the feet to lose mineral, a model of a metatarsal in mature rats exposed to a spaceflight was used. The experiment was designed to analyze the third metatarsal, depicted in the first figure, at the start and after one, four, and eight weeks of unloading of the hindlimbs by tail suspension.
Derived from text
Astronauts; Bone Demineralization; Feet (Anatomy)

20040077086 NASA Ames Research Center, Moffett Field, CA, USA
lnflight Activity Breaks Reduce Sleepiness in Pilots
Neri, David; Mallis, Melissa; Research and Technology 1999; December 2000, pp. 11-12; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

This flight simulator study examined whether regularly spaced brief bouts of controlled physical activity (standing up, walking, stretching) combined with social interaction could improve alertness and performance during a long, uneventful, overnight flight requiring extended wakefulness and vigilance. The data obtained from this study support NASA's Aero-Space Technology Enterprise and its objective of reducing the aircraft accident rate Fourteen two-man crews flew a 6-hour 12:00-8:00 a.m.) uneventful flight from Seattle to Honolulu in the Ames 747-400 flight simulator. The 14 subjects in the Treatment Group received five short (7-minute) breaks with controlled physical activity and social interaction, spaced hourly during the cruise portion of the flight. An equivalent number in the Control Group received only one 7-minute break in the middle of cruise. Measures of psychomotor vigilance performance, subjective sleepiness, continuous brain wave activity (electroencephalography; EEG), and continuous eye movement activity (electrooculography; EOG) were collected throughout the flight.
Derived from text
Aircraft Pilots; Pilot Performance; Wakefulness; Sleep Deprivation

20040077169 NASA Ames Research Center, Moffett Field, CA, USA
Inducing Presyncope in Men: A Comparison of Two Stimuli
Cowings, Patricia S.; Toscano, William B.; Taylor, Bruce; Research and Technology 1999; December 2000, pp. 142-143; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

NASA has identified cardiovascular deconditioning as a serious biomedical problem associated with long-duration exposure to microgravity in space. High priority has been given to the development of countermeasures for this disorder and the resulting orthostatic intolerance (sudden drop in blood pressure while standing) experienced by crewmembers upon their return to the norm of Earth. This in turn leads to presyncopal symptoms, that is, feeling lightheaded or dizzy just prior to fainting. The primary purpose of the present study was to directly compare two tests of orthostatic tolerance in normal adult men. The first was a supine lower-body negative pressure (LBNP) test and the second was a combined test of head-up tilt (HUT) and LBNP. In order to test countermeasures for postflight orthostatic intolerance, investigators needed to understand the nature of physiological responses to a gravitational stress. This study would determine which of these types of tolerance tests is best suited for evaluating treatments or countermeasures that will be used to help future astronauts adapt more readily to microgravity as well as to facilitate readaptation to Earth. physiological responses were measured using the Autogenic-Feedback System-2 (AFS-21, which is designed for monitoring crewmembers in space. Each subject received one supine LBNP test and one HUT + LBNP test, administered at one-week intervals. The LBNP device is a clear plastic tube (mounted on a tilt-table), which covered the subject s feet and legs while he was lying flat on his back (supine), and was sealed at the

waist with a soft rubber strip. Ten minutes of resting baseline data were collected, then the air was removed from the LBNP tube with a vacuum system. Removing the air from the tube had the effect of pulling blood from the subject s upper body down to the legs, resulting in lowered blood pressure as gradually more air was removed at increments of 10 mm Hg (millimeters of mercury) every three minutes. The maximum negative pressure was -100 mm Hg. The HUT + LBNP was essentially Eight men, average age 37.5, were tested. Several the same as the one described above with one important difference; after the IO-minute resting baseline, the table was tilted upward at the head to 60 degrees for an additional 10 minutes before air was removed from the lower chamber. Results showed that subjects could tolerate the supine LBNP significantly longer than the combined HUT + LBNP (p < 0.0004) (figure 1). There were significant differences between the tests for heart rate (p < 0.003), stroke volume (p < 0.041, peripheral blood volume (p < 0.02), and thoracic fluid volume (p < 0.01 6). In all cases the magnitude of physiologi- cal changes from baseline were much greater for the HUT + LBNP than for supine LBNP, that is, higher stress levels than the supine LBNP. The HUT + LBNP can be used to reliably induce presyncope in men; however, data suggest that this device, as used in the present study, produces too strong a stimulus for testing countermeasures when used with normorensive subjects.
Derived from text
Lower Body Negative Pressure; Cardiovascular System; Microgravity; Physiological Responses; Orthostatic Tolerance; Countermeasures

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040075739 NASA Ames Research Center, Moffett Field, CA, USA
Human Motion Perception: Error Metrics and Neural Models
Stone, Lee; Research and Technology 1997; September 1998, pp. 12-13; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Pilots and astronauts have to make accurate judgments of their self-motion (or of that of the craft they are controlling) to navigate safely and effectively. In many critical aerospace tasks, such as flying a helicopter at low altitude under low-contrast conditions or landing the shuttle after several weeks of adaptation to microgravity, human performance in self-motion estimation is pushed to its limits, yet any perceptual error could have disastrous consequences. The goal of this research project is to identify visual conditions under which humans are likely to make perceptual errors in visual motion judgments and to understand at the neural level why these errors occur, as part of a strategy to develop methods of preventing or mitigating them. The specific aims are (1) to develop predictive biologically based models of human performance in heading estimation and related motion perception tasks, and (2) to identify empirically those conditions that lead to human error, as part of an effort to test, refine, and validate some models, while ruling out others. The availability of validated quantitative models of human self-motion perception will aid in the design of training regimes for pilots, in the development of displays and automation systems that interact more effectively with human pilots while they fly aircraft or spacecraft, and in the evolution of artificial vision systems based on the massively parallel architecture of the human brain.
Author
Human Performance; Motion Perception

20040077145 NASA Ames Research Center, Moffett Field, CA, USA
pH Biotelemetry Transmitter
Hines, John W.; Skidmore, Michael G.; Research and Technology 1999; December 2000, pp. 148-149; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames continued its development of pill-shaped biotelemeters for measuring physiological parameters during space life sciences experiments with the addition of a pH biotelemeter. These devices could eventually be used to monitor animal health parameters and the performance of self-contained biological systems aboard the International Space Station (ISS) Gravitational Biology Facility, and can be readily adapted to monitor the health of astronauts in the Human Research Facility. The equipment has enormous potential outside NASA as well.
Derived from text
Biotelemetry; Physiological Factors; Ph; Life Sciences; Gravitational Physiology

54
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*.

20040075518 National Defense Univ., Washington, DC
Defense Horizons. Number 20, October 2002. From Petro to Agro: Seeds of a New Economy
Armstrong, Robert E.; Oct. 2002; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422419; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Biotechnology; Horizon; Security; Seeds

20040075631 Defence Research and Development Canada, Toronto, Ontario, Canada
Task Switching with 2D and 3D Displays of Geographic Terrain: The Role of Visual Momentum
Hollands, Justin G.; Ivanovic, Nada; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 19-1 - 19-8; In English; See also 20040075615; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We were interested in determining if the visual momentum provided by gradual transition between 2D and 3D views of geographic terrain aided task switching. Forty-two participants made judgments about the properties of two points placed on terrain depicted as 2D or 3D displays. Participants performed the tasks in pairs of trials, switching tasks and displays between trials. On half the trials (continuous transition), the display dynamically rotated in depth from one display format to the other. On the other half (discrete transition), a blank screen was shown for the same duration. The results showed that performance improved more for the continuous transition than the discrete transition condition. We argue that this was because the transition provided improved visual momentum between consecutive displays, and recommend the use of dynamic transition when commanders are viewing multiple display windows over time.

Author

Display Devices; Operator Performance; Visual Perception; Human Factors Engineering

20040075634 Norwegian Defence Research Establishment, Kjeller, Norway
Using Visualization to Address Human Capacity Limitations
Hollands, Justin G.; Korsnes, Reinert; Llinas, James; Ovsttun, Geir; Porathe, Thomas; Treurniet, Joanne; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 53-1 - 53-11; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An intriguing aspect of visualization as a technology is that it offers the potential to improve the functional capacity of the human operator. In this report, we discuss how this can be done in a variety of ways: by recoding information, by using multimodal displays, by training, or by using intelligent interfaces, agents, and ontologies. In doing so, we argue that the capacity of the human-machine system should be defined as distributed working memory - at information shared between the human and machine when performing a dynamic task. We also discuss how the system design process can be structured to incorporate human capacity.

Author

Man Machine Systems; Human Performance; Visual Perception; Display Devices

20040075758 NASA Ames Research Center, Moffett Field, CA, USA
Advanced Life Support Research and Technology Development Activities
Kliss, Mark; Research and Technology 1997; September 1998, pp. 142-144; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Ames Research Center carries out research and development of new technologies that will enable the human exploration and development of space. These activities will reduce life-cycle costs, improve operational performance, promote self-sufficiency, and minimize the expenditure of resources in future space exploration, such as a human mission to Mars. Advanced Life Support technologies for a human Mars mission are depicted in the figure. There are also significant

opportunities for Earth application of the developed technologies. The following are some of the key examples of these activities.
Author
Life Support Systems; Carbon Dioxide Removal

20040077030 NASA Johnson Space Center, Houston, TX, USA
Ground Reaction Force and Mechanical Differences Between the Interim Resistive Exercise Device (iRED) and Smith Machine While Performing a Squat
Amonette, William E.; Bentley, Jason R.; Lee, Stuart M. C.; Loehr, James A.; Schneider, Suzanne; March 2004; 40 pp.; In English
Report No.(s): NASA/TP-2004-212063; S-917; No Copyright; Avail: CASI; A03, Hardcopy

Musculoskeletal unloading in microgravity has been shown to induce losses in bone mineral density, muscle cross-sectional area, and muscle strength. Currently, an Interim Resistive Exercise Device (iRED) is being flown on board the ISS to help counteract these losses. Free weight training has shown successful positive musculoskeletal adaptations. In biomechanical research, ground reaction forces (GRF) trajectories are used to define differences between exercise devices. The purpose of this evaluation is to quantify the differences in GRF between the iRED and free weight exercise performed on a Smith machine during a squat. Due to the differences in resistance properties, inertial loading and load application to the body between the two devices, we hypothesize that subjects using iRED will produce GRF that are significantly different from the Smith machine. There will be differences in bar/harness range of motion and the time when peak GRF occurred in the ROMbar. Three male subjects performed three sets of ten squats on the iRED and on the Smith Machine on two separate days at a 2-second cadence. Statistically significant differences were found between the two devices in all measured GRF variables. Average Fz and Fx during the Smith machine squat were significantly higher than iRED. Average Fy (16.82 plus or minus.23; p less than .043) was significantly lower during the Smith machine squat. The mean descent/ascent ratio of the magnitude of the resultant force vector of all three axes for the Smith machine and iRED was 0.95 and 0.72, respectively. Also, the point at which maximum Fz occurred in the range of motion (Dzpeak) was at different locations with the two devices.
Author
Microgravity; Musculoskeletal System; Physical Exercise; Biodynamics; Resistance; Sitting Position

20040077064 NASA Ames Research Center, Moffett Field, CA, USA
Physiologic Signal Conditioner for Crew Hazards and Error Management
Hines, John W.; Friedericks, Charlie; Ricks, Robert; Research and Technology 1999; December 2000, pp. 149; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Ames Research Center (ARC) Physiological Signal Conditioner (PSC) has been adapted to meet the requirements of the Crew Hazards and Error Management (CHEM) project of the Flight Dynamics and Controls Division at Langley Research Center. This new unit is an eight-channel physiologic signal processor designed to meet the need for human response measurement technologies. The purpose of these technologies is to assess an aircraft crew's ability to perform flight management tasks effectively in real or simulated stressful situations.
Derived from text
Errors; Flight Crews; Hazards; Signal Analyzers; Physiological Factors

20040077123 NASA Ames Research Center, Moffett Field, CA, USA
Dynamic Modeling of Life Support Systems
Finn, Cory; Jones, Harry; Research and Technology 1999; December 2000, pp. 151-152; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Dynamic system models have been developed that track the flow of material through a regenerative life support system over time periods of months to years. These models are being used to help evaluate system design and operation issues for the Advanced Life Support Systems Integrated Test Bed (ALSSITB). The model captures the main flow stream characteristics associated with atmosphere regeneration, water recovery, crop growth, food processing, and waste processing. The system simulation quantifies the variations in stream flow rates and subsystem processing rates so that estimates can be made on buffer requirements for various system configurations and design options. It is also being used to investigate scheduling, operations, and control issues. Dynamic modeling is an important tool for developing robust system designs. Static or steady- state models are often used to obtain estimates on nominal processor flow rates and resupply requirements. ALSSITB has been developed at Ames Research Center (ARC) to investigate system design issues. The ALSSITB is currently being developed by Johnson

Space Center USC) to support long-duration human testing of integrated life support systems. It comprises a set of interconnected test chambers with a sealed internal environment capable of supporting a four- person test crew for periods exceeding one year. The life support systems to be tested will consist of both biological and physical/chemical technologies that perform air revitalization, water recovery, biomass production, food processing, and solid waste process- ing. A variety of system designs for the ALSSITB have been studied to date.
Derived from text
Life Support Systems; Dynamic Models

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040075768 NASA Ames Research Center, Moffett Field, CA, USA
Calcium Metabolism in Bion 11 Monkeys
Arnaud, Sara B.; Grindeland, Richard E.; Navidi, Meena; Research and Technology 1997; September 1998, pp. 138-139; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The calcium endocrine system regulates the supply of calcium and phosphorus for the mineralization of bone, a process that is known to be depressed during spaceflight. The role of circulating hormones in the localized decrease in bone formation in the weight-bearing skeleton is unresolved and difficult to study in the human because of the effects of exercise itself on calcium metabolism. Additional knowledge would not only improve understanding of the mechanism of adaptation to a weightless environment, but also provide a rationale for the use of the hormones of the calcium endocrine system-parathyroid hormone, calcitonin, and the vitamin D hormone (1,25-D)-in the prevention or restoration of bone loss during spaceflight. Currently, therapeutic trials that include these hormones are under way for the human osteoporoses that can result from systemic factors such as estrogen deficiency.
Derived from text
Bone Demineralization; Calcium Metabolism; Musculoskeletal System; Monkeys; Calciferol

20040077168 NASA Ames Research Center, Moffett Field, CA, USA
BIONA-C Inflight Technology Demonstration
Hines, John W.; Research and Technology 1999; December 2000, pp. 150; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Biological Ion Analysis in the Cell Culture Module (BIONA-C) flew onboard the space transport system (STS-93) (July 23-27, 1999) as a technology demonstration of the capability to monitor and control pH measurements during spaceflight. Working with the U. s. Army Medical Research and Material Command (USAMRMC) and in close collaboration with the Cell Culture Module (CCM) team from the Walter Reed Army Institute of Research (WRAIR), Ames Research Center (ARC) developed BIONA-C as an autonomous monitoring and control system for a spaceborne hollow-fiber bioreactor experiment. BIONA-C monitored the pH and temperature of circulating media and controlled the collection of samples and addition of nutrients for the cells growing in the ARC Rail, shown in the figure. The BIONA-C Rail contains four independent fluid paths that circulate media to support cell growth. In each path, media flows through a separate bioreactor where fluids can transfer across a permeable membrane to the cell culture, but cells cannot enter the fluid path. In two of the fluid paths the sensors are located directly in the circulating media (online), taking continuous pH measurements. Calibration of the online sensors occurs on Earth before and after the experiment. In the other two paths a precision pump periodically transfers media samples from the circulating media path to the sensors. This offline configuration allows the sensors to be calibrated inflight between each sample reading. The sensor arrays are sealed and electron beam sterilized. Sterile practices are used during all experimental preparation, rail priming, and sensor calibration. When operating, the rail maintains the temperature of the bioreactor and oxygenator assembly at 37 degrees Celsius. experiments gives BIONA-C enormous potential in the areas of space genomics, evolutionary biology, and astrobiology. The system has applications in cell growth and plant growth facilities in space. It can also be utilized in developing long-term, closed human habitats for future Mars exploration. The BIONA-C

technology can be adapted to perform in measurement stations that search for life in extreme environments such as ocean floor hydrothermal vents.
Derived from text
Bioassay; Bioreactors; Calibrating; Space Flight; Cells (Biology); Exobiology

20040077191 NASA Ames Research Center, Moffett Field, CA, USA
Synthesis of Organic Molecules in the Fracture Zone of Meteorite Impacts on Europa
Borucki, Jerome G.; Khare, Bishun N.; Research and Technology 1999; December 2000, pp. 90-91; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

This work studies the synthesis of organic molecules that occurs as a result of meteorite impacts into planets with icy surfaces, such as Europa. Meteorite impacts into icy surfaces cause a large zone of fracturing under the impact crater. Very large voltages are generated during this fracturing, and that energy is, in effect, "stored" in the ice as electrostatic charges spread over a large area of the ice for substantial periods of time. Over time, the electro-static charges can accumulate until a critical level ("the breakdown potential of ice") is reached, at which time electrical arcing occurs. In the presence of water-ice, methane, and ammonia, this arcing the ice at a temperature of -170 C. At projectile impact, light emission, high voltage, and a large magnetic field that lasted about 5 milliseconds (ms) were recorded; then after a pause of 280 ms, a secondary light, voltage, and magnetic field occurred. The voltage and light had four spikes in a 10-ms timeframe, and the emissions correlated with each other, indicating that arcing was occurring in the fracture zone under the impact.
Derived from text
Gas Flow; Biogeochemistry; Detection; Emittance; Microorganisms

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20040074480 Lawrence Livermore National Lab., Livermore, CA
National INFOSEC Technical Baseline Multi-Level Secure Systems
Anderson, J. P.; Sep. 28, 1998; 66 pp.; In English
Report No.(s): DE2004-15006880; UCRL-CR-132131; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this report is to provide a baseline description of the state of multilevel processor/processing to the INFOSEC Research Council and at their discretion to the R&D community at large. From the information in the report, it is hoped that the members of the IRC will be aware of gaps in MLS research. A primary purpose is to bring IRC and the research community members up to date on what is happening in the MLS arena. The review will attempt to cover what MLS products are still available, and to identify companies who still offer MLS products. We have also attempted to identify requirements for MLS by interviewing senior officers of the Intelligence community as well as those elements of DoD and DOE who are or may be interested in procuring MLS products for various applications. The balance of the report consists of the following sections; a background review of the highlights of the developments of MLS, a quick summary of where we are today in terms of products, installations, and companies who are still in the business of supplying MLS systems(or who are developing MLS system), the requirements as expressed by senior members of the Intelligence community and DoD and DOE, issues and unmet R&D challenges surrounding MLS, and finally a set of recommended research topics.
NTIS
Microwave Landing Systems; Information Systems

20040074491 Helsinki Univ. of Technology, Espoo, Finland
Translation-Invariant Operators on Spaces of Vector-Valued Functions
Hytonen, T.; 2003; 208 pp.; In English
Report No.(s): PB2004-105780; A-458; No Copyright; Avail: CASI; A10, Hardcopy

The treatise deals with translation-invariant operators on various function spaces (including Besov, Lebesgue-Bochner, and Hardy), where the range space of the functions is a possibly infinite-dimensional Banach space X. The operators are treated both in the convolution form Tf = k asterisk f and in the multiplier form in the frequency representation, Tf = m f, where the kernel k and the multiplier m are allowed to take values in L(X) (bounded linear operators on X). Several applications, most notably the theory of evolution equations, give rise to non-trivial instances of such operators. Verifying the

boundedness of operators of this kind has been a long-standing problem whose intimate connection with certain randomized inequalities (the notion of R-boundedness which generalizes classical square-function estimates) has been discovered only recently. The related techniques, which are exploited and developed further in the present work, have proved to be very useful in generalizing various theorems, so far only known in a Hilbert space setting, to the more general framework of UMD Banach spaces.
NTIS
Banach Space; Function Space; Linear Operators

20040074508 Lawrence Livermore National Lab., Livermore, CA
Start/End Delays of Voiced and Unvoiced Speech Signals
Herrnstein, A.; Sep. 24, 1999; In English
Report No.(s): DE2004-15006006; UCRL-TR-155600; No Copyright; Avail: National Technical Information Service (NTIS)
Recent experiments using low power EM-radar like sensors (e.g, GEMs) have demonstrated a new method for measuring vocal fold activity and the onset times of voiced speech, as vocal fold contact begins to take place. Similarly the end time of a voiced speech segment can be measured. Secondly it appears that in most normal uses of American English speech, unvoiced-speech segments directly precede or directly follow voiced-speech segments. For many applications, it is useful to know typical duration times of these unvoiced speech segments. A corpus, assembled earlier of spoken 'Timit' words, phrases, and sentences and recorded using simultaneously measured acoustic and EM-sensor glottal signals, from 16 male speakers, was used for this study. By inspecting the onset (or end) of unvoiced speech, using the acoustic signal, and the onset (or end) of voiced speech using the EM sensor signal, the average duration times for unvoiced segments preceding onset of vocalization were found to be 300ms, and for following segments, 500ms. An unvoiced speech period is then defined in time, first by using the onset of the EM-sensed glottal signal, as the onset-time marker for the voiced speech segment and end marker for the unvoiced segment. Then, by subtracting 300ms from the onset time mark of voicing, the unvoiced speech segment start time is found. Similarly, the times for a following unvoiced speech segment can be found. While data of this nature have proven to be useful for work in our laboratory, a great deal of additional work remains to validate such data for use with general populations of users. These procedures have been useful for applying optimal processing algorithms over time segments of unvoiced, voiced, and non-speech acoustic signals. For example, these data appear to be of use in speaker validation, in vocoding, and in denoising algorithms.
NTIS
Acoustics; Signal Detectors; Signal Transmission; Speech

20040074509 Lawrence Livermore National Lab., Livermore, CA
White Paper on Institutional Capability Computing Requirements
Kissel, L.; McCoy, M. G.; Seager, M. K.; Jan. 29, 2002; In English
Report No.(s): DE2004-15005991; UCRL-ID-147449; No Copyright; Avail: National Technical Information Service (NTIS)
This paper documents the need for a rapid, order-of-magnitude increase in the computing infrastructure provided to scientists working in the unclassified domains at Lawrence Livermore National Laboratory. This proposed increase could be viewed as a step in a broader strategy linking hardware evolution to applications development that would take LLNL unclassified computational science to a position of distinction, if not preeminence, by 2006. We believe that it is possible for LLNL institutional scientists to gain access late this year to a new system with a capacity roughly 80% to 200% that of the 12-TF/s (twelve trillion floating-point operations per second) ASCI White system for a cost that is an order of magnitude lower than the White system.
NTIS
Evolution (Development); Computer Programs; User Requirements

20040074515 Lawrence Livermore National Lab., Livermore, CA
Software Demonstration of 'rap': Preparing CAD Geometries for Overlapping Grid
Petersson, N. A.; Feb. 15, 2002; In English
Report No.(s): DE2004-15005937; UCRL-JC-147260; No Copyright; Avail: National Technical Information Service (NTIS)
We demonstrate the application code 'rap' which is part of the 'Overture' library. A CAD geometry imported from an IGES file is first cleaned up and simplified to suit the needs of mesh generation. Thereafter, the topology of the model is computed and a water-tight surface triangulation is created on the CAD surface. This triangulation is used to speed up the projection of points onto the CAD surface during the generation of overlapping surface grids. From each surface grid, volume

grids are grown into the domain using a hyperbolic marching procedure. The final step is to fill any remaining parts of the interior with background meshes.
NTIS
Computer Aided Design; Grid Generation (Mathematics)

20040074516 Lawrence Livermore National Lab., Livermore, CA
Dynamic Statistical Profiling of Communication Activity in Distributed Applications
Vetter, J. S.; Oct. 12, 2001; In English
Report No.(s): DE2004-15005931; UCRL-JC-145800; No Copyright; Avail: National Technical Information Service (NTIS)
A complete trace of communication activity for a terascale application is overwhelming in terms of overhead and storage. We propose a novel alternative that enables profiling of the application's communication activity using statistical message sampling during runtime. We have implemented an operational prototype and our evidence shows that this new technique can provide an accurate, low-overhead, tractable alternative for performance analysis of communication activity. Moreover, this alternative enables an assortment of runtime analysis techniques not previously available with post-mortem, trace-based systems. Our assessment of relative performance and coverage of different sampling and analysis methods shows that purely random selection is preferred over counter- and timer-based sampling. Experiments on several applications running up to 128 processors demonstrate the viability of this approach. In particular, on one application, statistical profiling results contradict conclusions based on evidence from tracing. The design of our prototype reveals that parsimonious modifications to the MPI runtime system could facilitate such techniques on production computing systems, and it suggests that this sampling technique could execute continuously for long-running applications.
NTIS
Computers; Messages; Timing Devices

20040074523 Lawrence Livermore National Lab., Livermore, CA
Merged Source Word Codes for Efficient, High-Speed Entropy Coding
Senecal, J.; Joy, K.; Duchaineau, M.; Dec. 05, 2002; In English
Report No.(s): DE2004-15005833; UCRL-JC-150989; No Copyright; Avail: National Technical Information Service (NTIS)
We present our work on fast entropy coders for binary messages utilizing only bit shifts and table lookups. To minimize code table size we limit our code lengths with a novel type of variable-to-variable (VV) length code created from source word merging. We refer to these codes as merged codes. With merged codes it is possible to achieve a desired level of efficiency by adjusting the number of bits read from the source at each step. The most efficient merged codes yield a coder with an inefficiency of 0.4%, relative to the Shannon entropy, in the worst case. On one of our test systems a current implementation of coder using merged codes has a throughput of 35 Mbytes/sec.
NTIS
Entropy; Simulation

20040075009 Lawrence Livermore National Lab., Livermore, CA
Accounting Data to Web Interface Using PERL
Hargreaves, C.; Aug. 13, 2001; In English
Report No.(s): DE2004-15006203; UCRL-ID-145202; No Copyright; Avail: National Technical Information Service (NTIS)
This document will explain the process to create a web interface for the accounting information generated by the High Performance Storage Systems (HPSS) accounting report feature. The accounting report contains useful data but it is not easily accessed in a meaningful way. The accounting report is the only way to see summarized storage usage information. The first step is to take the accounting data, make it meaningful and store the modified data in persistent databases. The second step is to generate the various user interfaces, HTML pages, that will be used to access the data. The third step is to transfer all required files to the web server. The web pages pass parameters to Common Gateway Interface (CGI) scripts that generate dynamic web pages and graphs. The end result is a web page with specific information presented in text with or without graphs.
NTIS
Document Markup Languages; Data Bases

20040075010 Lawrence Livermore National Lab., Livermore, CA
Determination of an Initial Mesh Density for Finite Element Computations via Data Mining
Kanapady, R.; Bathina, S. K.; Tamma, K. K.; Kamath, C.; Kumar, V.; Jul. 07, 2001; In English
Report No.(s): DE2004-15006201; UCRL-JC-144765; No Copyright; Avail: National Technical Information Service (NTIS)

Numerical analysis software packages which employ a coarse first mesh or an inadequate initial mesh need to undergo a cumbersome and time consuming mesh refinement studies to obtain solutions with acceptable accuracy. Hence, it is critical for numerical methods such as finite element analysis to be able to determine a good initial mesh density for the subsequent finite element computations or as an input to a subsequent adaptive mesh generator. This paper explores the use of data mining techniques for obtaining an initial approximate finite element density that avoids significant trial and error to start finite element computations.
NTIS
Computational Grids; Data Mining; Finite Element Method; Grid Generation (Mathematics)

20040075558 Helsinki Univ., Helsinki, Finland
Combinatorics of Curves on Hurwitz Surfaces
Martio, Olli, Editor; Vogeler, Roger; Annales Academie Scientiarum Fennicae: Mathematica; 2004; ISSN 1239-6304; Volume 137, pp. 1-43; In English; Copyright; Avail: Other Sources

The study of Hurwitz surfaces, or compact Reimann surfaces having the maximal number of automorphisms, has largely been a matter of determining which finite groups appear in the role of automorphism group. Such a group is known as a Hurwitz group. Identifying a Hurwitz group immediately gives the genus of the associated surface(s), but not much more than that. The surfaces themselves seem not to have been directly investigated in much detail. Our aim is to gain understanding of the geometry of Hurwitz surfaces in their constant-curvature realization. As a tool, we develop a combinatorial method which makes possible the convenient and algorithmic classification of conjugacy classes of the (2,3,7) triangle group T from which d Hurwitz groups descend. This information is then used to study closed geodesic curves. In particular, we identify and count the systoles and other short curves on many Hurwitz surfaces; we also introduce techniques for showing that certain families of closed curves are simple. Section 1 briefly reviews the Hurwitz theorem and its connection to hyperbolic geometry, as well as the major group/theoretic results. The combinatorial method is developed in Section 2, and Section 3 shows how the results of Section 2 can be exploited to produce explicit geometric information. Finally, there is an Appendix containing summaries of relevant background information on finite simple groups, hyperbolic isometries, and systoles. A quick comment on terminology may help prevent confusion. With regard to Riemann surfaces, the term symmetry is often highly specialized to mean an anti- conformal involution. We prefer a more generic usage, and employ the term in various ways which should always be clear from the context. Most frequently it refers to an orientation-preserving isometry of a hyperbolic surface.
Author
Combinatorial Analysis; Automorphisms; Classifications; Surface Geometry; Algorithms

20040075845 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Workshop on IEEE-1588, Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
Lee, K.; Eidson, J.; Sep. 24, 2003; In English
Report No.(s): PB2004-105186; NISTIR-7070; No Copyright; Avail: National Technical Information Service (NTIS)

The IEEE 1588 standard defines a protocol enabling precise synchronization of clocks in measurement and control systems implemented with technologies such as network communication, local computing, and distributed objects. The protocol enables heterogeneous systems that include clocks of various inherent precision, resolution, and stability to synchronize. The IEEE 1588 standard was approved as ANSI/IEEE 1588-2002 in January 2003. This conference was to provide a forum for users and implementers of the 1588 standard to exchange information and ideas about the standard.
NTIS
Protocol (Computers); Clocks; Control; Heterogeneity; Time Measurement

20040075860 Lawrence Livermore National Lab., Livermore, CA
Use of Fault Tree Analysis for Automotive Reliability and Safety Analysis
Lambert, H. E.; Sep. 24, 2003; 16 pp.; In English
Report No.(s): DE2004-15006932; UCRL-JC-154905; No Copyright; Avail: Department of Energy Information Bridge

Fault tree analysis (FTA) evolved from the aerospace industry in the 1960's. A fault tree is deductive logic model that is generated with a top undesired event in mind. FTA answers the question, 'how can something occur.' as opposed to failure modes and effects analysis (FMEA) that is inductive and answers the question, 'what if' FTA is used in risk, reliability and safety assessments. FTA is currently being used by several industries such as nuclear power and chemical processing. Typically the automotive industries uses failure modes and effects analysis (FMEA) such as design FMEAs and process

FMEAs. The use of FTA has spread to the automotive industry. This paper discusses the use of FTA for automotive applications. With the addition automotive electronics for various applications in systems such as engine/power control, cruise control and braking/traction, FTA is well suited to address failure modes within these systems. FTA can determine the importance of these failure modes from various perspectives such as cost, reliability and safety. A fault tree analysis of a car starting system is presented as an example.
NTIS
Automobiles; Reliability; Safety Management; Fault Trees; Reliability Analysis

20040075878 Lawrence Livermore National Lab., Livermore, CA
Engineering Technology Reports, Volume 2, Technology Base
Minichino, C.; Meeker, D.; Jul. 01, 2002; 68 pp.; In English
Report No.(s): DE2004-15006871; UCRL-53868-01-Vol-2; No Copyright; Avail: Department of Energy Information Bridge
Engineering has touched on every challenge, every accomplishment, and every endeavor of Lawrence Livermore National Laboratory during its fifty-year history. In this time of transition to new leadership, Engineering continues to be central to the mission of the Laboratory, returning to the tradition and core values of E.O. Lawrence: science-based engineering--turning scientific concepts into reality. This volume of Engineering Technical Reports summarizes progress on the projects funded for technology-base efforts. Technology-base projects effect the natural transition to reduction-to-practice of scientific or engineering methods that are well understood and established. They represent discipline-oriented, core competency activities that are multi-programmatic in application, nature, and scope. Objectives of technology-base funding include: (1) the development and enhancement of tools and processes to provide Engineering support capability, such as code maintenance and improved fabrication methods; (2) the support of Engineering science and technology infrastructure, such as the installation or integration of a new capability; (3) support for technical and administrative leadership through our technology Centers; (4) the initial scoping and exploration of selected technology areas with high strategic potential, such as assessment of university, laboratory, and industrial partnerships.
NTIS
Exploration; Fabrication; Augmentation

20040075879 Lawrence Livermore National Lab., Livermore, CA
Implicit Solution of Large-Scale Radiation Diffusion Problems
Brown, P. N.; Graziani, F.; Otero, I.; Woodward, C. S.; Jan. 04, 2001; 24 pp.; In English
Report No.(s): DE2004-15006869; UCRL-JC-141881; No Copyright; Avail: Department of Energy Information Bridge
In this paper, we present an efficient solution approach for fully implicit, large-scale, nonlinear radiation diffusion problems. The fully implicit approach is compared to a semi-implicit solution method. Accuracy and efficiency are shown to be better for the fully implicit method on both one- and three-dimensional problems with tabular opacities taken from the LEOS opacity library.
NTIS
Nonlinearity; Diffusion; Accuracy

20040075902 General Accounting Office, Washington, DC
Data Mining: Federal Efforts Cover a Wide Range of Uses
May 2004; 74 pp.; In English
Report No.(s): PB2004-105518; GAO-04-548; No Copyright; Avail: CASI; A04, Hardcopy
Both the government and the private sector are increasingly using 'data mining'-that is, the application of database technology and techniques (such as statistical analysis and modeling) to uncover hidden patterns and subtle relationships in data and to infer rules that allow for the prediction of future results. As has been widely reported, many federal data mining efforts involve the use of personal information that is mined from databases maintained by public as well as private sector organizations. GAO was asked to survey data mining systems and activities in federal agencies. Specifically, GAO was asked to identify planned and operational federal data mining efforts and describe their characteristics.
NTIS
Data Processing; Information Retrieval; Data Bases; Data Mining

20040076881 Utah Univ., Salt Lake City, UT, USA, California Univ., Davis, CA, USA, Oak Ridge National Lab., TN, National Center for Atmospheric Research, Boulder, CO

Visual Data Exploration and Analysis: Report on the Visualization Breakout Session of the SCaLeS Workshop

Bethel, W.; Frank, R.; Fulcomer, S.; Hansen, C.; Joy, K.; 2003; In English

Report No.(s): DE2003-815467; LBNL-PUB-886; No Copyright; Avail: National Technical Information Service (NTIS)

Scientific visualization is the transformation of abstract information into images, and it plays an integral role in the scientific process by facilitating insight into observed or simulated phenomena. Visualization as a discipline spans many research areas from computer science, cognitive psychology and even art. Yet the most successful visualization applications are created when close synergistic interactions with domain scientists are part of the algorithmic design and implementation process, leading to visual representations with clear scientific meaning. Visualization is used to explore, to debug, to gain understanding, and as an analysis tool.

NTIS

Scientific Visualization; Cognitive Psychology; Visual Perception

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*.

20040075811 NASA Ames Research Center, Moffett Field, CA, USA

New Release of Field Encapsulation Library

Moran, Patrick; Henze, Chris; Bryson, Steve; Kenwright, David; Research and Technology 1997; September 1998, pp. 70; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The second generation of a software library supporting work related to the design and evaluation of new aircraft has been developed at Ames Research Center. The Field Encapsulation Library (FEL) is designed to support the rapid development of applications involving both computational and experimental fluid dynamics data. The library contains many new features, including a derived-field capability and added support for mesh-independent algorithm development. The new library design also employs a technique known as "lazy evaluation" that makes it easier for the user to write applications that work with large data sets.

Derived from text

Computational Fluid Dynamics; Computer Programs; Free Electron Lasers

20040075822 NASA Ames Research Center, Moffett Field, CA, USA

Evolution of Strained Plane Wakes

Rogers, Michael M.; Research and Technology 1997; September 1998, pp. 49-50; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Turbulence models currently have difficulty predicting the response of turbulence to additional strains, such as those arising in the flow over a multicomponent airfoil designed to produce high lift. In particular, as the turbulent wake of an upstream airfoil component encounters the pressure gradient produced by a downstream component, it is strained. The response to this strain is poorly predicted by existing turbulence models. In order to provide insight into the behavior of such flows and to provide a database to aid turbulence modelers, several direct numerical simulations of strained plane wakes have been generated. These simulations are made in a reference frame moving with the tree-stream velocity outside the wake and thus they evolve in time. Such temporally evolving flows are computationally simpler to generate and therefore it is possible to achieve higher Reynolds numbers and more realistic turbulence. In the limit of small wake deficits the equations governing the temporally evolving problem are identical to those describing a spatially evolving flow, such as that of a wake in an adverse pressure gradient.

Derived from text

Turbulence Models; Turbulent Wakes; Predictions; Simulation; Numerical Analysis

20040077135 NASA Ames Research Center, Moffett Field, CA, USA

Automated Hardware Design via Evolutionary Search

Lohn, Jason D.; Colombano, Silvano P.; Research and Technology 1999; December 2000, pp. 131-132; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this research is to investigate the application of evolutionary search to the process of automated engineering design. Evolutionary search techniques involve the simulation of Darwinian mechanisms by computer algorithms. In recent years, such techniques have attracted much attention because they are able to tackle a wide variety of difficult problems and frequently produce acceptable solutions. The results obtained are usually functional, often surprising, and typically "messy" because the algorithms are told to concentrate on the overriding objective and not elegance or simplicity. advantages. First, faster design cycles translate into time and, hence, cost savings. Second, automated design techniques can be made to scale well and hence better deal with increasing amounts of design complexity. Third, design quality can increase because design properties can be specified a priori. For example, size and weight specifications of a device, smaller and lighter than the best known design, might be optimized by the automated design technique. The domain of electronic circuit design is an advantageous platform in which to study automated design techniques because it is a rich design space that is well understood, permitting human-created designs to be compared to machine- generated designs. developed for circuit design was to automatically produce high-level integrated electronic circuit designs whose properties permit physical implementation in silicon. This process entailed designing an effective evolutionary algorithm and solving a difficult multiobjective optimization problem. FY 99 saw many accomplishments in this effort.
Derived from text
Automatic Control; Hardware; Design Analysis; Algorithms; Search Profiles

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040075051 Naval Postgraduate School, Monterey, CA
Wireless Communications Infrastructure for Collaboration in Common Space
Mar. 2004; 67 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422377; No Copyright; Avail: CASI; A04, Hardcopy

Modern technology is making virtual environments a part of daily life. However, some constraints about the usage of virtual environments, such as the need for high performance and well-configured computers, prevent users from accessing virtual environments in some places other than special computer rooms. Mobile devices may be used to solve this limitation in a virtual environment. The remote-control approach to access virtual worlds on the Internet or on a corporate network is a new concept that opens new doors to users. First step of this approach is already in use, such as games implemented for mobile devices using the screen of a mobile device as display, and has given satisfying results for some users. This research will take the user, who not only wants to be mobile but also does not want to sacrifice high resolution textures and complex models, closer to his/her goal. Mobile devices provide mobility to the user, but sacrifice not only the reality of the virtual environments but also screen size, which is very important for visibility of complex virtual environments. The hybrid approach with wireless internet connection by using mobile devices as remote control gives the user the advantages of mobility over desktop PCs. On the other hand, the realism provided by high-quality PCs on the server side exceeds the capabilities of mobile devices.
DTIC
Computer Networks; Wireless Communication

20040075056 Army Research Lab., Aberdeen Proving Ground, MD
Self-Similarity in Tactical Network Traffic and Tactical Radio Experimentation
Brodeen, Ann E.; Brand, John; Hartwig, George W., Jr.; Brundick, Frederick S.; Lopez, Maria C.; Apr. 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422605; ARL-TR-3181; No Copyright; Avail: CASI; A03, Hardcopy

Network traffic has been reported to exhibit self- similar properties over time. This behavior has been traced to a number of factors, including file-size distributions and characteristics of current network protocols. In this report, we present results from examining tactical military networks to determine if they also exhibit self-similar behavior. Tactical networks differ from typical commercial networks in that the effective throughput is orders of magnitude lower, protocols are particular to the tactical function they support, and the data transmitted is typically more homogeneous than that found on commercial networks. Tactical network utilization is often decidedly different than that found on commercial networks. The data used in

this study were taken from two sources: (1) synthetic traffic streams generated using a fractional Gaussian noise generator and (2) data from field exercises.
DTIC
Analogies; Communication Networks; Military Technology; Traffic

20040075085 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Comparative Functional Analysis of Air Force and Commercially Available Transportation Information Management Systems
Holland, Patrick S.; Mar. 2004; 188 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422936; AFIT/GLM/ENS/04-05; No Copyright; Avail: CASI; A09, Hardcopy

The Air Force currently relies on two transportation information management systems for managing cargo and passenger movements throughout the Defense Transportation System. The two systems are Global Air Transportation Execution System (GATES) and Cargo Movement Operations System (CMOS). Although GATES and CMOS have evolved from legacy systems created during the 1980s, both systems are used to process cargo and passengers while providing the information needed to maintain in-transit visibility (ITV) and manage each movement. The purpose of this research is to identify commercially available logistics software packages and determine whether they provide the same functionality as the two Air Force information systems currently employed. Using a case study methodology, the researcher collected information on logistics software provided by SAP, Oracle, and PeopleSoft. A gap analysis was then conducted to identify the percentage of similarity between the Air Force and commercial systems. The results of the research show SAP having the highest percentage of similarity with each of the Air Force systems followed by Oracle and then PeopleSoft.
DTIC
Functional Analysis; Information Management; Information Systems; Management Systems; Military Operations; Passengers; Transportation

20040075100 Texas A&M Univ., College Station, TX
Damage Models and Computational Tools for Health- Monitoring of Smart Structures
Reddy, J. N.; Apr. 2004; 41 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0483
Report No.(s): AD-A422966; ARO-41551.5-EG; No Copyright; Avail: CASI; A03, Hardcopy

The primary goal of this research was to develop physically based damage models, computational approaches based on shear deformation plate theories and layerwise theory, a finite element formulation for the analysis of thin and thick laminated composite structures with embedded sensors/actuators. During the period of this project the following tasks have been completed: (1) literature search to assess damage and failures models; (2) theoretical formulation of the layerwise models for smart composite structures, (3) formulation of damage models, (4) finite element analysis of laminated adaptive plate structures using the layerwise theory, and (S) finite element analysis of laminated adaptive plate structures Using the single-layer theories (classical, first-order and third-order plate theories). Geometric nonlinearities are accounted for and parametric effects of lamination schemes, material properties, and boundary conditions were investigated.
DTIC
Composite Structures; Damage; Damage Assessment; Finite Element Method; Health; Smart Structures

20040075120 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Agent Based Simulation Seas Evaluation of DoDAF Architecture
DeStefano, Gregory V.; Mar. 2004; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422991; AFIT/GOR/ENS/04-05; No Copyright; Avail: CASI; A05, Hardcopy

With Department of Defense (DoD) weapon systems being deeply rooted in the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) structure, it is necessary for combat models to capture C4ISR effects in order to properly assess military worth. Unlike many DoD legacy combat models, the agent based model System Effectiveness and Analysis Simulation (SEAS) is identified as having C4ISR analysis capabilities. In lieu of requirements for all new DoD C4ISR weapon systems to be placed within a DoD Architectural Framework (DoDAF), investigation of means to export data from the Framework to the combat model SEAS began. Through operational, system, and technical views, the DoDAF provides a consistent format for new weapon systems to be compared and evaluated. Little research has been conducted to show how to create an executable model of an actual DoD weapon system described by the DoDAF. In collaboration with Systems Engineering masters student Captain Andrew Zinn, this research identified the

Aerospace Operation Center (AOC) weapon system architecture, provided by the MITRE Corp., as suitable for translation into SEAS. The collaborative efforts lead to the identification and translation of architectural data products to represent the Time Critical Targeting (TCT) activities of the AOC. A comparison of the AOC weapon system employing these TCT activities with an AOC without TCT capabilities is accomplished within a Kosovo-like engagement (provided by Space and Missile Center Transformations Directorate). Results show statistically significant differences in measures of effectiveness (MOEs) chosen to compare the systems. The comparison also identified the importance of data products not available in this incomplete architecture and makes recommendations for SEAS to be more receptive to DoDAF data products.
DTIC
Architecture (Computers); Command and Control; Reconnaissance; Seas; Simulation; Systems Engineering

20040075124 Northrop Grumman Information Technology, Inc., Fairborn, OH
AFRL Battlespace Visualization Branch Display Characterization Facility
Fullenkamp, Steve; Aleva, Denise L.; Meyer, Frederick M.; Schwartz, Robert; Trissell, Terry; May 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422995; AFRL-HE-WP-TR-2004-0053; No Copyright; Avail: CASI; A03, Hardcopy

Digital displays will play a critical role in providing a common battlespace picture whether in the aircraft cockpit, command and control facility or carried by ground troops. Advanced display technologies will be key to providing our warfighters with needed information. The purpose of the Display Characterization Facility at WPAFB is to provide quantitative performance data on current and upcoming display technologies and evaluate these technologies for specific Air Force applications. This requires an understanding not only of the specific display technology and its capabilities and limitations but also the capabilities and limitations of the human visual system, the tasks to be performed and characteristics of the environment which may affect the operator-display interaction. To this end, the Display Characterization Laboratory conducts both display hardware measurements and assessments of human performance using the displays under expected environmental conditions. Common display measurements are described along with their implications for operator visual performance.
DTIC
Characterization; Display Devices; Human-Computer Interface

20040075125 Texas Univ., Austin, TX
Solid Freeform Fabrication Proceedings
Bourell, D. L.; Wood, Kristin L.; Aug. 2003; 699 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0913
Report No.(s): AD-A422996; No Copyright; Avail: CASI; A99, Hardcopy

The Fourteenth Solid Freeform Fabrication Symposium, held at The University of Texas in Austin on August 4-6, 2003, was attended by 100 national and international researchers. papers addressed SFF issues in computer software, machine design, materials synthesis and processing, and integrated manufacturing. A total of 66 presentations were made, 57 oral presentations and 9 poster presentations. of these, 63 are included in the proceedings volume. The diverse domestic and foreign attendees represented industrial users, SFF machine manufacturers, universities, and government. The attendance was up this year from previous years. The Symposium organizers look forward to its being a continuing forum for technical exchange among the expanding body of researchers involved in SFF.
DTIC
Conferences; Fabrication

20040075135 Drexel Univ., Philadelphia, PA
Toward Development of a Virtual Distributed Control System
Kam, Moshe; Lebaudy, Andres; Xu, Yifeng; Lin, Erwei; Wang, Mianyu; May 14, 2004; 159 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0787; Proj-02PR13057-00
Report No.(s): AD-A423011; No Copyright; Avail: CASI; A08, Hardcopy

We describe two simulation and design tools, developed for large-scale distributed control applications. At present, these applications require extensive experimentation with hardware, which is costly, slow, and inflexible. The new simulators allow computerized evaluation of communication requirements and discovery of potential bottlenecks in large- scale systems of actuators, sensors, transport lines and communication networks. They provide designers with easy, quick, and inexpensive

methodology to examine, rate, and compare proposed designs. The first tool, the Communication Simulator, is used in early phases of the design, for quick but somewhat rough comparison of architectures. It requires estimates of the basic communication parameters of the nodes. The second tool, the Network Simulator, simulates node dynamics and communication traffic simultaneously, and provides detailed and accurate estimates of parameters such as packet loss, bandwidth utilization, channel throughput, and channel capacity. The simulators were validated using a large- scale dynamic architecture, the Chilled Water Reduced-Scale Advanced Demonstrator.
DTIC
Active Control; Distributed Interactive Simulation; Distributed Parameter Systems

20040075140 California Inst. of Tech., Pasadena, CA
Information Flow in Cooperative Control of Multi- Vehicle Systems
Murray, Richard; Jan. 2001; 5 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0460
Report No.(s): AD-A423018; No Copyright; Avail: CASI; A01, Hardcopy

Over the three years of this project, we obtained a substantial collection of results that relate the topology of the underlying communications network to the stability of the overall system, under the assumption of identical linear dynamics for each vehicle (nodes). These results characterize the stability of the system in terms of the frequency response of the individual vehicle dyuamics and the eigenvalues of the Laplacian Matrix associated with the communications topology. Extensions to the basic stability theorem have been obtained that account for nonlinear plant dynamis, switching communications graphs, and disturbance propagation.
DTIC
Communication Networks; Information Flow

20040075215 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Experimental Investigation of Productivity Stratification and Knowledge Transfer in an Electronically Mediated Environment
Sakamoto, Jachin; Mar. 23, 2004; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423139; AFIT/GIR/ENV/04M-19; No Copyright; Avail: CASI; A06, Hardcopy

The idea of anywhere and anytime learning is enticing from a military standpoint, given the high deployment rates in the current operational environment. Electronic-based learning is seen as an answer to this requirement. Currently there are many variations in electronic-based instructional media, and little has been done to determine which format or combination of formats is most conducive to facilitating knowledge transfer and learning. The research project explores, through the use of an experiment, three primary constructs of media richness, content flexibility, and forced engagement, in their relation to effectiveness or productivity in facilitating learning in the experimental participants. The instructional subject matter of choice in this experimental research was the art of detecting deceptive communication. Within the confines of this study, little empirical evidence was found to support the idea that any of the specific variations of electronic training medium outperformed the others in facilitating knowledge transfer.
DTIC
Computer Assisted Instruction; Deception; Education; Productivity; Stratification

20040075223 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Study of Course Design Factors that Influence E- Learning Course Completion Rates
Mathews, Edward A.; Mar. 23, 2004; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423152; AFIT/GIR/ENV/04M-15; No Copyright; Avail: CASI; A08, Hardcopy

E-learning has been defined as "the use of network technologies to create, foster, deliver, and facilitate learning, anytime and anywhere" (Linezine, 2000) . E-learning is on of the fastest growing services on the Internet today with revenues between 6 billion and 7 billion dollars (Bizreport, 2003). This growth comes with a peculiar problem - many students never complete their e-learning courses. Although there is significant variation among institutions - with some reporting course-completion rates of more than 80 percent and others finding that fewer than 50 percent of distance-education students finish their course... course- completion rates are often 10 to 20 percentage points higher in traditional courses than in distance offerings" (Carr, 2000). There have been few credible studies investigating actual non-completion rates and factors that affect these dropout rates (O'Connor et al., 2003). This study seeks to apply Human-Computer Interaction theory, through use of usability inspection method called Heuristic Evaluation, to identify course design characteristics that may influence course

completion rates. A research instrument was developed and applied to twenty (20 courses offered by the Air Force Institute of Technology's School of Systems and Logistics, and a Pearson Correlation was performed to identify any relationships between design factors and course completion rats. Analysis indicated some support for using the Heuristic Evaluation method. Practical and theoretical implications for this research are discussed.
DTIC
Computer Assisted Instruction; Education

20040075229 Purdue Univ., West Lafayette, IN
Scalable Protection Against DDOS and Worm Attacks
Park, Kihong; Apr. 2004; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0530; Proj-FTNP
Report No.(s): AD-A423164; AFRL-IF-RS-TR-2004-100; No Copyright; Avail: CASI; A04, Hardcopy

This report addresses two pressing challenges facing network security today: distributed denial of service (DDoS) and worm attacks. New solutions are aimed at providing scalable defenses against these potentially debilitating cyber threats. Two complementary modes of protection are achieved: 1) proactive protection that prevents attacks from imparting harm in the first place, and 2) reactive protection that locates the physical source of an attack and adapts to unforeseen vulnerabilities. The solutions are based on a new approach to network security (distributed packet filtering (DPF)) that casts a filter net" over the network system which stops the attack traffic. Scalability is afforded by the small size of the filter net: with only 15% deployment for DDoS and 4% for worm, DPF is able to achieve overwhelming protection. Efficacy under partial deployment, a key requirement of any viable solution, is made possible by the recently discovered power-law connectivity of the Internet. Performance evaluation of DPF using large-scale Internet topologies is carried out with DaSSF-Turbo, a scalable network simulation environment developed as part of the project. DaSSF- Turbo is a performance-oriented extension of DaSSF and facilitates Internet-scale benchmarking through automated network configuration, performance monitoring, and power-law partitioning.
DTIC
Protection; Worms

20040075231 Army Research Lab., Aberdeen Proving Ground, MD
Skills Required for Platoon Leaders in the Objective Force Unit of Action
Sterling, Bruce S.; Burns, Cheryl A.; May 2004; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-62716AH70
Report No.(s): AD-A423168; ARL-TN-0215; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this research was to identify and measure skills required by platoon leaders in the objective force unit of action (UA). The research was embedded in a UA experiment conducted in simulation in the Unit of Action Maneuver Battle Lab. The authors used the Job Assessment Survey Software to examine types and levels of skill clusters and individual skills needed by platoon leaders. Results showed that for both the tasks of "maintain situational awareness," and "command and control the platoon," the clusters of conceptual, communication, and vision are important. Concerning individual skills, the highest ranking skills over both tasks combined were mental skills, such as time sharing, selective attention, speed of closure, and memorization; communication skills, such as oral comprehension and oral expression; and vision skills, including depth perception, night vision, far vision, and near vision. Platoon leaders have very high skill requirements for their level in the future force. However, these high ratings may well be as much attributable to their lack of experience as to the difficulty of the job. The authors propose human factors, training, and selection interventions to help meet skill demands. (2 tables, 3 figures, 7 refs.)
DTIC
Command and Control; Leadership; Organizations; Personnel; Situational Awareness

20040075240 Reliable Software Technologies Corp., Sterling, VA
An Analytical Investigation of Software Mutation for Increased Information Survivability
Michael, C. C.; Bartie, Aron; Viega, John; Hulot, Alexandre; Jarymowycz, Natasha; Apr. 2004; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-C-0322; DARPA ORDER-F166; Proj-F166
Report No.(s): AD-A423201; AFRL-IF-RS-TR-2004-102; No Copyright; Avail: CASI; A03, Hardcopy

The work reported here has three major components. First, we report on the development of an analytic framework for

judging the success of diversification schemes at retarding malicious attacks. We attempt to quantify the relationship between the amount of work needed by a defender to achieve a certain level of diversity, and relate it to the amount of work needed by an attacker to subvert the resulting system. Second, we report on a prototype system for automating the creation of diverse programs. This is, in fact, a general- purpose mutation system wherein the modification of software is controlled by mutation scripts or meta-programs that drive the mutation of source code. Finally, we report on a further prototype system for boosting information-system survivability by means of diversity. This system monitors the behavior of programs and ensures their compliance with semantic constraints describing their intended behavior, so that undesired behavior can be detected. Monitoring all aspects of a program's semantics would be infeasible, but in a diverse system, different replicas of a program can monitor different, randomly selected aspects of software behavior.
DTIC
Computer Programs; Intrusion Detection (Computers); Mutations; Security

20040075257 Naval Postgraduate School, Monterey, CA
Proceedings of the Center for National Software Studies Workshop on Trustworthy Software
Michael, James B.; Voas, Jeffrey M.; Linger, Richard C.; May 10, 2004; 72 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423225; NPS-CS-04-006; No Copyright; Avail: CASI; A04, Hardcopy

Achieving what is often termed "software trustworthiness" has been an elusive goal, in part because of the lack of a clear understanding of why we sometimes succeed but often fail to produce trustworthy software. To better understand the challenges the USA faces in achieving the goal of producing and acquiring trustworthy software systems and products, a workshop on the subject of trustworthy software was held April 8-9, 2004 in Monterey, California. The 22 papers presented at the workshop are contained in this proceedings, which is intended to be used as input to a national research and development (R&D) agenda on software trustworthiness.
DTIC
Commercial Off-the-Shelf Products; Computer Programming; Computer Programs; Conferences; Procurement; Software Engineering; Software Reliability

20040075600 NASA Marshall Space Flight Center, Huntsville, AL, USA
Telescience Resource Kit Software Capabilities and Future Enhancements
Schneider, Michelle; [2004]; 1 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Telescience Resource Kit (TReK) is a suite of PC-based software applications that can be used to monitor and control a payload on board the International Space Station (ISS). This software provides a way for payload users to operate their payloads from their home sites. It can be used by an individual or a team of people. TReK provides both local ground support system services and an interface to utilize remote services provided by the Payload Operations Integration Center (POIC). by the POIC and to perform local data functions such as processing the data, storing it in local files, and forwarding it to other computer systems. TReK can also be used to build, send, and track payload commands. In addition to these features, work is in progress to add a new command management capability. This capability will provide a way to manage a multi- platform command environment that can include geographically distributed computers. This is intended to help those teams that need to manage a shared on-board resource such as a facility class payload. The environment can be configured such that one individual can manage all the command activities associated with that payload. This paper will provide a summary of existing TReK capabilities and a description of the new command management capability. For example, 7'ReK can be used to receive payload data distributed
Author
Communication Networks; Computer Programs; Payload Integration

20040075602 NASA Langley Research Center, Hampton, VA, USA
Future Air Traffic Growth and Schedule Model, Supplement
Kimmel, William M., Technical Monitor; Smith, Jeremy C.; Dollyhigh, Samuel M.; May 2004; In English
Contract(s)/Grant(s): NAS1-00135; WU 23-762-45-E2
Report No.(s): NASA/CR-2004-213027/SUPPL; No Copyright; Avail: CASI; C01, CD-ROM

The Future Air Traffic Growth and Schedule Model was developed as an implementation of the Fratar algorithm to project future traffic flow between airports in a system and of then scheduling the additional flights to reflect current passenger

time-of-travel preferences. The methodology produces an unconstrained future schedule from a current (or baseline) schedule and the airport operations growth rates. As an example of the use of the model, future schedules are projected for 2010 and 2022 for all flights arriving at, departing from, or flying between all continental USA airports that had commercial scheduled service for May 17, 2002. Inter-continental US traffic and airports are included and the traffic is also grown with the Fratar methodology to account for their arrivals and departures to the continental US airports. Input data sets derived from the Official Airline Guide (OAG) data and FAA Terminal Area Forecast (TAF) are included in the examples of the computer code execution.
Derived from text
Air Traffic; Computer Programs; Airline Operations

20040075604 Lockheed Martin Corp., Huntsville, AL, USA
Transitioning to Intel-based Linux Servers in the Payload Operations Integration Center
Guillebeau, P. L.; [2004]; 1 pp.; In English; Space Ops 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

The MSFC Payload Operations Integration Center (POIC) is the focal point for International Space Station (ISS) payload operations. The POIC contains the facilities, hardware, software and communication interface necessary to support payload operations. ISS ground system support for processing and display of real-time spacecraft and telemetry and command data has been operational for several years. The hardware components were reaching end of life and vendor costs were increasing while ISS budgets were becoming severely constrained. Therefore it has been necessary to migrate the Unix portions of our ground systems to commodity priced Intel-based Linux servers. hardware architecture including networks, data storage, and highly available resources. This paper will concentrate on the Linux migration implementation for the software portion of our ground system. The migration began with 3.5 million lines of code running on Unix platforms with separate servers for telemetry, command, Payload information management systems, web, system control, remote server interface and databases. The Intel-based system is scheduled to be available for initial operational use by August 2004 The overall migration to Intel-based Linux servers in the control center involves changes to the This paper will address the Linux migration study approach including the proof of concept, criticality of customer buy-in and importance of beginning with POSlX compliant code. It will focus on the development approach explaining the software lifecycle. Other aspects of development will be covered including phased implementation, interim milestones and metrics measurements and reporting mechanisms. This paper will also address the testing approach covering all levels of testing including development, development integration, IV&V, user beta testing and acceptance testing. Test results including performance numbers compared with Unix servers will be included. need for a smooth transition while maintaining real-time support. An important aspect of the paper will involve challenges and lessons learned. product compatibility, implications of phasing decisions and tracking of dependencies, particularly non-software dependencies. The paper will also discuss scheduling challenges providing real-time flight support during the migration and the requirement to incorporate in the migration changes being made simultaneously for flight support. This paper will also address the deployment approach including user involvement in testing and the , This includes COTS product compatibility, implications of phasing decisions and tracking of dependencies, particularly non- software dependencies. The paper will also discuss scheduling challenges providing real-time flight support during the migration and the requirement to incorporate in the migration changes being made simultaneously for flight support.
Author
Commodities; Compatibility; Computer Programs; Data Storage; Information Management; Payload Integration

20040075627 Malardalen Univ., Eskilstuna, Sweden
Real-Time 3D Nautical Navigational Visualisation
Porathe, Thomas; Sivertun, Ake; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 4-1 - 4-11; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a research project suggesting the use of real-time 3D techniques normally used in simulation environments as a navigation aid onboard ships. Based on a three-dimensional geographical database the surrounding world is presented in a "bridge-eye perspective" with navigational information such as own track, other ships in the vicinity and their tracks, water depth and radar echoes integrated in a single display. The integrated display suggested, acts as a complement to traditional electronic charts. The main objective is to lessen the cognitive load of the bridge personal and particularly the helms man in hand steering situations in high-speeds. (See fig. 1.)
Author
Navigation Aids; Real Time Operation; Simulation; Steering

20040075628 Pennsylvania State Univ., State College, PA, USA

Multi-Sensory, Multi-Modal Concepts for Information Understanding

Hall, David L.; Shaw, Timothy S.; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 2-1 - 2-4; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In recent years, extensive research has focused on the development of techniques for multi-sensor data fusion systems. These fusion systems process data from multiple sensors to develop improved estimates of the position, velocity, attributes, and identity of entities such as targets or entities of interest. Typically, the fused data are displayed on a geographical information display (e.g., data are overlaid on a map with terrain features, political information, and the data are shown as icons representing the observed entities). Analysts interpret the data to develop an assessment of an evolving situation or threat. Despite significant improvements in computer displays, haptic interface devices, and new three-dimensional full-immersion display capabilities, the data fusion displays have seen little changes to take advantage of a human#s ability to access data. This paper describes two concepts for improved understanding of data; (1) the utilization of multiple human senses to interact with and interpret data, and (2) the dual use of language and vision to improve information understanding. Author

Multisensor Fusion; Data Processing; Sensory Perception; Information Systems

20040075629 Buffalo Univ., NY, USA

Haptic Rendering Techniques for Non-Physical, Command Decision Support

Kesavadas, T.; Llinas, James; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 8-1 - 8-4; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The purpose of this paper is to explore non-traditional visualization techniques to assess threat and other variables in command center settings. Not all entities that a commander interacts in real life can be converted to visual medium, which is but just one of the five senses that we have. As an example, sense of threat during a critical situation during a mission cannot be easily communicated with color. Many special skills such as a surgeon using a sharp scalpel or a Pilot negotiating a sharp curve cannot be easily represented in videos or even real time Virtual Environments. We call such systems non-physical visualization. While elsewhere in this conference we speak about Ontological representation of such events, here some techniques currently underdevelopment to visualize such parameters are presented including tactile and haptic rendering techniques.

Derived from text

Sensory Perception; Real Time Operation; Visual Perception; Command and Control; Decision Making

20040075658 NASA Marshall Space Flight Center, Huntsville, AL, USA

A DMAP Program for the Selection of Accelerometer Locations in MSC/NASTRAN

Peck, Jeff; Torres, Isaias; [2004]; 5 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 May 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy

A new program for selecting sensor locations has been written in the DMAP (Direct Matrix Abstraction Program) language of MSC/NASTRAN. The program implements the method of Effective Independence for selecting sensor locations, and is executed within a single NASTRAN analysis as a "rigid format alter" to the normal modes solution sequence (SOL 103). The user of the program is able to choose among various analysis options using Case Control and Bulk Data entries. Algorithms tailored for the placement of both uni-axial and tri- axial accelerometers are available, as well as several options for including the model s mass distribution into the calculations. Target modes for the Effective Independence analysis are selected from the MSC/NASTRAN ASET modes calculated by the "SOL 103" solution sequence. The initial candidate sensor set is also under user control, and is selected from the ASET degrees of freedom. Analysis results are printed to the MSCINASTRAN output file (*.f06), and may include the current candidate sensors set, and their associated Effective Independence distribution, at user specified iteration intervals. At the conclusion of the analysis, the model is reduced to the final sensor set, and frequencies and orthogonality checks are printed. Example results are given for a pre-test analysis of NASA s five-segment solid rocket booster modal test.

Author

Solid Propellant Rocket Engines; Accelerometers; Space Shuttle Boosters; Degrees of Freedom

20040075671 NASA Marshall Space Flight Center, Huntsville, AL, USA

Enabling a New Planning and Scheduling Paradigm

Jaap, John; Davis, Elizabeth; 2004; 1 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Flight Projects Directorate at NASA's Marshall Space Flight Center is developing a new planning and scheduling environment and a new scheduling algorithm to enable a paradigm shift in planning and scheduling concepts. Over the past 33 years Marshall has developed and evolved a paradigm for generating payload timelines for Skylab, Spacelab, various other Shuttle payloads, and the International Space Station. The current paradigm starts by collecting the requirements, called "tasks models," from the scientists and technologists for the tasks that they want to be done. Because of shortcomings in the current modeling schema, some requirements are entered as notes. Next a cadre with knowledge of vehicle and hardware modifies these models to encompass and be compatible with the hardware model; again, notes are added when the modeling schema does not provide a better way to represent the requirements. Finally, another cadre further modifies the models to be compatible with the scheduling engine. This last cadre also submits the models to the scheduling engine or builds the timeline manually to accommodate requirements that are expressed in notes. A future paradigm would provide a scheduling engine that accepts separate science models and hardware models. The modeling schema would have the capability to represent all the requirements without resorting to notes. Furthermore, the scheduling engine would not require that the models be modified to account for the capabilities (limitations) of the scheduling engine. The enabling technology under development at Marshall has three major components. (1) A new modeling schema allows expressing all the requirements of the tasks without resorting to notes or awkward contrivances. The chosen modeling schema is both maximally expressive and easy to use. It utilizes graphics methods to show hierarchies of task constraints and networks of temporal relationships. (2) A new scheduling algorithm automatically schedules the models without the intervention of a scheduling expert. The algorithm is tuned for the constraint hierarchies and the complex temporal relationships provided by the modeling schema. It has an extensive search algorithm which can exploit timing flexibilities and constraint and relationship options. (3) A web-based architecture allows multiple remote users to simultaneously model science and technology requirements and other users to model vehicle and hardware characteristics. The architecture allows the users to submit scheduling requests directly to the scheduling engine and immediately see the results. These three components are integrated so that science and technology experts with no knowledge of the vehicle or hardware subsystems and no knowledge of the internal workings of the scheduling engine have the ability to build and submit scheduling requests and see the results. The immediate feedback will hone the users' modeling skills and ultimately enable them to produce the desired timeline. This paper summarizes the three components of the enabling technology and describes how this technology would make a new paradigm possible.

Author

Scheduling; Planning; Space Shuttle Payloads; Payloads; Feedback

20040075675 NASA Marshall Space Flight Center, Huntsville, AL, USA

Integrating Ground System Tools From Multiple Technologies Into a Single System Environment

Ritter, George H.; [2004]; 1 pp.; In English; Space Ops 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

With rapid technology changes and new and improved development techniques, it becomes extremely difficult to try to add capabilities to existing ground systems without wanting to replace the entire system. Replacing entire systems is not usually cost effective so there is a need to be able to slowly improve systems without long development times that introduce risk due to large amounts of change. The Marshall Space Flight Center s (MSFC) Payload Operations Integration Center (POIC) ground system provides command, telemetry, and payload planning systems in support of the International Space Station. Our systems have continuously evolved with technology changes due to hardware end of life issues, and also due to user requirement changes. As changes have been implemented, we have tried to take advantage of some of the latest technologies while at the same time maintaining certain legacy capabilities that are not cost affective to replace. One of our biggest challenges is to integrate all of these implementations into a single system that is usable, maintainable, and scalable. Another challenge is to provide access to our tools in such a way that users are not aware of all the various implementation methods and tools being used. This approach not only makes our system much more usable, it allows us to continue to migrate capabilities and to add capabilities without impacting system usability. This paper will give an overview of the tools used for MSFC ISS payload operations and show an approach for integrating various technologies into a single environment that is maintainable, flexible, usable, cost effective, and that meets user needs.

Author

Command Guidance; Payload Integration; Telemetry

20040075677 NASA Marshall Space Flight Center, Huntsville, AL, USA

Future Concepts for Realtime Data Interfaces for Control Centers

Kearney, Mike W., III; [2004]; 1 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

Existing methods of exchanging realtime data between the major control centers in the International Space Station program have resulted in a patchwork of local formats being imposed on each Mission Control Center. This puts the burden on a data customer to comply with the proprietary data formats of each data supplier. This has increased the cost and complexity for each participant, limited access to mission data and hampered the development of efficient and flexible operations concepts. Ideally, a universal format should be promoted in the industry to prevent the unnecessary burden of each center processing a different data format standard for every external interface with another center. With the broad acceptance of XML and other conventions used in other industries, it is now time for the Aerospace industry to fully engage and establish such a standard. This paper will briefly consider the components that would be required by such a standard (XML schema, data dictionaries, etc.) in order to accomplish the goal of a universal low-cost interface, and acquire broad industry acceptance. We will then examine current approaches being developed by standards bodies and other groups. The current state of CCSDS panel work will be reviewed, with a survey of the degree of industry acceptance. Other widely accepted commercial approaches will be considered, sometimes complimentary to the standards work, but sometimes not. The question is whether de facto industry standards are in concert with, or in conflict with the direction of the standards bodies. And given that state of affairs, the author will consider whether a new program establishing its Mission Control Center should implement a data interface based on those standards. The author proposes that broad industry support to unify the various efforts will enable collaboration between control centers and space programs to a wider degree than is currently available. This will reduce the cost for programs to provide realtime access to their data, hence reducing the cost of access to space, and benefiting the industry as a whole.

Author

Real Time Operation; Data Systems; Interfaces; Spacecraft Control

20040075710 NASA Ames Research Center, Moffett Field, CA, USA

Image Processing for High-Precision Eye-Movement Tracking

Mulligan, Jeffrey B.; Research and Technology 1997; September 1998, pp. 15-16; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Eye movements can provide a wealth of information about how human operators perceive and process visual information. Video-based measurement systems offer considerable advantages over competing approaches for use in applied contexts outside the laboratory: first, they do not require physical contact with the eye, and second, they do not restrict the subject s movement. This research investigates image processing methods in an effort to obtain greater accuracy from video images of the eye. Currently available commercial systems use special hardware to compute eye position in real time from images of the eye s anterior structures (first figure). To attain real-time performance, these systems must use relatively simple processing algorithms. This project is concerned with maximizing the final accuracy by the application of more sophisticated image processing, even when the calculations cannot be performed in real time on present-day microcomputers.

Author

Eye Movements; Image Processing; Computer Programs

20040075718 NASA Ames Research Center, Moffett Field, CA, USA

Virtual Reality on Mars Pathfinder

Stoker, C.; Blackmon, T.; Sims, M.; Zbinden, E.; Research and Technology 1997; September 1998, pp. 109-111; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this project was to produce a three-dimensional (3-D) photo-realistic virtual reality (VR) model of the Martian surface for use in the Mars Pathfinder mission. Marsmap, the interactive terrain visualization system, creates and renders digital terrain models produced from stereo images of Mars' surface taken by the lander's images for Mars Pathfinder (IMP) camera. A primary benefit of using VR to display geologic information i s that it provides an improved perception of depth and spatial layout of the remote site. The VR aspect of the display allows an operator to move freely in the environment, unconstrained by the physical limitations of the perspective from which the data were acquired. Virtual reality also offers a way to archive and retrieve information in a way that is easily understood. Combining the VR models with stereo display systems can enable a feeling of presence at the remote location. The capability, implemented in Marsmap, to interactively perform measurements from within the VR model, offered unprecedented ease in performing operations that are normally time

consuming and difficult using standard photogrammetric techniques. This ground-breaking project demonstrated the power of using VR as a cartographic tool.
Derived from text
Mars Pathfinder; Virtual Reality; Mars Photographs; Mars Surface; Geology

20040075726 NASA Ames Research Center, Moffett Field, CA, USA
Validating Requirements for Fault-Tolerant Systems Using Model Checking
Schneider, Francis; Callahan, Jack; Easterbrook, Steve; Research and Technology 1997; September 1998, pp. 125; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this work were to develop new techniques for validating fault-tolerance requirements in the early stages of software development, and then determining whether the requirements and high-level designs for fault-tolerant systems provide the required reliability before they are implemented. Another purpose was to explore the integrated application of model-checking technology as a verification and validation technique for software requirements.
Derived from text
User Requirements; Fault Tolerance; Computer Programming

20040075742 NASA Ames Research Center, Moffett Field, CA, USA
Measuring Human Detection Templates
Ahumada, Albert J., Jr.; Watson, Andrew B.; Beard, Bettina L.; Research and Technology 1997; September 1998, pp. 16-17; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

As part of NASA's goal to improve aircraft safety and performance, Ames is developing models that can be used to predict a human observer's ability to detect visual targets. Often these models perform well because they mimic visual system processing. When task performance depends on the observer's memory of a target, these models should include a characterization of these internal representations, or memory templates. A technique was developed to measure these templates when an observer is discriminating two different targets. The technique involves adding a small amount of random noise to each target stimulus. The two targets are then presented to the observer. The observer s discrimination response is then correlated with the lightness or darkness of the noise at each location, or pixel, in the image. If a particular pixel significantly contributes to the observer s decision, then the resulting response correlation image will show lighter or darker areas in those regions. The response correlation image illustrates the contribution of each noise image pixel to the observer's decision and can represent which features of the stimulus are being used to make the discrimination.
Author
Aircraft Safety; Visual Discrimination; Computer Programs

20040075744 NASA Ames Research Center, Moffett Field, CA, USA
High-Fidelity Virtual Environments
Ellis, Stephen R.; Research and Technology 1997; September 1998, pp. 18-19; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Virtual environments are personal simulators. They are interactive, head-referenced computer displays that create an illusion that causes their users to feel displaced to another location. This illusion is created through the operation of three types of equipment: (1) sensors, such as head position sensors, to detect the operator s body movements, (2) effectors, such as stereoscopic displays, to stimulate the operator s senses, and (3) special-purpose hardware to interlink the sensors and effectors to produce sensory experiences resembling those encountered by inhabitants immersed in a physical environment. In a virtual environment this linkage is accomplished by a simulation computer. In a head- mounted teleoperator display the linkage is accomplished by the robot manipulators, vehicles, control systems, sensors, and cameras at a remote work site. Both virtual environments and head-mounted teleoperator displays have applications in mechanical design, data visualization, robotics, and as aids for mechanical assembly.
Author
Virtual Reality; Simulators; Display Devices; Illusions; Scientific Visualization; Sensory Perception

20040075746 NASA Ames Research Center, Moffett Field, CA, USA
CTAS Joint Software Development
Eshow, Michelle M.; Research and Technology 1997; September 1998, pp. 23; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Federal Aviation Administration (FAA) has decided to field major elements of the Center/TRACON (Terminal Radar Approach Control) Automation System (CTAS) to many air traffic control facilities across the USA. To facilitate the deployment, NASA, the FAA, and their contractors have conceived and implemented an innovative software development approach known as Joint Development. Under joint Development, NASA and the FAA are working in a common baseline of software that combines the products of CTAS enhancements produced by NASA with the FAA-generated elements necessary for a field operational system. This approach contrasts with previous efforts in which there was a single discrete handoff of software or technology from a research organization to the FAA.
Derived from text
Air Traffic Control; Automatic Control; Computer Programming; Integrated Mission Control Center; Software Engineering

20040075783 NASA Ames Research Center, Moffett Field, CA, USA
Mars Pathfinder Virtual Reality Model (MarsMap)
Blackmon, Ted; Research and Technology 1997; September 1998, pp. 101-102; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Researchers at Ames Research Center (ARC) provided Pathfinder Mission scientists at the Jet Propulsion Laboratory (JPL) with three-dimensional (3-D) digital topographic models and an advanced interface for interaction with the virtual environment of the Martian surface. Because of the photographic realism of the 3-D models, scientists were able to learn more quickly about the Pathfinder landing site than they could have from a static view of the rock field that surrounded the lander. The virtual reality aspect of the display allowed them to move around the field, even to project a bird's eye view from above it. Moreover, 3-D measurements of positions, distances, and angles could be easily extracted from the topographic models, providing valuable tools for science analysis and mission planning.
Derived from text
Mars Pathfinder; Virtual Reality; Three Dimensional Models; Mars Surface; Landing Sites

20040075810 NASA Ames Research Center, Moffett Field, CA, USA
New Technique for Visualizing Unsteady Flow
Kao, David; Shen, Han-Wei; Research and Technology 1997; September 1998, pp. 69; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A new technique for accurately visualizing time-varying phenomenon in unsteady flow fields has been developed at Ames Research Center. The resulting images captured through the Unsteady Flow Line Integral Convolution (UFLIC) technique reveal complicated flow behavior and help scientists detect important flow features for computational fluid dynamics analysis. UFLIC employs a new algorithm that takes into consideration the time-variable and flow patterns from previous time steps. In unsteady flows, there are no well-defined flow lines because the flow is dynamic, and particles can advance to new locations easily. The UFLIC algorithm uses a time-dependent particle-tracing scheme to trace flow textures.
Derived from text
Time Dependence; Unsteady Flow; Flow Visualization

20040075812 NASA Ames Research Center, Moffett Field, CA, USA
DARWIN
Korsmeyer, David; Research and Technology 1997; September 1998, pp. 68; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Creating a more dynamic role for wind tunnels in the design process is the goal of a NASA information technology concept for redefining the classic approach to wind tunnel and other aeronautical testing. The project, called DARWIN (Developmental Aeronautics Revolutionizing Wind tunnels with Intelligent systems of NASA), combines custom and commercial software and hardware and advanced experimental instrumentation to create an extended version of the Remote Access Wind Tunnel system. In 1997 the DARWIN Workspace was developed, a user interface that allows secure remote access via the World Wide Web to wind tunnel data. The emphasis of DARWIN is on reducing the cycle time of the wind tunnel process, extracting more pertinent and accurate data from the wind tunnel environment, and changing the role of the wind tunnel from primarily one of a validation process to one of a dynamic and real-time participant in the overall design process.
Derived from text
Computer Programs; Wind Tunnel Tests; Wind Effects

20040075813 NASA Ames Research Center, Moffett Field, CA, USA

Portable Batch System Expands Its Customer Base

Henderson, Robert; Research and Technology 1997; September 1998, pp. 71; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Portable Batch System (PBS) project was started at Ames Research Center to produce a modern resource-management and job-queuing system that was compliant with the formal standards and was flexible and extensible in order to meet the changing needs of computing within the Agency. Although the initial effort concentrated on traditional supercomputers, PBS quickly gained wide acceptance on parallel systems such as the IBM SP series and on clusters of workstations. By providing a common command interface and job-management system across the complete range of modern computers, together with a flexible site and determined scheduling policy, PBS has gained wide acceptance in academic, industry; and the military.

Derived from text

Management Systems; Scheduling; Tasks; Computer Systems Programs

20040075815 NASA Ames Research Center, Moffett Field, CA, USA

Sonification of Multivariate Data

Stevenson, Jim; Research and Technology 1997; September 1998, pp. 64; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Previously, a program called MULTIVAR was developed for sonification of multivariate data. Magnitude was represented by frequency. Rows or columns of the data matrix were sequentially displayed. MULTIVAR contained many switches for sorting or scaling data. Timing of presentation within and between rows of the data matrix was controllable by tables and switches. sound-generating registers of the OPL frequency modulator (FM) chip. Its driving tables contain control variables such as frequency, voice number, speaker channel, [volume, attack, decay, sustain, and release] for carrier and modulator, and many others including a percussion mode and a four-parameter mode. They also contain appropriate data variables. A C-header file called ssound.h was also developed to control the OPL chip. This made it possible to easily generate many sonification examples using mathematical functions, probability distributions, and multivariate high-order Markov chains. MULTIVAR, making it possible for it to use volume and stereo panning as additional dimensions for data display. The polyphonic properties of the OPL chip enabled simultaneous display of several data elements as chords. Auditory illusions including Shepard tones were demonstrated.

Author

Computer Programs; Modulators

20040075819 NASA Ames Research Center, Moffett Field, CA, USA

Perceptual Image-Compression Prototype

Watson, Andrew B.; Research and Technology 1997; September 1998, pp. 158-159; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

NASA missions have generated and will continue to generate immense quantities of image data. For example, the Earth Observing System is expected to generate data in excess of one terabyte per day. NASA confronts a major technical challenge in managing this great flow of imagery: in collection, preprocessing, transmission to Earth, archiving, and requirements in most of these areas clearly exceed the capabilities of current technology. Part of the solution to this problem lies in efficient image-compression techniques. As part of a larger program of human factors research, Ames has developed a new technology called DCTune to improve image compression.

Derived from text

Data Compression; Image Processing; Imagery; Imaging Techniques

20040075826 NASA Ames Research Center, Moffett Field, CA, USA

Multidimensional Simulations of Marine Stratocumulus Clouds

Ackerman, Andrew; Research and Technology 1997; September 1998, pp. 167-168; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The effects of aerosols on cloud albedos contributes the single greatest uncertainty in estimates of global radiative forcing since preindustrial times. A dramatic example of these effects is provided by ship tracks, which are long, linear regions of enhanced cloud reflectivity that sometimes form downwind of ships. Previously, ship tracks and a number of other topics in the area of aerosol-cloud interactions have been investigated with a one-dimensional numerical model, which is composed of

three components: a size-resolved aerosol and cloud microphysics model, a detailed radiative transfer model, and a turbulent kinetic energy closure scheme. An advantage of using a one-dimensional model is that its computational efficiency allows simulations of processes with long time constants; it also permits large numbers of simulations to test model to test model sensitivities.
Derived from text
Aerosols; Cloud Physics; Mathematical Models; Radiative Transfer; Stratocumulus Clouds

20040077054 NASA Ames Research Center, Moffett Field, CA, USA
Distributed Remote Management of Aerospace Data
Walton, Joan D.; Korsmeyer, David J.; Research and Technology 1999; December 2000, pp. 65-66; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The DARWIN system provides web-based remote access to the integrated knowledge generated from advanced wind-tunnel instrumentation suites and by sophisticated numerical simulation codes. Every year at Ames Research Center, these independent sources generate large volumes of high-quality data on flight vehicles. However, these data are only valuable to the design process if they can be readily accessed, analyzed, and applied by aerospace engineers. The DARWIN system has been developed in conjunction with new computational and experimental test technologies to enhance design-cycle productivity by providing design engineers with faster and better access to these valuable data.
Derived from text
Computerized Simulation; Computer Programs; Data Systems

20040077071 NASA Ames Research Center, Moffett Field, CA, USA
Human-Centered Computing Studies on the NASA Haughton-Mars Project
Clancey, William J.; Sierhuis, Maarten; Lee, Pascal; Research and Technology 1999; December 2000, pp. 156-157; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

During the past two field seasons, July 1998 and 1999, Ames researchers investigated the field practices of scientists and engineers at Haughton Crater on Devon Island in the Canadian Arctic, 500 miles north of the Arctic Circle, under the auspices of the NASA Haughton-Mars Project (HMP). On the HMP, human-centered computing (HCC) studies (part of Exploration Research) are aimed at determining how human explorers might live and work on other planetary objects, in particular on Mars.
Derived from text
Circles (Geometry); Craters; Human Performance; Space Exploration

20040077072 NASA Ames Research Center, Moffett Field, CA, USA
Brahms: Human-Centered Modeling and Simulation
Sierhuis, Maarten; Clancey, William J.; vanHoof, Ron; Research and Technology 1999; December 2000, pp. 158-159; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames researchers are combining computational simulation with ethnographical field-observation methods and techniques from the social sciences and knowledge engineering in order to better understand and design the necessary collaboration between man and machine. Researchers are developing a multiagent modeling and simulation environment called Brahms, originally an acronym for "Business Redesign Agent-Based Holistic Modeling System," but now used as an internal product name for the modeling language, as well as the set of tools that comprises the product. Brahms facilitates an engineering paradigm shift from current system-centered engineering to a more human-centered engineering approach, in which an understanding of users of technology is at the center.
Derived from text
Human Factors Engineering; Man Machine Systems; Computer Programs

20040077084 NASA Ames Research Center, Moffett Field, CA, USA
Verification and Validation of Autonomous Systems
Pecheur, Charles; Research and Technology 1999; December 2000, pp. 135; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames researchers, in collaboration with Carnegie Mellon University (CMU), are developing technologies for rigorously verifying requirements for software models used in autonomous controllers for space devices. These models describe the different components and failure modes of a complex device such as a spacecraft. They are used by the Livingstone fault

recovery system to detect, diagnose, and recover from failures by comparing the observed condition of the spacecraft with the one predicted by the model.
Derived from text
Failure Modes; Technology Assessment; Computer Programs; Proving

20040077091 NASA Ames Research Center, Moffett Field, CA, USA
Performance of the COSMOS Multi-Level Parallelism Molecular Dynamics Code on the 512 CPU Origin System
Taft, James R.; Research and Technology 1999; December 2000, pp. 75-76; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Ames recently purchased an SGI 512 CPU Origin 2000 system. The system has been named Lomax, after the late celebrated Ames researcher Harvard Lomax. The Lomax system is the largest single shared-memory multi-processor system in the world. It is the result of an Ames-driven partnership with SGI to push the limits ot single-system shared memory designs. It is believed that large CPU count single-system designs offer many potential advantages in those research areas that require very high levels of parallel computational performance. This system has demonstrated over 60 billion floating-point operations per second (60 GFLOP/sec) of sustained performance for the production computational fluid dynamics (CFD) code OVERFLOW-MLP (13 times that of a 16 CPU C90 system). This system offers even higher performance potential for molecular dynamics simulations. Recently, the Lomax system was used as the parallelization testbed for the COSMOS ab initio molecular dynamics model used in NASA's astrobiology research effort. The COSMOS code is often used to perform protein-folding simulations. Historically, many important problems involving 20,000 - 30,000 atoms have not scaled well on "clustered" parallel systems. This lack of performance is due to the small amount of work performed by each CPU relative to the time spent transferring data between CPUs.
Derived from text
Computational Fluid Dynamics; Memory (Computers); Molecular Dynamics; Parallel Processing (Computers)

20040077095 NASA Ames Research Center, Moffett Field, CA, USA
Aerothermal Analysis of X-33 Elevon Control Surface Deflection
Kontinos, Dean; Prabhu, Dinesh; Research and Technology 1999; December 2000, pp. 80-81; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

As the X-33 nears final construction, the analytical emphasis has been redirected from generating design data to mitigating flight risk. Computational simulation of the flow field surrounding deflected elevon control surfaces has been performed to verify engineering estimates of the heating levels that the canted fin must be designed to withstand. This analysis serves to reaffirm design assumptions and reduce uncertainty, thus decreasing flight risk. In previous simulations, surface heating predictions were based on the assumption of a smooth body. In reality, the body surface has both protuberances, such as steps and gaps formed between seals or tiles, and control-surface deflections that divert the flow from its nominal path. These surface irregularities and control-surface deflections trigger local fluid mechanical interactions that increase the heat transfer in some zone of influence on the surface. The thermal protection system is designed to account for these local effects by applying multiplicative scale factors, derived through empiricism and theory that augment the baseline smooth-body heating levels.
Derived from text
Aerothermodynamics; Construction; Elevons; Heat Transfer; X-33 Reusable Launch Vehicle

20040077102 NASA Ames Research Center, Moffett Field, CA, USA
Release of Distributed Collaborative Virtual Wind Tunnel
Bryson, Steve; Green, Bryan; Whitney, David; Johan, Sandy; Keely, Leslie; Gerald-Yamasaki, Michael; Levit, Creon; Research and Technology 1999; December 2000, pp. 67-68; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Distributed, Collaborative Virtual Wind Tunnel (DCVWT) is an immersive virtual-reality-based system for use in the investigation of simulated airflow by geographically distributed, collaborative teams (figure 1). Participants in the DCVWT interact with the airflow simulation as if they were in the same room interacting with a model, even if they are in fact spread across the country. Simulations ranging from ocean temperature through commercial aircraft to the Reusable Launch Vehicle can be examined in the DCVWT. The DCVWT plays two roles, providing an immersive environment for collaborative design, as well as acting as a test bed for developing new methods. In addition to the Office of Aero-Space Technology, the results of the DCVWT effort also benefit the Human Exploration and Development of Space and the Earth Sciences Enterprises.

Programs like the intelligent Synthesis Environment Program use technology and techniques pioneered in the DCVWT in the development of distributed, collaborative design environments. own view of the same data. Each user can interact with the data representations, for example, moving a particle trace source, and all users will see the result. All users are "peers," each able to interact with the data, showing things to the other users. Interaction is performed via a "direct manipulation" paradigm, where each user can directly "pick up" a data analysis tool via a three-dimensional interface. Such a direct manipulation interface requires very high performance in order to give the sense of the data analysis tool moving in response to the user's motions. Such interaction involves information traveling from the user client to the server, computation of the new data analysis representation on the server, sending the new representation to all the clients, and drawing from all the clients. Because the complete round trip must occur in about one-tenth of a second, careful system design and a high-performance network are required.
Derived from text
Virtual Reality; Wind Tunnels; Air Flow; Systems Engineering

20040077107 NASA Ames Research Center, Moffett Field, CA, USA
A Computational Model of Situational Awareness
Shively, Robert J.; Research and Technology 1999; December 2000, pp. 51-52; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Situational awareness (SA) is a term that has great intuitive appeal, especially in aviation. Although often invoked in a descriptive manner, SA is difficult to precisely define. As a result, a computational, mathematically defined model of SA has been developed. The goal of the modeling effort was to enhance researcher communication and to advance efforts to improve pilot SA and performance through improved display design or aircrew procedures. The Computational Situational Awareness (CSA) model is composed of two essential features: situational elements and situation-specific nodes. Situational elements (SEs) are relevant information in the environment that define the circumstances (for example, other aircraft, obstacles, way points, own-ship parameters). The pilot experiences these elements through perception, experience, or a preflight briefing. Each SE has a mathematical weight based upon its importance in the situation and a mathematical value based upon one of four levels of awareness (detection, recognition, identification, and comprehension). These four levels of awareness provide a means of quantifying an operator s perception of the situational elements.
Derived from text
Situational Awareness; Computer Programs; Pilot Performance

20040077112 NASA Ames Research Center, Moffett Field, CA, USA
The Nearby Stars (NStars) Project
Backman, Dana E.; Research and Technology 1999; December 2000, pp. 103; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

NStars is a project based at Ames to produce a comprehensive Web-accessible database on stars closer than 80 light years to Earth and to promote further observations of those stars by the astronomical community. This effort supports present and future NASA Origins missions such as the Space infrared Telescope Facility (SIRTF), Stratospheric Observatory for infrared Astronomy (SOFIA), and the Terrestrial Planet Finder (TPF). For example, TPF is planned as an array of infrared space telescopes capable ot detecting Earth-like planets orbiting our nearest neighbor stars. This task is so technically difficult that TPF will not be able to survey all stars within i t s distance range during a reasonable mission lifetime. NStars is intended to help select a subset of target stars for TPF that have the best chance of harboring an Earth-like planet.
Derived from text
Terrestrial Planets; Data Bases; A Stars

20040077162 NASA Ames Research Center, Moffett Field, CA, USA
Overset Structured Grids for Unsteady Aerodynamics
Meakin, Robert L.; Research and Technology 1999; December 2000, pp. 46-47; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Department of Defense is supporting the development of robust adaptive refinement methods for unsteady geometrically complex moving body problems by means of the High Performance Computing Modernization Program (HPCMP) Initiative known as CHSSI. The object of the work is to exploit the computational advantages inherent in structured data to solve this important class of problems on parallel scalable computer platforms. The physical domain of complex problems is decomposed into near-body and off-body regions. The near-body domain is discretized with

"Chimera" overset grids that need extend only a short distance into the field. The off-body domain is discretized with overset structured Cartesian grids (uniform) of varying levels of refinement. The near-body grids resolve viscous boundary layers and other flow features expected to develop near body surfaces. Off-body grids automatically adapt to the proximity of near- body components and evolving flow features. The adaptation scheme automatically maintains solution accuracy at the resolution capacity of the near-body system of grids. The approach is computationally efficient and has high potential for scalability. Grid components are automatically organized into groups of equal size, which facilitates parallel scale-up on the number of groups requested. The method has been implemented in the computer program known as OVERFLOW-D.
Derived from text
Computational Grids; Computer Programs; Structured Grids (Mathematics)

20040077184 NASA Ames Research Center, Moffett Field, CA, USA
Java PathFinder: A Tool for Verifying and Validating Software
Brat, Guillaume; Havelund, Klaus; Park, SeungJoon; Visser, Willem; Research and Technology 1999; December 2000, pp. 54; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Software, particularly systems capable of autonomous operation, is fast becoming a major enabling technology at NASA. Unfortunately, the cost savings of autonomous software systems can easily be offset by the risk of in-flight failure of the software. Although rigorous testing of software before deployment can increase the confidence of its correctness, the tendency of in-flight software to be multi-threaded makes it hard to find subtle errors caused by the unforeseen interaction of concurrently executing components. The Java PathFinder project developed two versions of a tool that augments traditional testing techniques in order to find subtle errors in multi-threaded programs.
Derived from text
Failure; Errors; Computer Systems Programs; Computer Programs

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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.

20040075054 Naval Postgraduate School, Monterey, CA
Reliable Content Delivery Using Persistent Data Sessions in a Highly Mobile Environment
Pantoleon, Periklis K.; Mar. 2004; 207 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422441; No Copyright; Avail: CASI; A10, Hardcopy

Special Forces are crucial in specific Military operations. They usually operate in hostile territory where communications are difficult to establish and preserve, since the operations are often carried out in a remote environment and the communications need to be highly mobile. The delivery of information about the geographical parameters of the area can be crucial for the completion of their mission. But in that highly mobile environment, the connectivity of the established wireless networks (LANs) can be unstable and intermittently unavailable. Existing content transfer protocols are not adaptive to volatile network connectivity. If a physical connection is lost, any information or part of a file already retrieved is discarded and the same information must be retransmitted again after the reestablishment of the lost session. The intention of this Thesis is to develop a protocol in the application layer that preserves the already transmuted part of the file, and when the session is reestablished, the information server can continue sending the rest of the file to the requesting host. Further, if the same content is available from another server through a better route, the new server should be able to continue to serve the content, starting from where the session with the previous server ended.
DTIC
Communication Networks; Local Area Networks; Military Operations

20040075616 Taylor (Martin) Consulting, Toronto, Ontario, Canada
The IST-05 Reference Model in Evaluation and Design
Taylor, Martin; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 3-1 - 3-4; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A "visualisation system" is a system for presenting, probably interactively, some part of a dataspace, in such

a way that a user with some purpose in mind can visualise the import of the data for that purpose. Visualisation is something that happens in the head of a human, and may be evoked not only by graphical presentations, but also by text, or even by non-visual presentations such as touch and sound. Visualisation is taken to be one of two parallel routes to understanding, the other being analysis. Analysis works primarily by applying reasoning in the form of logic or mathematics to identifiable discrete entities, whereas visualisation often involves the perception of patterns involving the relationships among many items that may not even be individually identifiable. In many situations understanding is best achieved by the mutual support of visualisation and analysis, visualisation providing a context within which analysis provides precision. The IST-05 Reference model describes visualisation systems in a way that is both general and precise. Because of its generality, it can describe and guide the evaluation of any visualisation system, and as a consequence of its precision, it can be used to guide the system s design and evolutionary improvement. The Model is based around a hierarchy of feedback loops. In an outer loop, the human interacts with the dataspace, selecting and manipulating the data and the way the data is viewed, until its import for the human s purpose can be effectively understood. Of course, the human cannot do this by direct observation if the dataspace is bits and bytes in a computer memory. To avoid the need for telepathy in manipulating and understanding the data, the IST-05 Reference Model incorporates a processing loop inside the main outer loop. In this inner loop, the human s visualising processes interact with "Engines" in the computer. Engines are defined as processes that select and organize the data, under the control of the human user. Engines also prepare the data for display by the physical output devices. Engines are therefore tools that convert the human s physical manipulation of the input devices into operations on the data in the dataspace, and convert segments of the data into forms that the output devices can present to the human. These input and output devices connect to form an innermost major loop that is concerned only with the human s physical interactions with the display systems.
Derived from text

Visual Perception; Observation; Display Devices; Systems Engineering; Memory (Computers); Mathematical Logic

20040075617 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven, Germany

Support Concept for the Creation and Use of Doctrines: How to Present Planning Items in a Combat Direction System

Kaster, Annette; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 9-1 - 9-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Marine operators need modern command, control and weapon systems in order to fulfil their tasks in identification, classification and combat. Configuration adjustments at the technical board systems as well as at the control software have to be performed continuously dependent on the actual operational and tactical situation. These system adaptations depend on variations of parameter adjustments and can be optimised using computer supported configuration aids. Doctrines allow the early time and situation dependent automated configuration of ships in order to function optimally in time critical situations. The aim is the optimised adjustment of corresponding algorithms and systems. This requires an as complete as possible planning. Doctrines are special decision rules that describe the dependencies of required actions on occurring events. They refer to task sequences that define the timely configuration of weapon systems and the required parameter adjustments when situation data change that relate to the tactical and technical mission environment. Working with doctrines implies characteristically the handling of a variety and multitude of parameters and situation data and the definition and implementation of their dependencies. Given this variety a doctrine control without potential interaction of the operator is not conceivable. The operator should be informed about the actual parameter adjustments, the system state, the state of the doctrine control and the chances to intervene manually if required. This can only be ensured, if the support system (in form of a doctrine control) has a task- and user-oriented as well as an ergonomically designed human-machine interface. In creation of doctrines the main problem is the immense number of parameters to be taken into account as well as adjusted. Regarding that difficulty a support concept has been developed with the main focus on a user deserved conception in consideration of economic, navy-specific requirements. Although dealing here with a naval application the concept can easily be conferred to any other domain like other military forces or even civilian applications.
Derived from text

Architecture (Computers); Human Factors Engineering; Command and Control; Support Systems; Man Machine Systems; Computer Design

20040075618 Swedish Defence Research Establishment, Linkoeping, Sweden

Ontology Driven Sensor Independence in a Query Supported C2-System

Jungert, Erland; Silvervarg, Karin; Horney, Tobias; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 10-1 - 10-11; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Information systems requiring sensor data input must generally include means for sensor data fusion as well as powerful mechanisms for user interaction and result visualization. From a user perspective the use of sensor data requires knowledge about the attached sensors and the data they generate. However, most end-user do not possess this kind of knowledge and for this reason techniques for sensor data independence must be developed to ensure that the users easily can apply their queries and interpret the result without too much trouble. In this work, an information system including a query language that can be applied to multiple sensor data is described. The query language allows data fusion when ever necessary. To facilitate query composition the query language has been furnished with a visual user interface that allows the end-users to apply their queries in a simple way. Furthermore, the query language has also been supplied with means for sensor data independence to make it possible for the endusers to apply queries without specific sensor and sensor data domain knowledge. The sensor data independence is made possible by an ontological knowledge base system.
Author
Information Systems; Multisensor Fusion; Query Languages

20040075630 QinetiQ Ltd., Farnborough, UK
Improving Campaign Assessment and Decision Making in Command and Control Through the Use of Visualisation Techniques
Fricker, Liz; Macklin, Claire; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 17-1 - 17-6; In English; See also 20040075615; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At present, no adequate visualisation tool exists to support command teams in situation assessment and selection of appropriate courses of action. Research, intending to counter a gap identified between technology and the human operator, is being conducted to understand the psychological processes underlying campaign planning and situation assessment. Through a better understanding of the underlying psychological processes, it may be possible to design the most appropriate visualisation techniques to support the operators mental models of the scenario. Humans are very effective at representing large amounts of highly complex and multivariate information visually. Research has shown that memory for previously shown visual material is very accurate and much better than for textual material (Anderson, 1995). If incoming information is organised and linked to existing knowledge, enhanced meaning is attributed to the links. Providing visual information in a framework, as described above, will facilitate processing and comprehension (Macklin, Cook, Angus, Adams, Cook and Cooper, 2002). Visualisation technologies can aid humans in perceiving and processing information. This in turn will enhance their ability to understand, co-ordinate, share and act on information (Sands, 2000). Visualisations have the potential to guide our perceptions of data by facilitating the identification of interrelationships. Visualisations should enable the user to interact and cope with large amounts of data. The visualisation should allow the human viewer to extract information from a vast source of information, draw conclusions and make predictions related to the command environment. The research being carried out by QinetiQ Centre for Human Sciences, aims to develop visual metaphors to support command and control tasks, with the overall objective of visualising the battlefield more effectively. By enhancing military command and control teams situation assessment, consequent decision making and selection of appropriate actions can be facilitated.
Derived from text
Command and Control; Decision Making; Multivariate Statistical Analysis; Visual Perception

20040075635 Selskapet for Industriell og Teknisk Forskning, Oslo, Norway
Do You Have to See Everything - All the Time? Or is it at All Possible?
Aasgaard, Rune; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 6-1 - 6-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation motivates the use of View Dependent Level-of-detail (LOD) in complex graphical displays, both for reducing computer workload and improving visual quality. In addition, some challenges are discussed. When generating perspective views of geographical data the resulting image can be seen as a map with a very flexible "scale". Areas near the viewer require a high data density, while areas in the background can be shown with very simplified graphics. Using data with only one single detail level gives the view some "myopia" and restricts the possibilities for giving overview presentations. LOD methods on the other hand support several "scales" in the same data model.
Author
Display Devices; Computer Programs; Workloads (Psychophysiology)

20040075636 Buffalo Univ., NY, USA

Visualizing Non-Physical, Logical Constructs for Command Decision Support

Llinas, James; Kesavadas, T.; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 7-1 - 7-2; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In recent years research in Data Fusion and Visualization science has focused on understanding physical environments and data types. Advanced visualization techniques including VR and other related technologies have succeeded in providing meaningful outputs. However many abstract concepts are beyond traditional modes of display and hence require new paradigms in visualization. Our objective is to present an organized, provocative introductory presentation regarding the definitions and structure of such non-physical concepts as well as possible means for visualizing/ communicating their states as a framework to encourage lively discussions among military staff and research scientists on approaches for both computing the estimated value of and for efficiently communicating/visualizing the results of fusion-based estimates of these conceptual states. Through such discussion, it is hoped that a NATO consensus can be established on the issues surrounding this important topic, and also that agreement can be established on additional research needed to both better understand this topical area and to develop effective visualization/communication methods.

Derived from text

Communicating; Military Technology; Multisensor Fusion; Research and Development; Estimating

20040075638 Norwegian Defence Research Establishment, Horten, Norway

Transformation of Geographical Information into Linguistic Sentences: Two Case Studies

Bjorke, Jan T.; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 18-1 - 18-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

At present, no adequate visualisation tool exists to support command teams in situation assessment and selection of appropriate courses of action. Research, intending to counter a gap identified between technology and the human operator, is being conducted to understand the psychological processes underlying campaign planning and situation assessment. Through a better understanding of the underlying psychological processes, it may be possible to design the most appropriate visualisation techniques to support the operators mental models of the scenario. Humans are very effective at representing large amounts of highly complex and multivariate information visually. Research has shown that memory for previously shown visual material is very accurate and much better than for textual material (Anderson, 1995). If incoming information is organised and linked to existing knowledge, enhanced meaning is attributed to the links. Providing visual information in a framework, as described above, will facilitate processing and comprehension (Macklin, Cook, Angus, Adams, Cook and Cooper, 2002). Visualisation technologies can aid humans in perceiving and processing information. This in turn will enhance their ability to understand, co-ordinate, share and act on information (Sands, 2000). Visualisations have the potential to guide our perceptions of data by facilitating the identification of interrelationships. Visualisations should enable the user to interact and cope with large amounts of data. The visualisation should allow the human viewer to extract information from a vast source of information, draw conclusions and make predictions related to the command environment. The research being carried out by QinetiQ Centre for Human Sciences, aims to develop visual metaphors to support command and control tasks, with the overall objective of visualising the battlefield more effectively. By enhancing military command and control teams situation assessment, consequent decision making and selection of appropriate actions can be facilitated.

Derived from text

Decision Making; Information; Multivariate Statistical Analysis; Visual Perception

20040075667 NASA Marshall Space Flight Center, Huntsville, AL, USA

Making Wireless Networks Secure for NASA Mission Critical Applications using Virtual Private Network (VPN) Technology

Nichols, Kelvin F.; Best, Susan; Schneider, Larry; [2004]; 1 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Quebec, Canada; No Copyright; Avail: Other Sources; Abstract Only

With so many security issues involved with wireless networks, the technology has not been fully utilized in the area of mission critical applications. These applications would include the areas of telemetry, commanding, voice and video. Wireless networking would allow payload operators the mobility to take computers outside of the control room to their offices and anywhere else in the facility that the wireless network was extended. But the risk is too great of having someone sit just inside of your wireless network coverage and intercept enough of your network traffic to steal proprietary data from a payload experiment or worse yet hack back into your system and do even greater harm by issuing harmful commands. Wired

Equivalent Privacy (WEP) is improving but has a ways to go before it can be trusted to protect mission critical data. Today s hackers are becoming more aggressive and innovative, and in order to take advantage of the benefits that wireless networking offer, appropriate security measures need to be in place that will thwart hackers. The Virtual Private Network (VPN) offers a solution to the security problems that have kept wireless networks from being used for mission critical applications. VPN provides a level of encryption that will ensure that data is protected while it is being transmitted over a wireless local area network (IAN). The VPN allows a user to authenticate to the site that the user needs to access. Once this authentication has taken place the network traffic between that site and the user is encapsulated in VPN packets with the Triple Data Encryption Standard (3DES). 3DES is an encryption standard that uses a single secret key to encrypt and decrypt data. The length of the encryption key is 168 bits as opposed to its predecessor DES that has a 56-bit encryption key. Even though 3DES is the common encryption standard for today, the Advance Encryption Standard (AES), which provides even better encryption at a lower cycle cost is growing acceptance. The user computer running the VPN client and the. target site that is running the . VPN firewall exchange this encryption key and therefore are the only ones that are able to decipher the data. The level of encryption offered by the VPN is making it possible for wireless networks to pass the strict security policies that have kept them from being used in the past. Now people will be able to benefit from the many advantages that wireless networking has to offer in the area of mission critical applications.
Author
Wireless Communication; Local Area Networks; Computer Information Security

20040075681 NASA Marshall Space Flight Center, Huntsville, AL, USA
Spaceflight Operations Services Grid Prototype
Bradford, Robert N.; Mehrotra, Piyush; Lisotta, Anthony; March 12, 2004; 10 pp.; In English; Space Ops 2004, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: CASI; A02, Hardcopy

NASA over the years has developed many types of technologies and conducted various types of science resulting in numerous variations of operations, data and applications. For example, operations range from deep space projects managed by JPL, Saturn and Shuttle operations managed from JSC and KSC, ISS science operations managed from MSFC and numerous low earth orbit satellites managed from GSFC that are varied and intrinsically different but require many of the same types of services to fulfill their missions. Also, large data sets (databases) of Shuttle flight data, solar system projects and earth observing data exist which because of their varied and sometimes outdated technologies are not and have not been fully examined for additional information and knowledge. Many of the applications/systems supporting operational services e.g. voice, video, telemetry and commanding, are outdated and obsolete. The vast amounts of data are located in various formats, at various locations and range over many years. The ability to conduct unified space operations, access disparate data sets and to develop systems and services that can provide operational services does not currently exist in any useful form. In addition, adding new services to existing operations is generally expensive and with the current budget constraints not feasible on any broad level of implementation. To understand these services a discussion of each one follows. The Spaceflight User-based Services are those services required to conduct space flight operations. Grid Services are those Grid services that will be used to overcome, through middleware software, some or all the problems that currently exists. In addition, Network Services will be discussed briefly. Network Services are crucial to any type of remedy and are evolving adequately to support any technology currently in development.
Derived from text
Data Systems; Applications Programs (Computers); NASA Programs; Computer Networks

20040075757 NASA Ames Research Center, Moffett Field, CA, USA
Multi-Level Parallelism: A New Computing Technique
Taft, James R.; Research and Technology 1997; September 1998, pp. 73; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

High-performance computing platforms are evolving toward systems with ever larger numbers of processors. These systems utilize standard off-the- shelf microprocessors at the heart of their design. Virtually all hardware vendors have adopted this design approach because it dramatically reduces their costs. Unfortunately, this usually forces researchers to embark on large code-conversion efforts (often consuming work-years) to take advantage of the new parallel systems. This project demonstrated that new parallel systems, such as the Origin 2000, could be used in a heavy computational fluid dynamics (CFD) production environment. Furthermore, the CFD codes, running on the Cray C90 systems, could be converted to the parallel systems and still maintain their high-performance levels on the vector machines. The production CFD code OVERFLOW waschosen as the test bed for the MLP effort. OVERFLOW is composed of approximately 100,000 lines of

FORTRAN. It was chosen because it represented one of the toughest tests for the resiliency of the MLP programming approach.
Author
Computational Fluid Dynamics; Parallel Processing (Computers)

20040077057 NASA Ames Research Center, Moffett Field, CA, USA
MATRIX(sub x)Automated Testing Tool
Patterson-Hine, Ann; Henry, Joel; Research and Technology 1999; December 2000, pp. 56; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

This research program has focused on developing tools and techniques that can automate the process of testing and troubleshooting complex control systems that are implemented using an autocoder. Significant increases in software complexity and sophistication have made software more difficult to test and trouble-shoot. Historically, the cost of debugging has been the most time-consuming and expensive aspect of large-scale software development. In order to increase software production efficiency, many real-time systems and controllers are being implemented with the code generated by automatic code generators, such as the MATRIXx SystemBuild from Integrated Systems, Inc. and SIMULINK Real Time Workshop from The Mathworks, Inc.
Derived from text
Autocoders; Complex Systems; Program Verification (Computers); Computer Systems Programs; Automatic Control

20040077120 NASA Ames Research Center, Moffett Field, CA, USA
Mobile Exploration System
Alena, Richard; Research and Technology 1999; December 2000, pp. 154-155; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Mobile Exploration System (MEX) research project is a distributed information system designed to assist planetary exploration operations that consist of three primary nodes with unique computational capabilities appropriate for its operational function, linked together via high-speed radio communication systems. The three nodes include a science center node, a base camp node, and a mobile node, which are packaged to endure the rigors of wilderness traverses. Each operational node allows humans at that location to participate in the exploration activity. Figure 1 shows the three nodes schematically. The science center computational node, supported by several Web and video teleconferencing servers, represents the Earth-based mission control and planetary science data systems. Consultation with remote institutions and scientists is supported via Internet-based collaboration tools.
Author
Information Systems; Data Systems; Radio Communication; Telecommunication; Space Exploration; Planetary Systems

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CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20040073813 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Mobile Robot Positioning - Sensors and Techniques
Borenstein, J.; Everett, H. R.; Feng, L.; Wehe, D.; Jan. 1997; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422844; No Copyright; Avail: CASI; A03, Hardcopy

Exact knowledge of the position of a vehicle is a fundamental problem in mobile robot applications. In the search for a solution, researchers and engineers have developed a variety of systems, sensors, and techniques for mobile robot positioning. This paper provides a review of relevant mobile robot positioning technologies. The paper defines seven categories for positioning systems: (1) Odometry, (2) Inertial Navigation, (3) Magnetic Compasses, (4) Active Beacons, (5) Global Positioning Systems, (6) Landmark Navigation, and (7) Model Matching. The characteristics of each category are discussed and examples of existing technologies are given for each category. The field of mobile robot navigation is active and vibrant, with more great systems and ideas being developed continuously. For this reason the examples presented in this paper serve only to represent their respective categories; they do not represent a judgment by the authors. Many ingenious approaches can be found in the literature, although, for reasons of brevity, not all could be cited in this paper. The appendix contains a tabular comparison of the positioning systems discussed in this review that includes system and description, features, accuracy

(position), accuracy (orientation), effective range, and source of information. (47 refs.)
DTIC
Performance Prediction; Position (Location); Positioning; Reliability Engineering; Robot Sensors; Robots

20040075118 Air Force Research Lab., Brooks AFB, TX
Real-Time Assessment of Mental Workload Using Psychophysiological Measures and Artificial Neural Networks
Wilson, Glenn F.; Russell, Christopher A.; Jan. 2003; 10 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422989; No Copyright; Avail: CASI; A02, Hardcopy

The functional state of the human operator is critical to optimal system performance. Degraded states of operator functioning can lead to errors and overall suboptimal system performance. Accurate assessment of operator functional state is crucial to the successful implementation of an adaptive aiding system. One method of determining operators' functional state is by monitoring their physiology. In the present study, artificial neural networks using physiological signals were used to continuously monitor, in real time, the functional state of 7 participants while they performed the Multi-Attribute Task Battery with two levels of task difficulty. Six channels of brain electrical activity and eye, heart and respiration measures were evaluated on line. The accuracy of the classifier was determined to test its utility as an on-line measure of operator state. The mean classification accuracies were 85%, 82%, and 86% for the baseline, low task difficulty, and high task difficulty conditions, respectively.
DTIC
Artificial Intelligence; Data Processing; Electroencephalography; Human Performance; Mental Performance; Neural Nets; Psychophysiology; Real Time Operation; Workloads (Psychophysiology)

20040075154 Auburn Univ., AL
Superresolution of Passive Millimeter-Wave Imaging
Reeves, Stanley J.; Jan. 2003; 4 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0147
Report No.(s): AD-A423035; AFRL-SR-AR-TR-04-0255; No Copyright; Avail: CASI; A01, Hardcopy

This project develops a new method for image acquisition to improve resolution. Ordinarily, a focal plane sensor array is arranged in a rectangular grid at sub-Nyquist spacing, and the array must be dithered to sample the image plane at the Nyquist rate in each dimension. However, the Nyquist rate oversamples the image due to the usually circular support of the diffraction-limited image spectrum. We develop efficient algorithms for optimizing the dithering pattern so that the image can be reconstructed as reliably as possible from a periodic nonuniform set of samples obtained from a dithered rectangular-grid array. Furthermore, we develop efficient reconstruction algorithms that can quickly reconstruct the uniformly sampled image from its nonuniform samples. To support this framework, we derive a reconstruction method that accommodates the shift-variant effects of boundary conditions as well as the effect arising from the need to smooth the image less near edges to reconstruct sharp edges from low-resolution data. The method decomposes the image into two parts, one of which can be computed with FFT's and the other requiring a small matrix inversion. The resulting methods allow faster image acquisition as well as faster reconstructions that contain less noise and fewer artifacts when restoring and superresolving the acquired images.
DTIC
High Resolution; Image Processing; Microwave Imagery; Millimeter Waves; Pattern Registration; Restoration

20040075709 NASA Ames Research Center, Moffett Field, CA, USA
Closed-Loop Neural Control of Rotor Noise and Vibration
Kottapalli, Sesi; Research and Technology 1997; September 1998, pp. 60; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

A study to identify and control helicopter rotor blade-vortex interaction (BVI) noise and vibratory hub loads using neural networks has been initiated at Ames Research Center. BVI noise can make a major contribution to the total rotorcraft noise, and can be annoying. The vibratory hub loads substantially determine the total rotorcraft vibration level. This vibration affects pilot and passenger comfort and the vehicle s structural fatigue life. Current neural control simulation covers simultaneous control of BVI noise and vibratory hub loads by using an objective function approach. In the present study, the advancing side BVI noise and the vibratory hub load components were represented by two metrics, namely, the noise metric and the hub loads metric. The objective function was composed of the sum of the weighted squares of the noise and hub loads metrics. The

closed-loop controller must be fast-executing and must converge quickly (in six iterations or less); gradient-based methods must not be used. was completed; it involved the use of a two-hidden-layer radial-basis function neural network with one input and two outputs. A simple, easy-to-implement neural control technique, the 'direct inverse' method, was successfully applied and found to be robust. The present approach had the following essential ingredients: accurate plant modeling, halving of the metric in order to accelerate controller convergence, 'inverted-axes' control modeling, and a feedback iterative loop. A simple, two-hidden-layer back-propagation neural network used in the control step was successful. Results from the present, closed-loop neural network controller showed that simultaneous reductions of 5 decibels in the baseline noise and 54% in the baseline vibratory hub loads were achievable in only two controller iterations.
Author
Feedback Control; Neural Nets; Rotor Aerodynamics; Noise Reduction

20040075824 NASA Ames Research Center, Moffett Field, CA, USA
Aeronautics Design/Test Environment Condition-Based Maintenance for the 12-Foot Pressure Wind Tunnel
Patterson-Hine, Ann; Research and Technology 1997; September 1998, pp. 66-67; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

In support of the Aeronautics Design/test Environment effort to enhance operations at wind tunnel facilities, researchers collaborating with wind tunnel experts implemented a software application to monitor system performance and to diagnose anomalous behavior in the make-up air (MUA) compressor subsystem of the 12-Foot Pressure Wind Tunnel at Ames Research Center. This project combined the efforts of the System Health Management team, the Research Laboratory at Pennsylvania State University. Condition-based maintenance (CBM) can increase facility efficiency by reducing or eliminating costly repairs required because of unnecessary maintenance and failures.
Author
Wind Tunnels; Data Acquisition; Expert Systems

20040077090 NASA Ames Research Center, Moffett Field, CA, USA
Three Degree-of-Freedom Architecture for Hand-Controllers and Robots
Adelstein, Bernard D.; Ho, Peter; Research and Technology 1999; December 2000, pp. 74-75; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this work was to develop a new mechanical architecture-for actively powered haptic ("force-feel") hand-controllers and robotic manipulators-that offers enhanced performance in terms of combined work-space size, position and force control accuracy, and payload. For hand- controllers, these attributes have obvious impact on the subjectively perceived "feel" of interactions with virtual or telemanipulated environments. controller or manipulator form the mechanical linkage that couples force and motion between the device s actuators (motors) and end-effector. Thus, the linkage s architecture directly determines not only the work space but also transmission characteristics such as dynamic range (comparing maximum usable force to friction) and bandwidth (frequency content of deliverable force and motion) that define control.
Derived from text
Degrees of Freedom; Robot Arms; Controllers

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040075089 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Rapidly-Converging Alternative to Source Iteration for Solving the Discrete Ordinates Radiation Transport Equations in Slab Geometry
Wager, Nicholas; Mar. 2004; 172 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422941; AFIT/DSP/ENP/04-01; No Copyright; Avail: CASI; A08, Hardcopy

I present a numerical technique to solve the time independent Boltzmann Transport Equation for the transport of neutrons and photons. The technique efficiently solves the discrete ordinates equations with a new iteration scheme. I call this new scheme the angle space distribution iteration method because it combines a non-linear, high angular- resolution flux approximation within individual spatial cells with a coarse angular-resolution flux approximation that couples all cells in a spatial mesh. This shown to be an efficient alternative to source iteration. The new method is implemented using the step

characteristic and exponential characteristic spatial quadrature schemes. The latter was introduced in 1993 and has been shown to accurate for both optically thin and optically thick spatial meshes and to produce strictly positive angular fluxes. The discrete ordinates equations can be solved using the conventional source iteration method. However, it is well known that this method converges prohibitively slowly for optically-thick problems with regions that are dominated by scattering rather than absorption. The new scheme converges rapidly even for such problems. Numerical results show that the new scheme is reliably accurate for the problems intended, and that it is fast and efficient in use of memory. The angle space distribution iteration method is demonstrated in slab geometry, for a single energy group, using isotropic cross sections, with exponential and step characteristic spatial quadrature.
DTIC
Boltzmann Transport Equation; Iteration; Radiation Transport; Slabs

20040075255 Rutgers - The State Univ., New Brunswick, NJ
Installation of STOCK 1100 Retort
Bruins, H. B.; Feb. 2000; 30 pp.; In English
Contract(s)/Grant(s): SP0300-96-D-0016; Proj-98004
Report No.(s): AD-A423221; FTR-107; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes various activities under taken in this project, ranging from installing a STOCK 1100 Retort, modifying support equipment in the Coranet Demo Facility, obtaining retort racks for the MRE pouch and designing and obtaining retort racks for the Polymeric Half Steam Table Tray. The Government who owns various STOCK retorts shipped one of these retorts to the CORANET Demo facility to support CORANET production requirements. This retort was installed in the facility and started up by STOCK AMERICA INC during the summer of 1997. This project designed and tested also injection molded racks for a polymeric half steam table tray. In total four rack configurations were tested, using different materials. STOCK performed complete finite element analysis studies to deterraine structural requirements of the rack as it was impacted by the various material formulations. These studies were then computer modeled to determine their performance under various retort operating conditions. These results were then evaluated and incorporated in the final mold design changes. The final rack is based on a polypropylene based resin enhanced by a glass fiber filling for structural strength to meet the demanding requirements of the polymeric half steam table tray.
DTIC
Installing; Rations; Trays

20040075769 NASA Ames Research Center, Moffett Field, CA, USA
Virtual Environment Surgery and the Virtual Hospital
Ross, Muriel D.; Smith, Jeffrey D.; Research and Technology 1997; September 1998, pp. 146-147; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Biocomputation Center is dedicated to computer-based three-dimensional (3-D) visualization, mathematically based modeling, and 3-D simulation. The emphasis is on teams of broadly based, interdisciplinary investigators, and on a union between computational, theoretical, and experimental research. Virtual environment surgery (VES) technologies of the Biocomputation Center have found several new applications in FY97, including breast cancer imaging research and 3-D ultrasound and computed tomography (CT) visualization tools. In addition, the first steps have been taken toward creating a virtual hospital, linking several clinical institutions using the VES technology and the Next Generation Internet/NASA Research and Education Network (NGI/NREN).
Derived from text
Three Dimensional Models; Computer Techniques; Mathematical Models

20040075896 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of a Pressure-Dependent Constitutive Model with Combined Multilinear Kinematic and Isotropic Hardening
Allen Phillip A.; Wilson, Christopher D.; October 30, 2003; 16 pp.; In English; 2004 International ABAQUS Users' Conference, 25-27 May 2004, Boston, MA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The development of a pressure-dependent constitutive model with combined multilinear kinematic and isotropic hardening is presented. The constitutive model is developed using the ABAQUS user material subroutine (UMAT). First the pressure-dependent plasticity model is derived. Following this, the combined bilinear and combined multilinear hardening equations are developed for von Mises plasticity theory. The hardening rule equations are then modified to include pressure

dependency. The method for implementing the new constitutive model into ABAQUS is given.
Author
Mathematical Models; Plastic Properties; Stress Functions; Kinematics; Hydrostatics

20040076876 NASA Marshall Space Flight Center, Huntsville, AL, USA
Variable Step Integration Coupled with the Method of Characteristics Solution for Water-Hammer Analysis, A Case Study
Turpin, Jason B.; March 22, 2004; 9 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

One-dimensional water-hammer modeling involves the solution of two coupled non-linear hyperbolic partial differential equations (PDEs). These equations result from applying the principles of conservation of mass and momentum to flow through a pipe, and usually the assumption that the speed at which pressure waves propagate through the pipe is constant. In order to solve these equations for the interested quantities (i.e. pressures and flow rates), they must first be converted to a system of ordinary differential equations (ODEs) by either approximating the spatial derivative terms with numerical techniques or using the Method of Characteristics (MOC). The MOC approach is ideal in that no numerical approximation errors are introduced in converting the original system of PDEs into an equivalent system of ODEs. Unfortunately this resulting system of ODEs is bound by a time step constraint so that when integrating the equations the solution can only be obtained at fixed time intervals. If the fluid system to be modeled also contains dynamic components (i.e. components that are best modeled by a system of ODEs), it may be necessary to take extremely small time steps during certain points of the model simulation in order to achieve stability and/or accuracy in the solution. Coupled together, the fixed time step constraint invoked by the MOC, and the occasional need for extremely small time steps in order to obtain stability and/or accuracy, can greatly increase simulation run times. As one solution to this problem, a method for combining variable step integration (VSI) algorithms with the MOC was developed for modeling water-hammer in systems with highly dynamic components. A case study is presented in which reverse flow through a dual-flapper check valve introduces a water-hammer event. The predicted pressure responses upstream of the check-valve are compared with test data.
Author
Water Hammer; Incompressible Flow; Water Flow; Method of Characteristics; Measure and Integration; Differential Equations

20040077036 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Interpolation Method for Obtaining Thermodynamic Properties Near Saturated Liquid and Saturated Vapor Lines
Nguyen, Huy H.; Martin, Michael A.; October 09, 2003; 8 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-14 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

The availability and proper utilization of fluid properties is of fundamental importance in the process of mathematical modeling of propulsion systems. Real fluid properties provide the bridge between the realm of pure analytiis and empirical reality. The two most common approaches used to formulate thermodynamic properties of pure substances are fundamental (or characteristic) equations of state (Helmholtz and Gibbs functions) and a piecemeal approach that is described, for example, in Adebiyi and Russell (1992). This paper neither presents a different method to formulate thermodynamic properties of pure substances nor validates the aforementioned approaches. Rather its purpose is to present a method to be used to facilitate the accurate interpretation of fluid thermodynamic property data generated by existing property packages. There are two parts to this paper. The first part of the paper shows how efficient and usable property tables were generated, with the minimum number of data points, using an aerospace industry standard property package (based on fundamental equations of state approach). The second part describes an innovative interpolation technique that has been developed to properly obtain thermodynamic properties near the saturated liquid and saturated vapor lines.
Author
Interpolation; Vapors; Equations of State; Propulsion System Configurations; Propulsion System Performance; Mathematical Models

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040075072 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Creating Cost Growth Models for the Engineering and Manufacturing Development Phase of Acquisition Using Logistic and Multiple Regression

Lucas, Brandon M.; Mar. 2004; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422915; AFIT/GCA/ENC/04-02; No Copyright; Avail: CASI; A04, Hardcopy

Cost growth remains a concern for cost analysts, program managers, senior DoD decision-makers, Congress, and even the American public. All of these people have a vested interest in the cost of DoD programs and most would like to see those costs decrease; as such, we need additional tools to help combat cost growth. Previous research creates the foundation for the use of a two-step methodology to help predict cost growth, which we follow closely. First, utilizing logistic regression we analyze whether specific program characteristics predict cost growth within the Engineering and Manufacturing Development (EMD) phase for combined RDT&E and procurement budgets. The second step uses this answer (i.e., a positive response) to find cost growth predictor variables. Specifically, we perform a multiple regression analysis and determine the amount of cost growth incurred by these DoD programs. Through these two steps, we seek to unearth any predictive relationships within the data in order to build a predictive cost growth model. The final models predict whether a program will have cost growth and what the potential amount of the cost growth will be for the combined RDT&E and procurement budgets within the EMD phase of acquisition.

DTIC

Cost Analysis; Cost Estimates; Manufacturing; Product Development

20040075087 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Analytical Results for a Single-Unit System Subject to Markovian Wear and Shocks

Finkelstein, Daniel E.; Mar. 23, 2004; 95 pp.; In English

Report No.(s): AD-A422939; AFIT/GAM/ENS/04-01; No Copyright; Avail: CASI; A05, Hardcopy

This thesis develops and analyzers a mathematical model for the reliability measures of a single-unit system subject to continuous wear due to its operating environment and randomly occurring shocks that inflict a random amount of damage to the unit. Assuming a Markovian operating environment and shock arrival mechanism, Laplace-Stieltjes transform expressions are obtained for the failure time distribution and all of its moments. Moreover, an analytical expression is derived for the long-run availability of the single-unit system when it is subject to an inspect-and-replace maintenance policy. The analytical results are illustrated, and their results compared with those of Monte Carlo-simulated failure data. The numerical results indicate that the reliability measures may be accurately computed via numerical inversion of the transform expressions in a straightforward manner when the input parameters are known a priori. In stark contrast to the simulation model which requires several hours to obtain the reliability measures, the analytical procedure computes the same measures in only a few seconds.

DTIC

Mathematical Models; Wear

20040075094 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Effects of Uncertainty on Real World Aerospace Mission Data

Barosko, Steven J.; Mar. 2004; 103 pp.; In English

Report No.(s): AD-A422951; AFIT/GOR/ENS/04-01; No Copyright; Avail: CASI; A06, Hardcopy

Uncertainty is an age old element of warfare. How does one measure success or failure on the battlefield? This thesis explores the effect of uncertainty on real world aerospace mission data from Operation Iraqi Freedom (OIF). Sources of uncertainty are identified during data preparation and the effects of uncertainty are investigated using multivariate analysis techniques. Two distinct cases are analyzed: one case with a low level of uncertainty in predicting whether or not a mission is pre-planned or alert generated, and another case with a high level of uncertainty in predicting whether or not a mission is a success or a failure. Three multivariate analysis techniques are used on both cases: Signal-to-Noise Ratio (SNR) saliency, Feed Forward Neural Network (FFNN) supervised training, and General Regression Neural Network (GRNN) supervised training. Measures of performance are gathered from each of these techniques and analyzed to determine the effect of uncertainty on the data.

DTIC

Aerospace Environments; Aerospace Systems; Multivariate Statistical Analysis; Neural Nets

20040075129 Tufts Univ., Medford, MA

Galilean-Invariant Lattice-Boltzmann Models with H Theorem

Boghosian, Bruce M.; Love, Peter J.; Coveney, Peter V.; Karlin, Iliya V.; Succi, Sauro; Aug. 26, 2003; 5 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0385; F49620-01-1-0566; Proj-2304

Report No.(s): AD-A423000; AFRL-VS-HA-TR-2004-1055; No Copyright; Avail: CASI; A01, Hardcopy

The authors demonstrate that the requirement of Galilean invariance determines the choice of H function for a wide class of entropic lattice-Boltzmann models for the incompressible Navier-Stokes equations. The required H function has the form of the Burg entropy for D=2, and of a Tsallis entropy with q=1-(2/D) for D>2, where D is the number of spatial dimensions. They use this observation to construct a fully explicit, unconditionally stable, Galilean-invariant, lattice-Boltzmann model for the incompressible Navier-Stokes equations, for which attainable Reynolds number is limited only by grid resolution. (14 refs.)

DTIC

Boltzmann Transport Equation; Computational Fluid Dynamics; Distribution Functions; Incompressible Flow; Navier-Stokes Equation; Theorems; Turbulent Flow

20040075192 Lucent Technologies, Murray Hill, NJ

Bell Labs Algorithms Pow Wow

Shepherd, F. B.; Chekuri, Chandra; Gupta, Anuparn; Mirrokni, Vahab; Shachnai, Hadas; Jan. 6, 2004; 21 pp.; In English

Contract(s)/Grant(s): N00014-03-M-0141

Report No.(s): AD-A423096; No Copyright; Avail: CASI; A03, Hardcopy

For two weeks researchers in algorithms gathered to remind each other of some old unsolved problems and to present some new ones. People broke off into groups according to their interest in certain problems. Problems were presented in the following areas: the k-cut and multiway cut, Min-max programming, triangle finding in linear time, directed multicut, minimum power k-connected subgraph job scheduling with communication delays bounded-degree biclique cover, metric labeling, priority Steiner Tree, network design: orientation constraints edge-coloring dynamic bipartite multi- graphs, edge coloring bipartite multi-hypergraphs, optimal cost chromatic partition (OCCP), single source unsplittable flow, confluent flow, combinatorial algorithms for short-path decomposable flows, shortest path routing, and packing dijoins and feedback arc sets. In each of these areas the problems were identified and progress made during the meeting was presented.

DTIC

Algorithms; Color; Combinatorial Analysis; Computer Networks

20040075193 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Logistic and Multiple Regression: The Two-Step Approach to Estimating Cost Growth

Genest, Daniel C.; Mar. 2004; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423097; AFIT/GCA/ENC/04-01; No Copyright; Avail: CASI; A04, Hardcopy

This study sought to predict cost growth in major Department of Defense (DoD) acquisition programs using logistic and multiple regression. In recent years, the use of statistical regression has proven to be successful in predicting the relationships associated with cost growth. This research follows on the work of Sipple (2002) and Bielecki (2003) and further explores the possibilities of using statistical regression to accurately estimate the dollar value associated with risk and uncertainty early in a program's life cycle. In doing so, the author intends to reduce cost growth by increasing the accuracy of the original cost estimates subsequently used to compute cost growth. The author first used logistic regression to determine whether or not cost growth would occur in a program and, if so, continued with multiple regression to determine to what extent it would occur. Data were compiled from all DoD departments using the Selected Acquisition Reports published between 1990 and 2002. The study analyzes programs during the Engineering and Manufacturing Development phase in the Research and Development, Test and Evaluation (RDT&E) phase of acquisition. For the logistic regression portion of the research, the author produced a seven-variable model that accurately predicted 72 percent of the randomly selected validation data. For multiple regression, a six-variable model was produced that accurately predicted the amount of cost growth incurred for 91 percent of the programs that incurred cost growth. Results show that the two-step regression methodology offers a significant advantage over traditional methods by removing the data points that do not incur cost growth. The author concludes that there is no significant advantage gained by either isolating each cost variance category individually or combining them. (9 tables, 3 figures, 10 refs.)

DTIC

Cost Estimates; Costs; Defense Program; Estimating; Procurement; Weapon Systems

20040075243 Air Force Research Lab., Hanscom AFB, MA
Moment Equation Description of Weibel Instability
Basu, S.; Dec. 2002; 5 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423204; AFRL-VS-HA-TR-2004-1077; No Copyright; Avail: CASI; A01, Hardcopy

A macroscopic description of the linear Weibel instability, based on a closed set of linear moment equations, is presented. The moment equations are derived from the linearized Vlasov equation by taking the appropriate velocity moments of it and the closure is achieved by means of an assumption, which is justified %when the temperature anisotropy is strong. The macroscopic description is manifestly more informative of the physical mechanism of the instability than the kinetic description. It is hoped that the researchers will find such a description analytically more convenient to use in solving plasma physics problems where Weibel instability due to strong temperature anisotropy plays a role.
DTIC
Algebra; Anisotropy; Linear Equations; Method of Moments; Plasmas (Physics); Weibel Instability

20040075251 Army Research Lab., Adelphi, MD
An Analysis of Optimal Training for Correlated Fading Channels Using Cutoff Rate
Misra, Saswat; Swami, Ananthram; Tong, Lang; Apr. 2004; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423214; ARL-TR-3193; No Copyright; Avail: CASI; A05, Hardcopy

We consider the problem of optimal allocation of resources (power and bandwidth) between training and data for transmission over a Gauss Markov fading channel. Inaccurate channel state information ((CSI) is available at the receiver through periodic training. The transmitter is assumed to have knowledge of the channel Doppler spread. We compute the ergodic cutoff rate Ro for the temporally-correlated Rayleigh flat fading channels with imperfect channel state information (CSI) available at the receiver. We study MMSE estimators that predict the current channel state based on: all past pilot observations, only the most recent pilot observation, and the most recent and next in the future pilot observations.
DTIC
Doppler Effect; Education; Fading

20040077166 NASA Ames Research Center, Moffett Field, CA, USA
AutoBayes-Automatic Synthesis of Statistical Data Analysis Programs from Bayesian Networks
Fischer, Bernd; Pressburger, Tom; Schumann, Johann; Research and Technology 1999; December 2000, pp. 133-134; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The goal of the AutoBayes project is to make statistical data analysis easier and more accessible to scientists by automatically synthesizing efficient data-analysis programs from statistical models that are used for the definition of valid information. Data analysis can be defined as any process that extracts more abstract information from mere data. It includes such diverse tasks as general parameter estimation and curve fitting, clustering and classification, data compression, fusion of heterogeneous data sources, change and anomaly detection in time-series or image data, or image segmentation. Although there are many approaches to data analysis, statistical data analysis is the only mathematically rigorous approach. In statistical data analysis, a statistical model is used to define how much information the data originally contains, and thus, how much statistically valid information can ultimately be extracted from the data. This approach is standard in medical sciences such as epidemiology, where the cost of wrong conclusions can be high, and statistical data analysis is now becoming more widespread within the fields relevant to NASA. Unfortunately, the development of statistical data-analysis programs is expensive and time-consuming, and it requires expertise at the intersection of computer science, statistics, and the application.
Derived from text
Statistical Analysis; Mathematical Models; Information; Imaging Techniques

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040075049 Army Research Lab., White Sands Missile Range, NM
Integrated Survivability Assessment
Guzie, Gary L.; Apr. 2004; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422333; ARL-TR-3186; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the Integrated Survivability Assessment (ISA) methodology, which provides a practical, simple process for assessing the survivability of integrated systems (systems of systems), systems, and/or subsystems with respect to the integrated threat spectrum and/or to individual threats. ISA methodology applies classical systems engineering analysis work breakdown structure processes to formulate an analysis matrix-of-matrices, which enables a roll-up aggregation of results to any analysis level desired. ISA addresses the analysis of both weapon and countermeasure effects, equivalently, as well as considers operational environment effects (natural and manmade), and for the first time, provides systems analysts with a common/unified survivability assessment integration methodology for these diverse areas. The primary enabling factor facilitating this integrated approach to survivability assessment is the employment of a common Vulnerability Risk Assessment methodology for all threat effect survivability analyses.
DTIC
Systems Analysis

20040075169 Military Operations Research Society, Alexandria, VA
MORS Workshop -- Test and Evaluation, Modeling and Simulation and VV&A: quantifying the Relationship Between Testing and Simulation Held in Albuquerque, New Mexico on October 15-17, 2002
Oct. 17, 2002; 139 pp.; In English
Contract(s)/Grant(s): N00014-99-C-0113
Report No.(s): AD-A423055; No Copyright; Avail: CASI; A07, Hardcopy

This publication is the report of the Military Operations Research Society (MORS) Workshop Test & Evaluation, Modeling and Simulation and VV&A: Quantifying the Relationship Between Testing and Simulation. The Military Operations Research Society (MORS) initiated a workshop on simulation validation (SIMVAL) in 1990 in response to numerous initiatives on the use of Modeling and Simulation (M&S) as a part of the acquisition process. This workshop was followed by several other workshops designed to develop a common set of terms for Verification, Validation and Accreditation (VV&A), and to define elements of VV&A that could be used to ensure that models possessed a degree of credibility - assurance that the model was adequate for addressing a specific issue. While M&S had been in use for a number of years, there was littie agreement on what had to be done to ensure that the model was accurate based on internal logic checks as well as comparison with real world data.
DTIC
Computerized Simulation; Evaluation; Simulation; System Effectiveness

20040075637 Defence Research and Development Canada, Valcartier, Quebec, Canada
A Showcase of Visualization Approaches for Military Decision Makers
Gouin, Denis; Vernik, Rudi; Evdokiou, Peter; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 1-1 - 1-25; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Military command and control systems use a wealth of visualization techniques that are applied to a variety of application domains, including Command and Control, Intelligence, Logistics and Information Operations. Recognizing this variety, the TTCP C3I Action Group on Information Visualization has conducted a survey of visualization techniques and approaches used in allied command and control systems or being examined as applied R&D activities. A knowledge-based of these techniques C3I-Vis has been developed. A presentation of some of the showcased examples contained in C3I-Vis is proposed as a way of stimulating discussion for the workshop. The presentation will highlight good examples of current practices and state of the art approaches, including visual approaches, information representations, user interaction and customization.
Author
Command and Control; Information; Research and Development; Visual Perception; Intelligence

20040075660 NASA Marshall Space Flight Center, Huntsville, AL, USA
Turnaround Time Modeling for Conceptual Rocket Engines
Nix, Michael; Staton, Eric J.; [2004]; 11 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-13 May 2004, Las Vegas, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

Recent years have brought about a paradigm shift within NASA and the Space Launch Community regarding the performance of conceptual design. Reliability, maintainability, supportability, and operability are no longer effects of design; they have moved to the forefront and are affecting design. A primary focus of this shift has been a planned decrease in vehicle turnaround time. Potentials for instituting this decrease include attacking the issues of removing, refurbishing, and replacing

the engines after each flight. less, it is important to understand the operational affects of an engine on turnaround time, ground support personnel and equipment. One tool for visualizing this relationship involves the creation of a Discrete Event Simulation (DES). A DES model can be used to run a series of trade studies to determine if the engine is meeting its requirements, and, if not, what can be altered to bring it into compliance. Using DES, it is possible to look at the ways in which labor requirements, parallel maintenance versus serial maintenance, and maintenance scheduling affect the overall turnaround time. A detailed DES model of the Space Shuttle Main Engines (SSME) has been developed. Trades may be performed using the SSME Processing Model to see where maintenance bottlenecks occur, what the benefits (if any) are of increasing the numbers of personnel, or the number and location of facilities, in addition to trades previously mentioned, all with the goal of optimizing the operational turnaround time and minimizing operational cost. The SSME Processing Model was developed in such a way that it can easily be used as a foundation for developing DES models of other operational or developmental reusable engines. Performing a DES on a developmental engine during the conceptual phase makes it easier to affect the design and make changes to bring about a decrease in turnaround time and costs.
Author
Turnaround (Sts); Spacecraft Maintenance; Space Shuttle Main Engine

20040075743 NASA Ames Research Center, Moffett Field, CA, USA
Hybrid Systems Research
Meyer, George; Research and Technology 1997; September 1998, pp. 22; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Hybrid systems are dynamic systems in which discrete and continuous behaviors coexist and interact. Broadly speaking, they are systems in which change occurs in response to events that take place discretely, asynchronously, and sometimes nondeterministically and also in response to dynamics that represent causal evolution as described by differential and difference equations of time. Often a given system may be represented as a parallel composition of simpler hybrid systems. Each such subsystem is represented by an automaton with discrete states and events. Each discrete state supports a continuous multidimensional state space, on which the system evolves according to a given state equation defined on states, controls, and disturbances. Conditions such as departure from normal operation represented as a subset of the state space, may cause discrete state transitions. Certain of the discrete states are designated as unsafe states. The two primary concerns are system safety and system liveness. A hybrid system is safe if it visits only safe states. It is lively if it performs its intended function. The objective of the research is to develop, in collaboration with the universities, a rigorous theory for the design and analysis of hybrid systems. The focus of the research has been on the combined system comprising an aircraft, cockpit, and pilot. The continuous part in this case describes aircraft motion including translation, rotation, aerodynamics, and power, requiring all together at least a 14-dimensional state space. The autopilot, with its control modes and the control panel, determines the discrete part of the system. The concept of minimally restrictive legal controllers has been developed. Such controllers enforce safety with the fewest restrictions on liveness. Algorithms for the design of minimally restrictive legal controllers have been developed for a class of hybrid systems.
Author
Systems Analysis; Dynamical Systems

20040077152 NASA Ames Research Center, Moffett Field, CA, USA
Hybrid Systems
Meyer, George; Research and Technology 1999; December 2000, pp. 10-11; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

It is the central tenet of the Free Flight concept that the proper distribution of real-time decisionmaking between users and air traffic service providers will improve system safety and efficiency. Consequently, it is important to thoroughly understand the trade-off between centralized and decentralized information flow and control for such large systems. Technically such systems are difficult to analyze because they are composed of many objects that interact in a complex and hybrid environment. At present there are no effective analytical tools for use in the design and analysis of such systems. The objective of the present task is to contribute, through university research grants and internal research, to the development of such tools, and to then apply them to the specific case of air traffic management.
Author (revised)
Systems Analysis; Decision Support Systems; Air Traffic Control

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040075159 Lucent Technologies, Murray Hill, NJ
Fundamentals of Combinatorial Optimization and Algorithm Design
Shepherd, Bruce; Winkler, Peter; Chekuri, Chandra; May 5, 2004; 7 pp.; In English
Contract(s)/Grant(s): N00014-03-M-0141
Report No.(s): AD-A423042; No Copyright; Avail: CASI; A02, Hardcopy

The main activities supported by the contract were research support (primarily travel) for C. Chekuri, B. Shepherd and P. Winkler. Funds were also used to run the Bell Labs Pow Wow workshop which addressed various problems in the field of combinatorial optimization algorithm design. The workshop resulted in fruitful research papers and has sparked other collaborations, which may lead to new results in the future. The contract also supported a 2-week visit by Bill Cunningham who worked with G. Wilfong and B. Shepherd on some generalized coloring problems arising from the Clos-Network switch designs. Some new technical results were enabled by the contract in the areas of All or Nothing Problems, Combinatorial Probability and Generalized Coloring and Optical Networking.
DTIC
Algorithms; Combinatorial Analysis; Optimization

20040075256 Army Cold Regions Research and Engineering Lab., Hanover, NH
Finite-Difference, Time-Domain Simulation of Sound Propagation in a Dynamic Atmosphere
Wilson, D. K.; Liu, Lanbo; May 2004; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423222; ERDC/CRREL-TR-04-12; No Copyright; Avail: CASI; A04, Hardcopy

Finite-difference time-domain (FDTD) techniques hold much promise for performing realistic simulations of sound propagation through complex dynamic outdoor environments. This report focuses on a key aspect of FDTD in the atmosphere namely the incorporation of a moving background medium (wind and turbulence in the atmosphere) into the calculations. Appropriate differential equations for FDTD simulation of sound propagation in a moving fluid are discussed. It is shown that FDTD calculations are not possible with this equation set when using the staggered grid "leap-frog" approach which is common for FDTD simulation of other types of wave propagation. Various finite-difference operators that are valid for a moving medium such as Runge-Kutta and an unstaggered leap-frog approach are discussed and compared. It is shown that a rigorous FDTD solution in a moving medium requires storing the field variables over at least two time steps thereby requiring at least twice as much computer memory as the customary staggered grid. Several other topics pertinent to FDTD simulation of sound propagation in the atmosphere are discussed including implementation of porous ground layers absorbing boundaries and rigid surfaces. Example calculations demonstrate the performance of the various finite-difference operators for a high Mach number uniform flow. Other example calculations show FDTD calculations for propagation above rigid and porous ground surfaces over rigid barriers and through turbulence. With sufficiently dense spatial grids very good agreement can be obtained between the FDTD calculations and known theoretical solutions.
DTIC
Acoustic Simulation; Finite Difference Theory; Sound Propagation

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20040074347 Hong Kong Polytechnic, Kowloon, Hong Kong
Simplified Formulae System for Resonant Inverse Compton Scattering of a Fast Electron in an Intense Magnetic Field
You, J. H.; Chen, W. P.; Zhang, S. N.; Chen, L.; Liu, D.; Chou, C. K.; Monthly Notice of the Royal Astronomical Society; April 2003; Volume 340, No. 2, pp. 687-693; In English
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

We present simple analytical formulae for the emission spectrum and total power of a special kind of resonant inverse Compton scattering (RICS) of a relativistic electron in an intense magnetic field. In contrast with the available formulae

system, we obtain a markedly simplified one based on the semiclassical quantum theory, which is more understandable for people who are unfamiliar with quantum electrodynamics. We show that the RICS process, under an appropriate 'accommodation condition' derived in this paper, is predominantly much more efficient than the coexistent ordinary inverse Compton scattering, and produces highly beamed high-frequency radiation with moderately good monochromaticity. Our formulae are simple to use - thus offering a lucid physical intuition for the theory - and may find wide applications in hard X-ray and gamma-ray astrophysics.
Author
Compton Effect; Emission Spectra

20040074485 Helsinki Univ. of Technology, Espoo
Aspects of Fracture Processes in Paper
Salminen, L.; 2003; 50 pp.; In English
Report No.(s): PB2004-105790; No Copyright; Avail: CASI; A03, Hardcopy

The strength properties and fracture processes are studied in paper. This thesis deals with the fundamental structure and physical phenomenon of fracture. The methods employed are Monte Carlo simulations with a finite element model and experiments in fractography and acoustic emission.
NTIS
Finite Element Method; Fractography; Mathematical Models

20040074517 Lawrence Livermore National Lab., Livermore, CA
X-ray Spectropolarimetry Studies at the Nevada Terawatt Facility and LLNL EBIT
Shlyaptseva, A. S.; Kantsyrev, V. L.; Bauer, B. S.; Neill, P.; Harris, C.; Oct. 20, 2001; In English
Report No.(s): DE2004-15005892; UCRL-JC-146317; No Copyright; Avail: National Technical Information Service (NTIS)

Recent results from x-pinches at the NTF provide experimental evidence for the existence of strong electron beams in x-pinch plasmas and motivate the development of a new diagnostic, x-ray spectropolarimetry, for investigating the anisotropy of such plasmas. This diagnostic is based on theoretical modeling of polarization-dependent spectra measured simultaneously by spectrometers with different sensitivity to polarization. Results of the first polarization-sensitive experiments at the NTF are presented. K-shell emission from Ti x-pinches is recorded simultaneously by two identical spectrometers with the dispersion plane perpendicular and parallel to the discharge axis. The spectroscopic analysis of more than eight Ti x-pinch shots show how spectropolarimetry complements the usual diagnostics of a z-pinch plasma. The polarization-sensitive spectra, generated by a Maxwellian electron beam at LLNL EBIT have been collected and analyzed. These data make an important contribution to the plasma polarization spectroscopy program at the NTF. In particular, the study of multiply-charged Ti ion spectra help in the interpretation of the polarization-sensitive spectra from Ti x-pinches at the NTF.
NTIS
Electron Beams; Mathematical Models; Spectroscopic Analysis; X Ray Analysis

20040074522 Lawrence Livermore National Lab., Livermore, CA
Electron Beam/Converter Target Interactions in Radiographic Accelerators
McCarrick, J.; Caporaso, G.; Chambers, F.; Chen, Y. J.; Falabella, S.; May 27, 2003; In English
Report No.(s): DE2004-15005834; UCRL-JC-151024; No Copyright; Avail: National Technical Information Service (NTIS)

Linear induction accelerators used in X-ray radiography have single-pulse parameters of the order 20 MeV of electron beam energy, 2 kA of beam current, pulse lengths of 50-100 ns, and spot sizes of 1-2 mm. The thermal energy deposited in a bremsstrahlung converter target made of tantalum from such a pulse is (approx)80 kJ/cc, more than enough to bring the target material to a partially ionized state. The tail end of a single beam pulse, or any subsequent pulse in a multi-pulse train, undergoes a number of interactions with the target that can affect beam transport and radiographic performance. Positive ions extracted from the target plasma by the electron beam space charge can affect the beam focus and centroid stability. As the target expands on the inter-pulse time scale, the integrated line density of material decreases, eventually affecting the X-ray output of the system. If the target plume becomes sufficiently large, beam transport through it is affected by macroscopic charge and current neutralization effects and microscopic beam/plasma instability mechanisms. We will present a survey of some of these interactions, as well as some results of an extensive experimental and theoretical campaign to understand the practical amelioration of these effects, carried out at the ETA-II accelerator facility at the Lawrence Livermore National Laboratory.
NTIS
X Rays; Targets; Radiography; Magnetohydrodynamic Stability

20040074988 Lawrence Livermore National Lab., Livermore, CA

Thermal Scattering Law Data: Implementation and Testing Using the Monte Carlo Neutron Transport Codes COG, MCNP and TART

Cullen, D. E.; Hansen, L. F.; Lent, E. M.; Plechaty, E. F.; May 17, 2003; In English

Report No.(s): DE2004-15005882; UCRL-ID-153656; No Copyright; Avail: National Technical Information Service (NTIS)

Recently we implemented the ENDF/B-VI thermal scattering law data in our neutron transport codes COG and TART. Our objective was to convert the existing ENDF/B data into double differential form in the Livermore ENDL format. This will allow us to use the ENDF/B data in any neutron transport code, be it a Monte Carlo, or deterministic code. This was approached as a multi-step project. The first step was to develop methods to directly use the thermal scattering law data in our Monte Carlo codes. The next step was to convert the data to double-differential form. The last step was to verify that the results obtained using the data directly are essentially the same as the results obtained using the double differential data. Part of the planned verification was intended to insure that the data as finally implemented in the COG and TART codes, gave the same answer as the well known MCNP code, which includes thermal scattering law data. Limitations in the treatment of thermal scattering law data in MCNP have been uncovered that prevented us from performing this part of our verification. NTIS

Data Acquisition; Scattering; Neutrons

20040074992 Lawrence Livermore National Lab., Livermore, CA

Ion Storage Techniques and Time-of-Flight Mass Spectrometry in Physical Forensic Science

Chambers, D. M.; Grace, K. I.; Jun. 27, 2000; 12 pp.; In English

Report No.(s): DE2004-15006378; UCRL-JC-139401; No Copyright; Avail: Department of Energy Information Bridge

Effective investigative analysis requires proper selection of sample-collection procedures, preservation, and analysis methods. To achieve these objectives it is essential to tailor the collection and analysis methods to the application requirements, which are constrained by different parameters such as analysis time, sample concentration, matrix interferences, and analyte stability (e.g., surface activity ('stickiness') and chemical reactivity). In addition, method optimization must be accomplished without compromising sample integrity. Maintaining sample integrity requires minimizing and characterizing contamination as well as reducing sample degradation and loss to prevent both false positive and negative detection, respectively. When specific constraints are defined, depending on target chemical(s) and application scenarios, it is sometimes necessary to modify or develop new equipment and methods to best satisfy the application requirements. For this work, we are interested in real-time monitoring of airborne chemicals, which are commonly referred to as volatile organic compounds (VOC). Although there are a number of techniques for remote analysis of VOCs, many of these applications do not provide the specificity and sensitivity needed in real-time application scenarios. For example, spectroscopic techniques are capable of providing low part-per-billion volume/volume (ppb v/v) detection if a compound is distributed over a large area, however, they provide limited compound structural information. A different approach using air monitoring mass spectrometry can provide more specific chemical information in terms of compound molecular weight and structural information, however, preconcentration is required to achieve low ppb detection. Operation of the trap as a pulsed extraction eliminates many of the limitations that accompany operating the trap using mass selective axial ejection. As pulsed extraction source, the IS can be operated under high ion/ion and ion/neutral collision conditions without regard to perturbing ion secular motion. This permits overfilling of the IS and the use of air as a collisional damping gas with little effect on resolution and mass accuracy. A subsequent advantage of using air as a collisional damping gas is that it enhances ionization efficiency by providing a mechanism for chemical ionization. In addition to ion storage, the ion trap can be operated to deliver an ion packet with a spatial and kinetic energy distribution well suited for time-of-flight analysis. This mode of operation enhances sensitivity and resolution permitting the TOF-MS analyzer to be used effectively for real-time air monitoring. Among the different changes to trap operation needed for optimal operation, those modifications that minimize dispersion of the ion packet during extraction have the greatest effect on performance. Together these modifications, which include (1) phase synchronization, (2) RF clamping and (3) bipolar extraction, permit resolution of up to 1600 m/(Delta)m at FWHM and detection into the low ppb range for VOCs. Sensitivity for semi-VOCs is significantly lower and is attributed to adsorption loss in the IS envelop. We are currently investigating solutions to this limitation.
NTIS

Mass Spectroscopy; Time of Flight Spectrometers

20040074995 Brookhaven National Lab., Upton, NY, USA

Lattice Matrix Elements and CP Violation in B and K Physics: Status and Outlook

Soni, A.; 2003; 30 pp.; In English

Report No.(s): DE2004-15006338; BNL-71464-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Status of lattice calculations of hadron matrix elements along with CP violation in B and in K systems is reviewed. Lattice has provided useful input which, in conjunction with experimental data, leads to the conclusion that CP-odd phase in the CKM matrix plays the dominant role in the observed asymmetry in B(yields)(psi)K(sub s). It is now quite likely that any beyond the SM, CP-odd, phase will cause only small deviations in B-physics. Search for the effects of the new phase(s) will consequently require very large data samples as well as very precise theoretical predictions. Clean determination of all the angles of the unitary triangle therefore becomes essential. In this regard B(yields) KD(sup 0) processes play a unique role. Regarding K-decays, remarkable progress made by theory with regard to maintenance of chiral symmetry on the lattice is briefly discussed. First application already provide quantitative information on B(sub K) and the(Delta)I= 1/2 rule. The enhancement in ReA(sub 0) appears to arise solely from tree operators, esp. Q(sub 2); penguin contribution to ReA(sub 0) appears to be very small. However, improved calculations are necessary for(epsilon)(prime)/(epsilon) as there the contributions of QCD penguins and electroweak penguins largely seem to cancel. There are good reasons, though, to believe that these a will not survive improvements that are now underway. Importance of determining the unitary triangle purely from K-decays is also emphasized.
NTIS
Lattice Parameters; Hadrons; CP Violation

20040075011 Lawrence Livermore National Lab., Livermore, CA
239Pu(n,2n)238Pu Cross Section Inferred from IDA Calculations and GEANIE Measurements
Chen, H.; Ormand, W. E.; Dietrich, F. S.; Sep. 01, 2000; In English
Report No.(s): DE2004-15006166; UCRL-ID-141663; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents the latest (sup 239)Pu(n,2n)(sup 238)Pu cross sections inferred from calculations performed with the nuclear reaction-modeling code system, IDA, coupled with experimental measurements of partial (gamma)-ray cross sections for incident neutron energies ranging from 5.68 to 17.18 MeV. It is found that the inferred (sup 239)Pu(n,2n)(sup 238)Pu cross section peaks at E(sub inc) (approx.) 11.4 MeV with a peak value of approximately 326 mb. At E(sub inc)(approx.) 14 MeV, the inferred (sup 239)Pu(n, 2n)(sup 238)Pu cross section is found to be in good agreement with previous radio-chemical measurements by Lockheed.
NTIS
Neutrons; Nuclear Reactions

20040075166 Air Force Research Lab., Hanscom AFB, MA
Electromagnetic Wave Structures Within Subauroral Polarization Streams
Mishin, E. V.; Burke, W. J.; Huang, C. Y.; Rich, F. J.; Aug. 2003; 12 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423050; AFRL-VS-HA-TR-2004-1079; No Copyright; Avail: CASI; A03, Hardcopy
We report on oscillations in electric (deltaEy) and magnetic (deltaBz) fields and plasma density (deltaNi) observed by Defense Meteorological Satellite Program (DMSP) satellites within fast subauroral convection streams in the evening sector during the magnetic storm of 6 November 2001. There are two types of wave phenomena. The first and more common is characterized by electromagnetic and plasma density variations that have the same frequency range of ^0.15 Hz in the spacecraft frame of reference. The second is characterized by large-amplitude plasma and field oscillations over a broader range of frequencies ^O.1 to 0.3 Hz. In this case the perturbation densities and fields appear to have different frequency responses. In this and other magnetic storms, strong waves are associated with the precipitation of ^30 keV ions. Ratios of deltaEy/deltaBz indicate encounters with mixtures of electromagnetic (in part Alfvenic) and electrostatic modes. Poynting vectors associated with the oscillations can be directed either into or out of the ionosphere. The density perturbations appear to be extended east-west corrugations in the plasma flow streams with north-south wavelengths of ^50 km. The deltaEy and deltaNi variations were anticorrelated, as required for current conservation. Our analysis shows that Alfvenic perturbations arc consistent with expected effects of irregular potential distribution around ionospheric density irregularities mapped to the magnetosphere. Inertial currents act to generate mesoscale field-aligned currents carried by Alfven waves, as was previously discussed with regards to auroral arcs formation. We suggest that deltaNi irregularities observed by DMSP satellites in the evening sector began as striated plasma patches in the polar cap that convected to subauroral latitudes.
DTIC
Electromagnetic Radiation; Streams

20040075200 Situs Logic, Pasadena, CA

Asynchronous Techniques for Noise Tolerant Nanoelectronics

Martin, Alain J.; Nystroem, Mika; May 17, 2004; 14 pp.; In English

Contract(s)/Grant(s): DAAH01-03-C-R226; ARPA ORDER-P372/20

Report No.(s): AD-A423113; SITUS-TR-04-01; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this Phase I study was to demonstrate the advantages of asynchronous (clockless) VLST techniques with respect to noise tolerance, to determine the susceptibility of asynchronous QDI logic to noise-induced Single Event Upsets (SEU), and to propose solutions to detect and possible correct SEU errors. A logical model based on production rules was developed in which the effect of an SEU is represented as the random flipping of a single bit in the boolean representation of a circuit. Contrary to common belief, the study proves that an SEU will not necessarily lead to a deadlock, and that other forms of malfunctions may result: the circuit may duplicate an output or lose an input. Modifications to the circuit implementation of production rules have been proposed such that an SEU will always lead to deadlock. Further methods have ben developed to detect and correct single-bit upsets at the circuit level, with no change in system architecture, and little overhead on performance. In combination: with the natural tolerance of QDT circuits to slow parameter shifts and time variations, this study suggests that it is possible to build high-performance asynchronous hardware that is tolerant to noise. DTIC

Architecture (Computers); Fault Tolerance; Nanotechnology; Synchronism

20040075216 Air Force Inst. of Tech., Wright-Patterson AFB, OH

A Linear Subspace Approach to Burst Communication Signal Processing

Gisselquist, Daniel E.; Mar. 12, 2004; 273 pp.; In English

Report No.(s): AD-A423141; AFIT/DS/ENG/04-02; No Copyright; Avail: CASI; A12, Hardcopy

This dissertation focuses on the topic of burst signal communications in a high interference environment. It derives new signal processing algorithms from a mathematical linear subspace approach instead of the common stationary or cyclostationary approach. The research developed new algorithms that have well-known optimality criteria associated with them. The investigation demonstrated a unique class of multisensor filters having a lower mean square error than all other known filters, a maximum likelihood time difference of arrival estimator that outperformed previously optimal estimators, and a signal presence detector having a selectivity unparalleled in burst interference environments. It was further shown that these improvements resulted in a greater ability to communicate, to locate electronic transmitters, and to mitigate the effects of a growing interference environment. DTIC

Bursts; Data Transmission; Packets (Communication); Signal Processing

20040075829 Brookhaven National Lab., Upton, NY, USA, Rochester Univ., NY, USA, Florida State Univ., Tallahassee, FL, USA

Associated Higgs Boson Production with Heavy Quarks

Dawson, S.; Orr, L. H.; Reina, L.; Wackeroth, D.; 2003; 10 pp.; In English

Report No.(s): DE2004-15006716; BNL-71826-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

The production of a Higgs boson in association with a pair of e quarks will play a very important role at both hadron and lepton colliders. We review the status of theoretical predictions and their relevance to Higgs boson studies, with particular emphasis on the recently calculated NLO QCD corrections to the inclusive cross section for p(bar p), pp(yields) t(bar t)h. We conclude by briefly discussing the case of exclusive b(bar b)h production and the potential of this process in revealing signals of new physics beyond the Standard Model. NTIS

Higgs Bosons; Quarks

20040075830 Brookhaven National Lab., Upton, NY

Computational Simulation of Refrigeration Process for BEPCII Superconducting Facilities

Wang, L.; Du, H. P.; Jia, L. X.; Yang, G. D.; 2003; 12 pp.; In English

Report No.(s): DE2004-15006711; BNL-71778-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

The main challenge to build the cryogenic system for the Beijing Electron-Positron Collider Upgrade is to accommodate the strong differences among three types of superconducting devices with regard to their structure, location, as well as the cryogenic operating requirement. Three kinds of cooling methods are applied in the overall cryogenic system, saturated liquid

helium cooling for the SRF cavities, single-phase helium cooling for the SCQ magnets, and two-phase helium cooling for the SSM solenoid. The optimization for the BEPCII cryogenic system was carried out by using a large-scale computational simulation package. This paper presents thermal parameters and numerical analyses for the BEPCII cryogenic system.
NTIS
Refrigerating; Superconducting Devices; Cooling

20040075831 Brookhaven National Lab., Upton, NY
CFD Analyses on LHE Cooling for SCQ Magnets in BEPCII Upgrade
He, Z. H.; Wang, L.; Tang, H. M.; Zhang, X. B.; Jia, L. X.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006710; BNL-71779-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
A pair of superconducting interaction region quadrupole magnets in Beijing Electron-Positron Collider Upgrade (BEPCII) are to be cooled by supercritical helium in order to eliminate the flow instabilities in the constrained cooling channels. The fluid flow is simulated by the commercial computational dynamics fluid software. The heat loads to the superconducting quadrupole (SCQ) magnets from the radiation shields at 80 K and from the thermal conduction of mechanical supports are considered. The temperature distribution of the fluid in the liquid helium cooling channels, and the heat transfer in the SCQ magnet and by its supports are presented. The influence of mass flow rate on pressure drop in the cooling passage is analyzed.
NTIS
Superconducting Magnets; Cooling; Computational Fluid Dynamics

20040075832 State Univ. of New York, Stony Brook, NY, USA, Brookhaven National Lab., Upton, NY, USA
Existence of Superscript 4 Subscript lambda Subscript lambda H and Decay to a Resonance in Superscript 4 lambda
Kahana, D. E.; Kahana, S. H.; Millener, D. J.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006709; BNL-71777-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
Experiment E906 at the BNL-AGS, searching for light S= -2 hypernuclei, found strong evidence for the nuclide(sub(Lambda)(Lambda))(sup 4)H. Perhaps the most striking feature of this experiment was the presence in the data of a narrow low-momentum(pi)(sup -) line at k(sub(pi))= 104-105 MeV/c. This line was ascribed to the decay of(sub(Lambda)(Lambda))(sup 4)H into a resonant state in(sub(Lambda))(sup 4)H. The existence of such a state is shown to be plausible, its characteristics delineated, and its relevance to ongoing theoretical calculations considered.
NTIS
Nuclear Physics; Decay

20040075833 Brookhaven National Lab., Upton, NY, USA
RHIC Physics: The Quark Gluon Plasma and the Color Glass Condensate: 4 Lectures
McLerran, L.; 2003; 72 pp.; In English
Report No.(s): DE2004-15006708; BNL-71762-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The purpose of these lectures is to provide an introduction to the physics issues which are being studied in the RHIC heavy ion program. These center around the production of new states of matter. The Quark Gluon Plasma is thermal matter which once existed in the big bang which may be made at RHIC. The Color Glass Condensate is a universal form of matter which controls the high energy limit of strong interactions. Both such forms of matter might be produced and probed at RHIC.
NTIS
Quarks; Condensates

20040075834 Brookhaven National Lab., Upton, NY, USA
Theory Studies for Polarized pp Scattering. August-September 2003
Kretzer, S.; Vogelsang, W.; 2003; 196 pp.; In English
Report No.(s): DE2004-15006702; BNL-71747-2003; No Copyright; Avail: Department of Energy Information Bridge
In the past two runs of RHIC, the first measurements with polarized proton beams have been performed. For many years to come, the RHIC spin program will offer exciting physics, exploring QCD and the nucleon in new ways. The aim of this small workshop was to attract several spin theorists to the center for about two weeks, in order to collaborate with both experimentalists and theorists at RBRC, and to initiate and/or complete studies of relevance to RHIC spin. A major focus of polarized-pp measurements at RHIC is on measuring the spin-dependent gluon density,(Delta)g. A channel for accessing(Delta)g is high-p(sub T) pion production. The unpolarized cross section for this reaction has been measured by PHENIX and was found in good agreement with a perturbative-QCD based (NLO) calculation. It was a remarkable and

exciting coincidence that PHENIX presented also the first results for the spin asymmetry for(rvec p)(rvec p)(yields)(pi)(sup 0)X during this workshop. This sparked a lot of additional activity and discussion. First steps toward the interpretation of the data were taken. Marco Stratmann and Barbara Jager (Regensburg University) presented recent work on the NLO calculation of the polarized cross section and the spin asymmetry, setting the stage for future full analysis of the data in terms of(Delta)g. Applications to(rvec e)(rvec p) scattering, very relevant to eRHIC, were also worked out and published during this workshop. Stratmann also discussed the procedure of NLO calculations for the case of transverse polarization in pp scattering.
NTIS
Quantum Chromodynamics; Scattering

20040075835 Brookhaven National Lab., Upton, NY
Computational Science at Brookhaven National Laboratory: Three Selected Topics
Davenport, J. W.; Deng, Y.; Glimm, J.; Samulyak, R.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006700; BNL-71745-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
We present an overview of computational science at Brookhaven National Laboratory (BNL), with selections from three areas: fluids, nanoscience, and biology. The work at BNL in each of these areas is itself very broad, and we select a few topics for presentation within each of them.
NTIS
Computerized Simulation; Science

20040075836 Brookhaven National Lab., Upton, NY, USA
Proton and anti-Proton Distributions at RHIC
Videbaek, F.; 2003; 10 pp.; In English
Report No.(s): DE2004-15006592; BNL-71496-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
Properties of transverse momentum spectra and rapidity dependence of protons and anti-protons in Au-Au collisions at (radical)(s(sub NN))= 200 GeV are discussed. The net-proton yields are approximately constant at y lesser than 1 and increases towards y(approx.) 3. The mean rapidity loss is estimated to be in the range of 1.9 lesser than (delta)y lesser than 2. 4.
NTIS
Protons; Antiprotons

20040075837 Brookhaven National Lab., Upton, NY
Naive Parton Model and BRAHMS Measurements
Debbe, R.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006590; BNL-71494-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The Naive Parton Model is revisited in conjunction with some data collected with Broad RAnge Hadron Magnetic Spectrometers (BRAHMS) at RHIC.
NTIS
Partons; Magnetic Spectroscopy; Hadrons

20040075838 Brookhaven National Lab., Upton, NY, European Organization for Nuclear Research, Geneva, Switzerland, Central Food Research Inst., Budapest, Hungary, Fermi National Accelerator Lab., Batavia, IL, USA
NuFACT02 Machine Working Group Summary
Autin, B.; Fernow, R. C.; Machida, S.; Harris, D. A.; Jun. 2003; 18 pp.; In English
Report No.(s): DE2004-15006585; BNL-71414-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
At (nu)Fact'02, the muon-based neutrino factory was confronted with existing and planned neutrino facilities. When it was first discussed in 1999 in Lyon, it raised great enthusiasm, especially because it was thought to be the only machine capable of measuring CP violation in the leptonic sector. Since that time the pendulum has partially swung back. Two successive detailed studies have shown that a neutrino Factory and the needed R&D were both expensive. In terms of present experiments, neutrino oscillations have been confirmed at SuperK and SNO and results are soon expected from KamLAND. K2K, MniBOONE, MINOS and CNGS are going ahead and new perspectives have been opened by off-axis pion-based neutrino beams and the approval of the high intensity Japanese Hadron Facility.
NTIS
Neutrinos; Neutrino Beams

20040075840 State Univ. of New York, Stony Brook, NY, USA, Brookhaven National Lab., Upton, NY, Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany

Novel Integrating Solid State Detector with Segmentation for Scanning Transmission Soft X-Ray Microscopy

Feser, M.; Jacobsen, C.; Rehak, P.; De Geronimo, G.; Holl, P.; Jul. 2001; 14 pp.; In English

Report No.(s): DE2004-15006568; BNL-69543; No Copyright; Avail: Department of Energy Information Bridge

An integrating solid state detector with segmentation has been developed that addresses the needs in scanning transmission x-ray microscopy below 1 keV photon energy. The detector is not cooled and can be operated without an entrance window which leads to a total photon detection efficiency close to 100%. The chosen segmentation with 8 independent segments is matched to the geometry of the STXM to maximize image mode flexibility. In the bright field configuration for 1 ms integration time and 520 eV x-rays the rms noise is 8 photons per integration.

NTIS

Radiation Detectors; X Rays

20040075841 Brookhaven National Lab., Upton, NY

Pressure Oscillation in RHIC Cryogenic System

Jia, L. X.; Montag, C.; Tallerico, T.; Hirzel, W.; Nicoletti, A.; 2003; 10 pp.; In English

Report No.(s): DE2004-15006485; BNL-71471-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Horizontal beam vibration around 10 Hz in the Relativistic Heavy Ion Collider (RHIC) have been identified and the possible sources to cause this vibration have been investigated. To determine the helium pressure oscillations as a possible primary vibration source, helium pressure measurements were carried out in the five cryogenic transfer lines at two valve boxes and six lead ports at one triplet cryostat for both magnet rings.

NTIS

Cryogenics; Gas Pressure; Atomic Energy Levels

20040075848 Oak Ridge National Lab., TN, USA

R-Matrix Evaluation of C1 Neutron Cross Sections up to 1.2 MeV

Sayer, R. O.; Guber, K. H.; Leal, L. C.; Larson, N. M.; Rauscher, T.; Mar. 2003; In English

Report No.(s): DE2003-814066; ORNL/TM-2003/50; No Copyright; Avail: National Technical Information Service (NTIS)

We have performed an evaluation of Cl-35, Cl-37, and(sup nat)Cl neutron cross sections in the resolved resonance region with the multilevel Reich-Moore R-matrix formalism. Resonance analyses were carried out with the computer code SAMMY, which utilizes Bayes' method, a generalized least squares technique. A recent modification of SAMMY enabled us to calculate charged particle penetrabilities for the proton exit channel. Our resonance parameter representation describes the data much better than does ENDF/B-VI, and it should lead to improved criticality safety calculations for systems where Cl is present.

NTIS

Chlorine; Isotopes; Neutron Cross Sections; Bayes Theorem

20040075862 Lawrence Livermore National Lab., Livermore, CA

Comparison of De-Noising Techniques for FIRST Images

Fodor, I. K.; Kamath, C.; Jan. 22, 2001; 12 pp.; In English

Report No.(s): DE2004-15006878; UCRL-JC-142085; No Copyright; Avail: Department of Energy Information Bridge

Data obtained through scientific observations are often contaminated by noise and artifacts from various sources. As a result, a first step in mining these data is to isolate the signal of interest by minimizing the effects of the contaminations. Once the data has been cleaned or de-noised, data mining can proceed as usual. In this paper, we describe our work in denoising astronomical images from the Faint Images of the Radio Sky at Twenty-Centimeters (FIRST) survey. We are mining this survey to detect radio-emitting galaxies with a bent-double morphology. This task is made difficult by the noise in the images caused by the processing of the sensor data. We compare three different approaches to de-noising: thresholding of wavelet coefficients advocated in the statistical community, traditional Altering methods used in the image processing community, and a simple thresholding scheme proposed by FIRST astronomers. While each approach has its merits and pitfalls, we found that for our purpose, the simple thresholding scheme worked relatively well for the FIRST dataset.

NTIS

Astronomical Photography; Astronomy; Statistical Analysis; Wavelet Analysis; Data Mining; Radio Galaxies

20040075863 Stanford Linear Accelerator Center, Stanford, CA, USA
Flavor-Specific Inclusive B Decays to Charm
2003; In English
Report No.(s): DE2003-813120; SLAC-PUB-9832; No Copyright; Avail: National Technical Information Service (NTIS)

We have measured the branching fractions for B(yields)(bar D)X, B(yields) DX, and B(yields)(bar D)X(ell)(sup+)(nu), where B is an average over B(sup 0) and B(sup+), D is a sum over D(sup 0) and D(sup+), and (bar D) is a sum over(bar D)(sup 0) and D(sup -). From these results and some previously measured branching fractions, we obtain(Beta)(b(yields) c(bar c)s)= (21. 9(+-) 3.7)%,(Beta)(b(yields) sg); 6.8%(at) 90% c.l, and(Beta)(D(sup 0)(yields) K(sup -)(pi)(sup+))= (3. 69(+-) 0.20)%. Implications for the B semileptonic decay problem (measured branching fraction being below theoretical expectations) are discussed. The increase in the value of(Beta)(b(yields) c(bar c)s) due to B(yields) DX eliminates 40% of the discrepancy.
NTIS
Particle Decay; Elementary Particle Interactions

20040075870 Lawrence Livermore National Lab., Livermore, CA
New Results on Nucleosynthesis in Massive Stars: Nuclear Data Needs for Nucleosynthesis
Hoffman, R. D.; Rauscher, T.; Heger, A.; Woosley, S. E.; Nov. 09, 2001; In English
Report No.(s): DE2004-15005891; UCRL-JC-146202; No Copyright; Avail: National Technical Information Service (NTIS)

We review the current status of the nuclear reaction rates needed to study nucleosynthesis in massive stars. Results for the calculated nucleosynthesis of all stable species from Hydrogen to Bismuth in a completely evolved 25 M(sub(circle-dot)) star of initial solar metallicity will be presented. Special emphasis will be paid to two particular reactions,(sup 12)C((alpha), (gamma))(sup 16)O and(sup 22)Ne((alpha),n)(sup 25)Mg, and their effect on the structure of the star and resultant nucleosynthesis. Both have been measured many times, but the present range of experimental uncertainty translates into remarkable sensitivity of the calculated nucleosynthesis.
NTIS
Massive Stars; Nuclear Fusion; Nuclear Reactions

20040075871 Stanford Linear Accelerator Center, Stanford, CA, USA
Kaluza-Klein/zeta(prime) Differentiation at the LHC and Linear Collider
Rizzo, T. G.; May 2003; In English
Report No.(s): DE2003-815630; SLAC-PUB-9731; No Copyright; Avail: National Technical Information Service (NTIS)

We explore the capabilities of the LHC and the Linear Collider (LC) to distinguish the production of Kaluza-Klein (KK) excitations from an ordinary Z(prime) within the context of theories with TeV scale extra dimensions. At the LHC, these states are directly produced in the Drell-Yan channel while at the LC the effects of their exchanges are indirectly felt as new contact interactions in processes such as e(sup+)e(sup -)(yields) f(bar f). While we demonstrate that the LC is somewhat more capable at KK/Z(prime) differentiation than is the LHC, the simplest LC analysis relies upon the LHC data for the resonance mass as an important necessary input.
NTIS
Excitation; Electron Transitions; Electron States

20040075873 Stanford Linear Accelerator Center, Stanford, CA, USA
Beam Loading Generated by the LOLA-IV Structure in TTF-II
Bane, K. L. F.; Emma, P.; Li, Z.; Ross, M.; 2003; In English
Report No.(s): DE2003-815612; SLAC-PUB-10160; No Copyright; Avail: National Technical Information Service (NTIS)

The LOLA-IV transverse detecting cavity is used in the Sub-Picosecond Photon Source (SPPS) as a diagnostic for measuring the length of very short bunches (with rms length on the order of tens of microns). It is envisioned to use the same structure for the same purpose in the Tesla Test Facility (TTF)-II. However, unlike the SPPS, the TTF-II may also run in multi-bunch mode, and the question arises, How serious is the beam loading that would be induced. In this report we address this question and find that, for LOLA-IV in TTF-II, the variation in beam-loading induced energy is confined to the first(approx) 80 bunches, and that the total spread in induced energy--the difference in energy between the bunch in the train with the highest energy and the one with the lowest energy--is very small,(approx) 0.03%.
NTIS
Photons; Detection; Confinement

20040075874 Stanford Linear Accelerator Center, Stanford, CA, USA

Two-Dimensional Photonic Crystal Accelerator Structures

Cowan, B. M.; Jul. 2003; In English

Report No.(s): DE2003-815599; SLAC-PUB-10070; No Copyright; Avail: National Technical Information Service (NTIS)

Photonic crystals provide a method of confining a synchronous speed-of-light mode in an all-dielectric structure, likely a necessary feature in any optical accelerator. We explore computationally a class of photonic crystal structures with translational symmetry in a direction transverse to the electron beam. We demonstrate synchronous waveguide modes and discuss relevant parameters of such modes. We then explore how accelerator parameters vary as the geometry of the structure is changed, and consider trade-offs inherent in the design of an accelerator of this type.

NTIS

Crystal Structure; Electron Beams; Symmetry

20040075875 Stanford Linear Accelerator Center, Stanford, CA, USA

Measurement of the Inclusive Charmless Semileptonic Branching Ratio of Beta Mesons and Determination of /V(sub ub)/

Aug. 2003; In English

Report No.(s): DE2003-815598; SLAC-PUB-10045; No Copyright; Avail: National Technical Information Service (NTIS)

We report a measurement of the inclusive charmless semileptonic branching fraction of B mesons in a sample of 89 million B(bar B) events recorded with the BABAR detector at the(Upsilon)(4S) resonance. Events are selected by fully reconstructing the decay of one B meson and identifying a charged lepton from the decay of the other B meson. The number of signal events is extracted from the hadronic mass distribution and is used to determine the ratio of branching fractions(Beta)((bar B)(yields) X(sub u)l(bar(nu)))/(Beta)((bar B)(yields) Xl(bar(nu)))= (2. 06(+-) 0.25(stat)(+-) 0.23(syst)(+-) 0.36(theo)) x 10(sup -2). Using the measured branching fraction for inclusive semileptonic B decays, we find(Beta)((bar B)(yields) X(sub u)l(bar(nu)))= (2.24(+-) 0. 27(stat)(+-) 0.26(syst)(+-) 0.39(theo)) x 10(sup -3) and derive the CKM matrix element vertical bar V(sub ub)vertical bar= (4.62(+-) 0.28(stat)(+-) 0. 27(syst)(+-) 0.48(theo)) x 10(sup -3).

NTIS

Mesons; Particle Decay; Measurement; Branching (Physics)

20040075880 Lawrence Livermore National Lab., Livermore, CA

Radiography and Ultrasonic Calculation Workbooks: Installation and Use

Rikard, D.; Dolan, K.; Mar. 24, 2000; 28 pp.; In English

Report No.(s): DE2004-15006868; UCRL-MA-140626; No Copyright; Avail: Department of Energy Information Bridge

The radiography and ultrasonic calculation workbooks are intended to assist Level I, II and III NDE personnel in calculations used in routine job applications. These workbooks are an upgraded version of Microsoft Excel spreadsheets, which were originally set up in October 1988, using a Macintosh Plus computer and Microsoft Excel version 1.5. A description of these was released as 'Computerized Calculations for Radiography and Ultrasonics', UCRL-JC-105419 in November 1990 and published in Materials Evaluation, Volume 49/Number 4, in April 1991. Over the years as Microsoft improved the capabilities of the Excel program to include the abilities to make sketches and to have multiple tabbed pages in a document called a workbook we have now modified the calculation spreadsheets to include these enhancements. Following is a short description on how to install and use these workbooks on a Macintosh or PC.

NTIS

Radiography; Macintosh Personal Computers; Ultrasonic Radiation

20040075900 Brookhaven National Lab., Upton, NY

Report of the 2003 RIA R&D Workshop

Ozaki, S.; 2003; 44 pp.; In English

Report No.(s): DE2004-15006717; BNL-71818-2003; No Copyright; Avail: Department of Energy Information Bridge

The 2003 RIA R&D Workshop was held on August 26-28, 2003 at the Four Points Sheraton Hotel in Bethesda, Maryland. This Workshop was chaired by Satoshi Ozaki of BNL and sponsored by the Nuclear Physics Division of DOE, with the help of Oak Ridge Institute for Science and Education (ORISE). The purpose of this workshop was to understand the present status of R&D efforts for RIA, to evaluate the needs for further R&D, and to identify opportunities for international collaborations. The workshop examined and documented the current pre-conceptual design for RIA, identifying areas where decisions on technical options remain. The status of the current RIA R&D program was documented,

recognizing areas where efforts were needed in light of what had been learned. The ongoing and planned R&D activities for operating and planned rare-isotope facilities were presented, enabling the workshop to be a venue to develop coordinated R&D efforts of mutual benefit to U. S. and international efforts. The scientific program for the first day (August 26, 2003) consisted mostly of invited talks presented by major research groups involved in RIA and other RI beam facilities. The talks included those covering: Science of RIA and the RIA Facility Performance Requirements; The Reference RIA Facility Pre-CDR design that was used for the NSAC cost exercise (M. Harrison Sub-Panel) in January 2001; New or latest perspectives on the RIA design at ANL & MSU; and RI Beam facility plans and overview of the R&D activities at overseas laboratories. The second day (August 27, 2003) was devoted to contributed talks on continuing R&D, including that which had been supported by DOE RIA R&D funds. The third day (August 28, 2003) began with open panel discussions in the morning, including further input from participants. The panel members discussed the present status of the RIA planning and R&D needs in a closed session for the rest of the day, and then worked on report planning and writing. This Workshop enjoyed participation by over 100 scientists, including those who represented international rare ion beam facilities. The workshop also had the good fortune of having an outstanding panel of experts covering subsystems of RIA in depth.
NTIS
Research and Development; Nuclear Physics; Technical Writing

20040075906 Tech-X Corp., Boulder, CO, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Colorado Univ., Denver, CO, USA
Simulations of Laser Propagation and Ionization in l'OASIS Experiments
Dimitrov, D. A.; Bruhwiler, D. L.; Leemans, W.; Esarey, E.; Catravas, P.; 2003; In English
Report No.(s): DE2003-815484; No Copyright; Avail: National Technical Information Service (NTIS)
We have conducted particle-in-cell simulations of laser pulse propagation through neutral He, including the effects of tunneling ionization, within the parameter regime of the L'OASIS experiments at the Lawrence Berkeley National Lab (LBNL). The simulations show the theoretically predicted blue shifting of the laser frequency at the leading edge of the pulse. The observed blue shifting is in good agreement with the experimental data. These results indicate that such computations can be used to accurately simulate a number of important effects related to tunneling ionization for laser-plasma accelerator concepts, such as steepening due to ionization-induced pump depletion, which can seed and enhance instabilities. Our simulations show self-modulation occurring earlier when tunneling ionization is included then for a pre-ionized plasma.
NTIS
Ionization; Pulsed Lasers

20040075907 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Accelerator Optimization Using a Network Control and Acquisition System
Geddes, C. G. R.; Catravas, P. E.; Faure, J.; Toth, C.; Van Tilbog, J.; 2003; In English
Report No.(s): DE2003-815482; No Copyright; Avail: National Technical Information Service (NTIS)
Accelerator optimization requires detailed study of many parameters, indicating the need for remote control and automated data acquisition systems. A control and data acquisition system based on a network of commodity PCs and applications with standards based inter-application communication is being built for the L'OASIS accelerator facility. This system allows synchronous acquisition of data at high (> 1Hz) rates and remote control of the accelerator at low cost, allowing detailed study of the acceleration process.
NTIS
Automatic Control; Optimization

20040076843 Stanford Univ., Stanford, CA, USA
Shielding Work at Stanford University
Panofsky, W. K. H.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 199-211; In English; See also 20040076842; No Copyright; Avail: CASI; A03, Hardcopy
I am not going to discuss the plans for a long linear accelerator itself but only the associated shielding problems. The work I will describe was done as part of a rather detailed engineering study, and I would like to acknowledge the help of Dr. Dedrick and Dr. McIntyre. I will describe very briefly the proposed setting of the machine. There is a photograph of the project site. Shown are the present Stanford campus and the site of the 700-Mev Mark Hi electron linear accelerator; the proposed site of the_other machine is along the 2-mile area outlined in white, with the target area at the left; the ou_tlined area is about 1000

ft across. The shielding problems of the proposed machine are substantially different from those of other machines discussed.
Derived from text
Linear Accelerators; Radiation Shielding

20040076844 Columbia Univ., NY, USA
Columbia University Synchrocyclotron
Goodell, W. F., Jr.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 20-24; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The Columbia University Nevis synchrocyclotron is designed to accelerate protons to 400 Mev at a beam current of approx. 1 micro a. In normal operation the proton beam is allowed to fall on an internal beryllium target to produce meson beams. These meson beams are then used externally to the shield. Occasionally an external low-energy neutron beam is used, but other external beams are not used. This simplifies the shielding requirements. It thick and is composed of ordinary concrete. The total weight is 2000 tons, and the shielding is composed of stepped blocks, the largest ones weighing 28 tons. They are handled by a 40-ton crane. This includes a 6-ft-thick roof over-all, except over the magnet yoke.
Derived from text
Beam Currents; Synchrocyclotrons; Shielding; Proton Beams

20040076846 Princeton Univ., NJ, USA
Princeton-Pennsylvania 3-Bev High-intensity Proton Synchrotron
White, M. G.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 187-192; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

Most of the physics in any speech has been given by others in the past few days; therefore I will not attempt a detailed discussion of what happens to the 3-bev proton when it enters a shield. My main concern is the basic approach to the shielding problem. Shielding is not just a matter of computing nucleon cascades, it is equally important to decide how the machine itself is to be handled and also how to achieve flexibility in the shielding. A guess must be made about the future experimental use of the machine many years hence and about our ability to control the beam location.
Author
Synchrotrons; Protons

20040076847 Brookhaven National Lab., Upton, NY, USA
Brookhaven National Laboratory 30-Bev Proton AGS
Green, G. K.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 193-196; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The alternating-gradient synchrotron (AGS) is now being fabricated in concrete, steel, and sand. The basic designs of this machine were clone some time ago because, on this scale, considerable time elapses between design and construction. I think we would now design in a little more shielding than we did, but I think adequate shielding allowance has been made, provided that exposures are not required to be kept as low as 2 mr/week in order of magnitude. I do not believe that a machine on this scale will conform to such exposure limits unless one is willing to spend quantities of money that are inherently unobtainable.
Derived from text
Synchrotrons; Protons; Shielding; Exposure

20040076848 Carnegie Inst. of Tech., Pittsburgh, PA, USA
Carnegie Institute of Technology Synchrocyclotron
Hinman, G. W.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 8-13; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

I should preface these remarks by saying that all of the radiation surveys made at Carnegie Institute of Technology were for studying radiation levels in the areas where experimenters and other employees around the synchrocyclotron were working during its operation; these surveys were not made for studying the shielding properties of the shielding materials. The disposition of the shielding around the synchrocyclotron is shown.
Derived from text
Radiation Dosage; Shielding; Mechanical Properties; Electrical Properties

20040076849 California Inst. of Tech., Pasadena, CA, USA

California Institute of Technology Electron Synchrotron

Walker, R. L.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 45-48; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The shielding of the 1.0- to 1.5-bev electron synchrotron at California Institute of Technology is based on the obvious idea that the most effective place for shielding is as near as possible to the place where the radiation is produced. This idea is made practical by the design of the magnet itself, which automatically provides considerable shielding very close to the sides of the vacuum system where most (perhaps 80 per cent) of the energy of the accelerated electrons is dissipated.The fact that the shielding provided by the magnet structure is generally effective and the straight sections are the major radiation leaks is illustrated by a survey made of the counting rate in a liquid scintillation counter very close to the magnet as a function of azimuth around the magnet. The survey was done both above the magnet and around the outside at the median plane. In both places the counting rate shows high peaks at each straight section, with counting rates 20 to 50 times those found near the middle of the steel quadrants. The highest peak is at the southeast tangent tank, as would be expected. The scintillation counter is sensitive to all types of radiation, of course, but we intend to make a similar measurement with the neutron counter in the near future.

Author

Synchrotrons; Radiation Shielding

20040076853 Rochester Univ., NY, USA

University of Rochester Synchrocyclotron

Barnes, S. W.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 27; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

At Rochester the synchrocyclotron started out at about a 25-watt level and was totally unshielded. As the level of operation was raised, it was found that a shield was necessary. The synchrocyclotron is in its own building, which is thin-walled and has a great many large glass windows so that the radiation can escape. There is a thick dike. When the machine is running, personnel are separated from the source of radiation by a distance of about 200 to 300 ft. So long as the machine was operating at about a 25-watt level, this arrangement was adequate. There is a fence to keep undergraduates and the public at a reasonable distance, and there have been no complaints. As the operation level approached 250 watts, radiation was detected.

Author

Synchrocyclotrons; Radiation Shielding

20040076860 Brookhaven National Lab., Upton, NY, USA

New Cosmotron Shielding

Karelitz, M. B.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 197-198; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The cosmotron is operating at a continuously rising intensity, which may soon reach at least 10(exp 12) protons/pulse. The present shielding obviously is inadequate, and the only satisfactory solution appears to be to enclose the machine completely in a tunnel, which may reduce considerably the convenience of performing experiments. As more and more experiments are being performed in the external beams and the experimental setups become more complicated, the available target areas outside the present shield are also inadequate, and plans are being made for extending the cosmotron building in the direction of the emergent beam. Since no construction job may be performed without some interruption of the experimental program, it was hoped that building the new target area and installation of the shielding around the cosmotron could be done during the same period; however, we do not have sufficient funds to do both jobs at the same time.

Derived from text

Shielding; Protons; Particle Accelerators

20040076861 California Univ., Berkeley, CA, USA

University of California Radiation Laboratory Proton Synchrocyclotron

Moyer, B. J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 38-44; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The plan view of the concrete distribution of the shielding at the Berkeley bevatron may be seen.The major part has a uniform thickness 5 ft and a height of 15 ft. It is of ordinary structural concrete, density 2.4 g/cu cm, except for the middle

one of the three horizontal courses which is of density 3.5 g/cu cm. There is no roof, and, as will be seen below, this is the major deficiency of the shielding. In the vicinity of the west tangent tank, which is the principal target region, the shielding is 10 ft thick as indicated. The obliquity with which high-energy nucleons and mesons from the target enter the shield gives an effective depth along their trajectories considerably greater than the normal thickness. Since the magnet has a double flux return path (i.e., H-magnet, rather than C-magnet), the magnet iron and copper coils surround the beam with an effective thickness of 2 to 3 ft except at the tangent tanks.
Author
Synchrocyclotrons; Protons; Thickness; Shielding

20040076862 Chicago Univ., Chicago, IL, USA
University of Chicago Synchrocyclotron
Marshall, J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 14-19; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The shielding requirements of the 170-in. synchrocyclotron at the University of Chicago are particularly severe because of its urban location on the University campus. Sufficient protection had to be provided so that laboratory space close to the machine would be usable during operation and so that radiation exposure could be avoided for persons inside and outside the building. Because of the limited space available, the machine is placed below ground level with an adequate shield covering it and its associated experimental area. The cyclotron and a 100-Mev betatron in the same building are served by a 100-ton bridge type crane. The roof shielding of each machine is demountable with the crane so that heavy and bulky objects inside the shields can be installed or serviced. Some additional discussion may be valuable, however, in making clear the reasons for certain of the design features. The cyclotron pit is mostly well below ground--water level--and consequently must be made watertight. This is achieved by a double-wall construction with a watertight membrane in between. The pit is constructed as a rigid box floating, more or less, in the ground. Access to the pit is by a stairway from the control room, its entrance shielded from direct radiation by the leg of the magnet yoke. A freight elevator and a steep stairway at the north end of the pit provide access to the experimental area. A shaft was provided for access to the south end of the pit without disturbing roof shielding. It was intended as a means of introducing experimental equipment. It has never been used and has been somewhat embarrassing as a radiation leak even though it is thoroughly covered with roof beams. The shaft is not visible in the drawing of the pit but is responsible for the extra roof shielding at the south end.
Author
Synchrocyclotrons; Shielding; Radiation Dosage; Protection

20040076866 Brookhaven National Lab., Upton, NY, USA
Brookhaven National Laboratory 30-Bev Proton AGS
Green, G. K.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 193-196; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The alternating-gradient synchrotron (AGS) is now being fabricated in concrete, steel, and sand. The basic designs of this machine were clone some time ago because, on this scale, considerable time elapses between design and construction. I think we would now design in a little more shielding than we did, but I think adequate shielding allowance has been made, provided that exposures are not required to be kept as low as 2 mr/week in order of magnitude. I do not believe that a machine on this scale will conform to such exposure limits unless one is willing to spend quantities of money that are inherently unobtainable.
Derived from text
Synchrotrons; Protons; Shielding

20040076869 Purdue Univ., West Lafayette, IN, USA
Purdue University Electron Synchrotron
Palfrey, T. R., Jr.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 53; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The energy, construction, and beam flux of our electron synchrotron are so nearly like those of the Massachusetts Institute of Technology (MIT) machine as reported by Livingston that only a few remarks about our machine will be necessary. Our shielding differs from the MIT shielding in several respects: t. Our control room is about 75 ft away from the accelerator and is shielded by what is effectively about 6 ft of ordinary concrete. 2. The accelerator is below ground, and therefore underground alcoves in the wall serve as beam catchers. 3. We have chosen to set up our experimental station somewhat closer to the machine; that is, we do not have a permanent lead and concrete wall. Instead, we precollimate the beam in about 12

in. of lead-litharge-glycerine placed between the exciter coils; we shield with about 12 in. of lead placed in the crotch of the C section from which the beam exits; and then we shield additionally on the outside with an 8-in. lead wall. This shielding is sufficient to protect experiments from unreasonable backgrounds not associated with the bombarded target. During running, non-scientific personnel are kept out of the beam areas. The experimenters are permitted to spend reasonable amounts of time working on the floor with the accelerator. Surveys by us and by an AEC team have shown that about the only unsafe regions are those near places struck by the beam.
Author
Synchrotrons; Radiation Shielding

20040076872 Cornell Univ., NY, USA
Cornell University Electron Synchrotron
Littauer, R.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 54; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

Cornell's 1.5-bev strong focusing electron synchrotron is housed in a separate building connected with the main laboratory, where all controls are located, by a 60-ft tunnel. As with other circular electron accelerators, radiation levels around this machine are substantially lower than those encountered near proton accelerators; shielding for personnel safety is thus a relatively easy matter, and effort is directed mostly toward shielding of experimental equipment. Since the synchrotron operates with an external beam--that of bremsstrahlung produced at an internal target--and this usually passes without tubing directly across the room, safety problems do arise in so far as accidental passage of persons through the beam is concerned. Moreover, only about l0 per cent of the electron energy is converted into gamma rays at the intentionally placed internal target since too thick a target would result in an undesirable energy and angular spread of the external beam. Hence a major fraction of the energy must be dissipated elsewhere, generating further bremsstrahlung at the inner vacuum chamber walls and other machine parts exposed to the degraded electrons spiraling in beyond the internal target. The possibility then arises of secondary concentrated beams being produced at locations where a protrusion in the vacuum chamber wall or some other obstruction happens to intercept a large number of such spent electrons. Complete circumferential shielding of the machine was anticipated in the design of the base, which would permit a 6-in. layer of lead to be placed in the accelerator's median plane immediately adjacent to the magnet coils. This would give very efficient close-in shielding and probably would result in safe gamma radiation levels under all circumstances in the accelerator room; neutron measurements under these conditions have not been made. In view of the danger of accident by passage through the external beam, however, the decision has been reached to allow no personnel in the accelerator room when the beam is being brought to high energy. Hence the need for complete circumferential shielding does not arise, and such shielding is at present placed only in a few strategic sectors. A resultant advantage is the easy accessibility of the accelerator for servicing. Reentrant lead and concrete beam traps are placed in the path of each external location. The only significant radiation that can be expected to emerge from these traps is that of neutrons; a measurement of the neutron flux in the accelerator room indicates that, at present beam intensities of about 3x10 sup9 electrons/sec, tolerance levels are not exceeded. Even so, the only area adjacent to the accelerator building and not shielded from it by concrete and earth has been fenced off and interlocked to prevent persons from entering while high-energy beams are being produced.
Author
Synchrotrons; Radiation Shielding

20040076874 Atomic Energy Commission, Oak Ridge, TN, USA
Factors Influencing Shielding Design and Accelerator Location
Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 58-64; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

On the question of location and shielding of the accelerators, which is the subject of this panel discussion, we have, of course, two problems to solve. One is that we must protect people, and the other is that we must protect experiments, not only our own but also those of our colleagues in other parts of our institutions or, in some cases, neighboring institutions. These two things must be done in various localities which can, perhaps, be listed as follows: (i) the immediate neighborhood of the project, that is, the immediate neighborhood of the accelerators and the people concerned directly with them; (2) the rest of the institution of which the accelerator is a part; and (3) the general public.
Author (revised)
Radiation Shielding; Accelerators

20040076877 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Synchrotron Light Sources: The Search for Quantum Chaos
Schlachter, F.; 2003; In English
Report No.(s): DE2003-815472; No Copyright; Avail: National Technical Information Service (NTIS)

A storage ring is a specialized synchrotron in which a stored beam of relativistic electrons circulates for many hours, producing broadband radiation which includes vacuum ultraviolet and x rays, depending on the energy of the electrons. A modern light source produces a bright photon beam, which can be focused to a small spot, and can thus fill the entrance slit of a monochromator; the result is a high flux of photons with high spectral brightness. One application for a photon beam of high spectral brightness has been to study doubly excited autoionizing states of the helium atom, which is a prototypical three-body atomic system. A group led by Gunter Kaindl has performed experiment at the ALS to search for quantum chaos. New experimental results and theory indicate that the onset of quantum chaos has been observed.
NTIS
Synchrotrons; Light Sources

20040076878 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA
Extraction of Highly Charged Ions from the Electron Beam Ion Trap at LBNL for Application in Surface Analysis and Materials Science
Schenkel, T.; Persaud, A.; Kraemer, A.; McDonald, J. W.; Holder, J. P.; 2003; In English
Report No.(s): DE2003-815471; No Copyright; Avail: National Technical Information Service (NTIS)

We describe results from highly ion extraction experiments at the Electron Beam Ion Trap (EBIT) facility which is now operated at Lawrence Berkeley National Laboratory after transfer from Lawrence Livermore National Laboratory. Requirements on ion source performance for the application of highly charged ions (e. g. Xe(sup 44+)) in surface analysis and materials science are discussed.
NTIS
Electron Beams; Ion Sources

20040076886 NASA Marshall Space Flight Center, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
The Nonlinear Coupling of Electromagnetic Ion Cyclotron and Lower Hybrid Waves in the Ring Current Region
Khazanov, G. V.; 2004; 1 pp.; In English; 2004 American Geophysics Spring Meeting, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The excitation of lower hybrid waves (LHWs) is a widely discussed mechanism of interaction between plasma species in space, and is one of the unresolved questions of magnetospheric multi-ion plasmas. In this paper we present the morphology, dynamics, and level of LHW activity generated by electromagnetic ion cyclotron (EMIC) waves during the May 2-7, 1998 storm period on the global scale. The LHWs were calculated based on a newly developed self-consistent model (Khazanov et. al., 2002, 2003) that couples the system of two kinetic equations: one equation describes the ring current (RC) ion dynamic, and another equation describes the evolution of EMIC waves. It is found that the LHWs are excited by helium ions due to their mass dependent drift in the electric field of EMIC waves. The level of LHW activity is calculated assuming that the induced scattering process is the main saturation mechanism for these waves. The calculated LHWs electric fields are consistent with the observational data.
Author
Ion Cyclotron Radiation; Nonlinearity; Ring Currents; Electromagnetic Coupling; Wave Excitation

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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*.

20040074459 NASA Langley Research Center, Hampton, VA, USA

Turbulent Flow Field Measurements of Separate Flow Round and Chevron Nozzles with Pylon Interaction Using Particle Image Velocimetry

Doty, Michael J.; Henerson, Brenda S.; Kinzie, Kevin W.; May 03, 2004; 15 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK; Original contains color illustrations

Contract(s)/Grant(s): 781-10-12

Report No.(s): AIAA Paper 2004-2826; No Copyright; Avail: CASI; A03, Hardcopy

Particle Image Velocimetry (PIV) measurements for six separate flow bypass ratio five nozzle configurations have recently been obtained in the NASA Langley Jet Noise Laboratory. The six configurations include a baseline configuration with round core and fan nozzles, an eight-chevron core nozzle at two different clocking positions, and repeats of these configurations with a pylon included. One run condition representative of takeoff was investigated for all cases with the core nozzle pressure ratio set to 1.56 and the total temperature to 828 K. The fan nozzle pressure ratio was set to 1.75 with a total temperature of 350 K, and the freestream Mach number was M = 0.28. The unsteady flow field measurements provided by PIV complement recent computational, acoustic, and mean flow field studies performed at NASA Langley for the same nozzle configurations and run condition. The PIV baseline configuration measurements show good agreement with mean flow field data as well as existing PIV data acquired at NASA Glenn. Nonetheless, the baseline configuration turbulence profile indicates an asymmetric flow field, despite careful attention to concentricity. The presence of the pylon increases the upper shear layer turbulence levels while simultaneously decreasing the turbulence levels in the lower shear layer. In addition, a slightly shorter potential core length is observed with the addition of the pylon. Finally, comparisons of computational results with PIV measurements are favorable for mean flow, slightly over-predicted for Reynolds shear stress, and underpredicted for Reynolds normal stress components.

Author

Particle Image Velocimetry; Sound Waves; Pressure Ratio; Jet Aircraft Noise; Nozzles

20040074488 Helsinki Univ. of Technology, Espoo

Parametrization, Auralization, and Authoring of Room Acoustics for Virtual Reality Applications

Vaananen, R.; 2003; 78 pp.; In English

Report No.(s): PB2004-105789; No Copyright; Avail: CASI; A05, Hardcopy

The primary goal of this work has been to develop means to represent acoustic properties of an environment with a set of spatial sound related parameters. These parameters are used for creating virtual environments, where the sounds are expected to be perceived by the user as if they were listened to in a corresponding real space. The virtual world may consist of both visual and audio components. Ideally in such an application, the sound and the visual parts of the virtual scene are in coherence with each other, which should improve the user immersion in the virtual environment.

NTIS

Acoustic Properties; Parameterization

20040075044 NASA Langley Research Center, Hampton, VA, USA

A Method for Estimating Noise from Full-Scale Distributed Exhaust Nozzles

Kinzie, Kevin W.; Schein, David B.; [2004]; 9 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

Contract(s)/Grant(s): NAS1-02046; 23-781-10-12-01

Report No.(s): AIAA Paper 2004-2876; No Copyright; Avail: CASI; A02, Hardcopy

A method to estimate the full-scale noise suppression from a scale model distributed exhaust nozzle (DEN) is presented. For a conventional scale model exhaust nozzle, Strouhal number scaling using a scale factor related to the nozzle exit area is typically applied that shifts model scale frequency in proportion to the geometric scale factor. However, model scale DEN designs have two inherent length scales. One is associated with the mini-nozzles, whose size do not change in going from model scale to full scale. The other is associated with the overall nozzle exit area which is much smaller than full size. Consequently, lower frequency energy that is generated by the coalesced jet plume should scale to lower frequency, but higher frequency energy generated by individual mini-jets does not shift frequency. In addition, jet-jet acoustic shielding by the array

of mini-nozzles is a significant noise reduction effect that may change with DEN model size. A technique has been developed to scale laboratory model spectral data based on the premise that high and low frequency content must be treated differently during the scaling process. The model-scale distributed exhaust spectra are divided into low and high frequency regions that are then adjusted to full scale separately based on different physics-based scaling laws. The regions are then recombined to create an estimate of the full-scale acoustic spectra. These spectra can then be converted to perceived noise levels (PNL). The paper presents the details of this methodology and provides an example of the estimated noise suppression by a distributed exhaust nozzle compared to a round conic nozzle.
Author
Noise Intensity; Noise Reduction; High Frequencies; Estimating; Emission Spectra

20040075133 Mississippi Univ., University, MS
Thermoacoustics With Multiple-Phase Working Fluids
May 14, 2004; 95 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0227; Proj-02PRO5605-00
Report No.(s): AD-A423008; ONRGA-RH/HEB0504-F; No Copyright; Avail: CASI; A05, Hardcopy

A one year effort to improve the understanding of thermoacoustic engines and refrigerators using multiple-phase working fluids resulted in a more complete. The specific system considered was an inert gas-condensing vapor mixture in a cylindrical pore with wet walls. It was found that vapor diffusion effects in the mixture are analogous to the heat diffusion effects in the thermoacoustics of inert gases, and that these effects can be expressed in terms of the thermoacoustic viscous function used in the theory of sound propagation of constant cross-section tubes. This theory was reduced to a concept for a practical device. This technical report in contained, for the most part, in two papers published in the Journal of the Acoustical Society of America which are a part of this report and a patent also included here.
DTIC
Sound Transmission; Thermoacoustic Effects; Working Fluids

20040075197 Ohio State Univ., Columbus, OH
Correlation of Flow Structures and Radiated Noise in High Speed Jets
Samimy, M.; Hileman, J.; Caraballo, E.; Thurow, B.; Apr. 2004; 30 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0154
Report No.(s): AD-A423107; GDTL 1-20; AFRL-SR-AR-TR-04-0264; No Copyright; Avail: CASI; A03, Hardcopy

The dynamics of large-scale turbulence structures within a high Reynolds number, ideally expanded Mach 1.3 jet were investigated during both the periods of production of strong acoustic radiation and extended periods of relative quiet that lacked such acoustic radiation. These results were acquired through a unique experiment where the sources of large amplitude sound waves were estimated with a three- dimensional microphone array and the flow field was simultaneously visualized on two orthogonal planes. The images from one of the planes were taken at a 167 kHz rate. Proper Orthogonal Decomposition (POD) was employed to create a basis of the size and distribution of large-scale structures within the two planes. These POD modes were then used to objectively determine the differences in the jet structure during noise generation and periods lacking significant noise generation. The results show that the flow during the periods of relative quiet cases is dominated by the lower order POD modes that consist of relatively large turbulence structures while it is dominated by higher order POD modes that capture the dynamic interplay of the large-scale structures during noise generation periods. For approximately one convective time scale prior to the moment of noise emission, a series of large- scale structures forms and disintegrates within the mixing layer and in the process a large amount of ambient fluid is entrained into the core of the jet. For the first time, these results show how the dynamic interplay of large-scale turbulence structures generates acoustic radiation within a high Reynolds number jet.
DTIC
Correlation; Flow Noise; High Speed; Jet Aircraft Noise

20040075206 University of Southern Mississippi, Hattiesburg, MS
The Ontogeny of the Dolphin Echolocation System
Kuczaj II, Stan A.; Mar. 2003; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0427
Report No.(s): AD-A423122; No Copyright; Avail: CASI; A01, Hardcopy

Recordings were obtained of the echolocation clicks produced by dolphin calves and their mothers during each calf 5 first

year of life. The results demonstrate that dolphin calves begin to produce echolocation clicks within the first few months of life. Initially, the mothers' click trains may serve to prompt the calf to begin and to end click production. The results of this study demonstrated that young dolphin calves produce echolocation clicks, and suggest that the mother may influence the development of the echolocation system by modeling its use for her calf. Analyses currently being conducted will specify the nature of the relationship between the mothers' click trains and those produced by their calves. These analyses will also detail the developmental path that each calf follows as it learns to use its echolocation system. This information will provide a framework within which to investigate the developmental relationships of click production and echo comprehension, a necessary next step to determine the implications of the developmental data for designing models of echolocation systems, particularly models that can learn from their own mistakes.
DTIC
Dolphins; Ontogeny; Rangefinding

20040075553 NASA Langley Research Center, Hampton, VA, USA
A Model for Shear Layer Effects on Engine Noise Radiation
Nark, Douglas M.; Farassat, F.; Pope, D. Stuart; Vatsa, V.; [2004]; 13 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-781-30-14
Report No.(s): AIAA Paper 2004-2992; No Copyright; Avail: CASI; A03, Hardcopy

Prediction of aircraft engine noise is an important aspect of addressing the issues of community noise and cabin noise control. The development of physics based methodologies for performing such predictions has been a focus of Computational Aeroacoustics (CAA). A recent example of code development in this area is the ducted fan noise propagation and radiation code CDUCT-LaRC. Included within the code is a duct radiation model that is based on the solution of FfowcsWilliams-Hawkings (FW-H) equation with a penetrable data surface. Testing of this equation for many acoustic problems has shown it to provide generally better results than the Kirchhoff formula for moving surfaces. Currently, the data surface is taken to be the inlet or exhaust plane for inlet or aft-fan cases, respectively. While this provides reasonable results in many situations, these choices of data surface location lead to a few limitations. For example, the shear layer between the bypass ow and external stream can refract the sound waves radiated to the far field. Radiation results can be improved by including this effect, as well as the rejection of the sound in the bypass region from the solid surface external to the bypass duct surrounding the core ow. This work describes the implementation, and possible approximation, of a shear layer boundary condition within CDUCT-LaRC. An example application also illustrates the improvements that this extension offers for predicting noise radiation from complex inlet and bypass duct geometries, thereby providing a means to evaluate external treatments in the vicinity of the bypass duct exhaust plane.
Author
Shear Layers; Aeroacoustics; Aircraft Noise; Mathematical Models; Noise Prediction (Aircraft)

20040075721 NASA Ames Research Center, Moffett Field, CA, USA
Are Surface Shear-Stress Fluctuations a Valid Source of Sound?
Shariff, K.; Wang, M.; Research and Technology 1997; September 1998, pp. 61-62; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

In aeroacoustics, a complete solution is possible only in rare instances. More often, one cautiously uses the acoustic analogy of Lighthill. In doing this, it is not always clear what to consider as a genuine source of sound and what to consider as a propagation effect. One way such a problem can arise is when the sources of sound cannot be separated from the effects of sound. For instance, it is well known that surface pressure fluctuations, which at first sight looked like a source of sound, actually represent only the reflection of sources located within the flow above the surface. Surface shear-stress fluctuations, the object of the present study, have posed a similar problem because sound propagating above the wall to those caused by the flow. Those who argue against shear-stress fluctuations being a valid source begin acoustic wavelength can radiate sound. These fluctuations, it is argued, must be a result of the b produces its own wall shear fluctuations in addition with the fact that only shear-stress fluctuations at the t sound itself. Therefore, shear-stress fluctuations are not a true source and provide merely a modification to the sound created by the flow. On the other hand, some investigators have boldly assumed that surface shear-stress fluctuations caused by the flow are a genuine source of dipole sound. Who is right? Numerical simulation is useful in resolving such issues in the absence of analytical insight. A simple two-dimensional computational experiment was undertaken after modifying a code developed earlier by Mitchell and Lele (Stanford University, Stanford, California), which meets the stringent requirements of accurate aeroacoustic computations. A portion of a wall was oscillated tangentially. This

does not prejudice the issue since (unlike normal motion) it is not by itself a source of sound.
Author (revised)
Aeroacoustics; Shear Stress; Two Dimensional Models

20040075723 NASA Ames Research Center, Moffett Field, CA, USA
Aeronautics Design/Test Environment Phased Microphone Array Technology
Watts, Michael; Research and Technology 1997; September 1998, pp. 62-63; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Noise has become a major driver in the design of aircraft. The development of low-noise aircraft within a rapid design-cycle process requires that the noise design be done concurrently with other disciplines such as high-lift aerodynamics and landing gear development. Phased Microphone Array Technology (PMAT), currently being developed as part of the Aeronautics Design/Test Environment effort to expand the role of the wind tunnel in the overall aircraft development process, shows great promise for attacking the noise design problem, as well as for being an instrumentation system that can be run concurrently with aerodynamic, performance, controls, and structural loads testing. Because it is nonintrusive, PMAT is compatible with optical measurement technologies that are being developed. Implementation of the array measurement capability will allow designers to evaluate the acoustic effect of design details in parallel with the aerodynamic development. This will result in a significant improvement in the present design-cycle process. In classic acoustic testing, the result is generally a spectral plot from a single microphone. Although this is informative, it can be ambiguous, for the spectrum contains noise from the environment as well as the noise generated by the test object. PMAT allows researchers to reduce the effect of the background noise and to locate noise sources coming only from the item being tested. This level of detail from the array results shows true effects of parameter changes, while it also reduces the corruption of the signal from the background noise.PMAT integrates several instrumentation, computer, and high-speed network systems to produce noise maps at specified frequencies. Sources of noise on aircraft and engine models are identified and isolated through computational analysis of the signals received from the microphone array. The signals are measured with a 100-element microphone array mounted in the wind tunnel and processed on a supercomputer.
Author
Phased Arrays; Microphones; Test Equipment; Aeroacoustics

20040075777 NASA Ames Research Center, Moffett Field, CA, USA
Effect of System Latency in Dynamic Virtual Acoustic Environments
Wenzel, Elizabeth M.; Research and Technology 1997; September 1998, pp. 20-21; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The aviation environment contains multiple channels of auditory and visual information that must be accessed under high-stress, high-workload conditions. Auditory displays that controllers and pilots currently use can be significantly enhanced by utilizing three-dimensional (3-D) audio technology. Separate channels of auditory information can be placed at different virtual locations (1) to enhance situation awareness (e.g., airborne or ground traffic collision avoidance alerts, taxiway navigation aids and announcements); (2) to increase intelligibility (through the use of binaural delivery systems); and (3) to reduce auditory fatigue. Enabling these displays requires the development of specialized hardware systems for rendering virtual audio, the assessment of their engineering performance characteristics, and the perceptual validation of the spatial cues rendered by such systems.
Derived from text
Acoustics; Auditory Fatigue; Binaural Hearing; Display Devices; Visual Perception

20040075780 NASA Ames Research Center, Moffett Field, CA, USA
Flight Test of Civil Tiltrotor Noise-Abatement Approach
Decker, William A.; Simmons, Rickey C.; Research and Technology 1997; September 1998, pp. 57-58; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Civil tiltrotor transports have the potential to relieve the growing congestion around the Nation's conventional airport runways. Operating as regional transports, civil tiltrotors can operate from airport vertipads, from short, unused runway segments, or directly from urban vertiports located near population and business centers. Safe, all-weather, low-noise terminal-area operations are needed to realize the tiltrotor's potential for improving the capacity of the air transportation

system. Rotorcraft noise, particularly that associated with approach operations, must be minimized to facilitate location of vertiports close to population centers.
Derived from text
Flight Tests; Congestion; Low Noise; Noise Reduction; Tilt Rotor Aircraft

20040075817 NASA Ames Research Center, Moffett Field, CA, USA
Methods for Predicting Blade-Vortex Interaction Noise
Caradonna, F. X.; Kitaplioglu, C.; McCluer, M.; Research and Technology 1997; September 1998, pp. 58-59; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Rotor-vortex interactions have been the subject of many experimental, analytical, and computational studies. Most of this activity is motivated by the importance of blade-vortex interactions (BVIs) as a major source of rotorcraft noise and vibration problems. The conceptual simplicity of the problem has encouraged the development of numerous computational methods, ranging from simple, incompressible two-dimensional analyses to full three-dimensional Euler/Navier-Stokes computational fluid dynamics (CFD) codes. However, experimental data of comparable simplicity were unavailable because of the difficulty of generating sufficiently clean vortices in a wind tunnel environment, and also because of the difficulty of acquiring corresponding loading and acoustic data. These experimental problems have been largely solved by the rotor/vortex-generator approach originally employed by B. McCormick (Pennsylvania State University) and later developed into a full aeroacoustic test at Ames Research Center. The first figure shows the rotor and vortex generator in the Ames wind tunnel setup.
Author
Vortex Generators; Vibration; Rotary Wing Aircraft; Computational Fluid Dynamics; Acoustic Properties

20040077055 NASA Ames Research Center, Moffett Field, CA, USA
Full-Span Tilt-Rotor Aeroacoustic Model
McClure, Megan S.; Johnson, Jeffrey L.; Research and Technology 1999; December 2000, pp. 37-38; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Tilt rotors are a new breed of subsonic aircraft developed for both military and civil aviation. The current production of the military V-22 Osprey and the launch decision of the BA-609 civil tilt rotor will certainly enhance the U.S. military and economic competitive status in the international aviation arena. In addition, civil tilt rotors have the potential to increase air transportation throughput in congested airports by off-loading busy runways. To support the U.S. civil tilt-rotor development, NASA created the Short Haul Civil Tiltrotor project (SHCT) from the Aviation Systems Capacity program. The SHCT program addresses critical enabling technologies for civil tilt rotors that include low-noise tilt rotors. NASA. Ames and Langley Research Centers, the U.S. Army Aeroflightdynamics Directorate, and the U.S. rotorcraft industry, have jointly developed an aeroacoustic research program aimed at accomplishing the SHCT goals. One of the major milestones of the program is to validate aeroacoustic analyses for low-noise tilt-rotor designs. The primary objective of the Tilt-Rotor Aeroacoustic Model (TRAM) project is to provide a comprehensive database for code validation.
Derived from text
Tilt Rotor Aircraft; Aeroacoustics; Models; Rotary Wing Aircraft; Low Noise; Flight Characteristics

20040077060 NASA Ames Research Center, Moffett Field, CA, USA
Stealth Technology Reduces Airframe Noise
Soderman, Paul T.; Research and Technology 1999; December 2000, pp. 44; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Recent airframe noise studies at Ames Research Center and elsewhere have identified flap side-edge noise as an important component of aircraft landing noise. During aerodynamic tests of an Air Force stealth fighter design (called SHARC) in the Ames 40- by 80-Foot Wind Tunnel, it came to our attention that stealth technology might have acoustic attributes. Specifically, the Continuous Moldline Technology (CMT) developed for SHARC eliminates flap side edges by blending the flap and wing trailing edges with a flexible material that is load bearing. This led to a 7- by 10-foot wind tunnel aeroacoustic test of a two-dimensional airfoil with a simple hinged flap with and without a CMT modification. phased microphone array technology (PMAT) acoustic system was installed in the Ames 7- by 10-Foot Wind Tunnel test section wall. The array is designed for visualization of noise sources and determination of their individual strengths. Noise radiation from the vertically mounted windflap model revealed a virtual elimination of the side-edge noise in the flyover direction. Because of the large noise reduction, it was necessary to recess the microphones in order to reduce flow-induced noise and increase the signal-to-noise ratio. A strong Kevlar cloth covered the recess. With this array geometry, noise levels that were 20 decibels below the wind

tunnel background noise could be identified. With the new array, it was found that the CMT flap was at least 6-8 decibels quieter than the simple hinged flap, as shown by the phased array images. Background noise made it impossible to identify noise sources below that level. Previous work indicates that the simple hinged flap is quieter than the conventional Fowler flap used on current air transports. Hence, new aircraft designs such as the Blended Wind Body, which can operate with a simple high lift system, would benefit from the low noise of simple hinged or CMT flap systems. Aerodynamic performance data were acquired simultaneously with the acoustic data.
Derived from text
Aeroacoustics; Airframes; Stealth Technology; Noise Reduction; Wind Tunnel Tests; Aircraft Design

20040077066 NASA Ames Research Center, Moffett Field, CA, USA
Tilt-Rotor Noise Reduction
Betzina, Mark D.; Kitaplioglu, Cahit; Nguyen, Khanh Q.; Research and Technology 1999; December 2000, pp. 33-34; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Reducing tilt-rotor noise by 12 decibels was a major goal of the Short Haul Civil Tiltrotor (SHCT) program. Blade vortex interaction (BVI) noise reduction was considered a key enabling technology that would allow tilt rotors to land in populated areas such as city centers, thereby relieving congestion at major airports. One of the SHCT objectives was to investigate BVI noise reduction techniques using an isolated, full-scale XV-15 tilt rotor in approach flight conditions in the Ames 80- by 120-Foot Wind Tunnel.
Derived from text
Aerodynamic Noise; Blade Slap Noise; Noise Reduction; Tilt Rotor Aircraft

20040077099 NASA Ames Research Center, Moffett Field, CA, USA
Resound Microphone Wind Noise Reduction
Horne, Clifton; Soderman, Paul T.; Research and Technology 1999; December 2000, pp. 43-44; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Resound Corp. in Redwood City, California, has developed a miniature, ear-mounted, hands-free, microphone/receiver for use by technicians, police, firefighters, or others who need an unobtrusive communication system. When used in the field, however, wind-induced noise tended to mask voice communication. A foam covering reduced the noise, but was bulky and obtrusive. Through a Reimbursable Space Act Agreement, Resound collaborated with the Experimental Physics Branch personnel to mitigate the wind-induced noise without resorting to bulky foam coverings. To achieve the objective, an artificial head was installed in a ducted fan flow in the AIP acoustics laboratory, and a series of experiments was conducted on wind-induced noise of the baseline ReSound microphone over a 3-month period. Using technology developed at Ames for measurement of aircraft model noise in wind tunnels, a screen-covered forebody was designed that protected the microphone sensor yet conformed to the shape and size of the ear-mounted device. The forebody had an aerodynamic shape to minimize flow perturbations; the screen inhibited unsteady pressures at the sensors while passing sound waves. New information was acquired on the baseline and on improved microphone designs regarding effects of turbulence, wind speed, head-tilt angle, and yaw angle. The fluid-mechanic sources of wind noise were isolated. Turbulence, airspeed, and noise were measured in the fan flow, jin the free-wind outdoors, in a moving truck in calm air, and in the low turbulence 7-by 10-foot wind tunnel. Results showed that the new wind screen gave improved noise reduction relative to the Resound baseline with foam covering and that it has more robust, streamlined shape that lends itself to unobtrusive operation by the user. Microphone response was carefully correlated with flow parameters such as turbulence, airspeed, and flow angle so that future changes can be evaluated using the database. Further improvements in the design may be possible by optimizing the screen impedance and the forebody shape.
Derived from text
Microphones; Noise Reduction; Wind Tunnels; Miniaturization; Acoustics

20040077180 NASA Ames Research Center, Moffett Field, CA, USA
Active Control of Tilt-Rotor Aeroacoustics
Nguyen, Khanh Q.; Lillie, Doug; Research and Technology 1999; December 2000, pp. 38; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Tilt-rotor aircraft have great potential to relieve air traffic congestion by ferrying passengers directly to and from vertiports located near urban areas. Since these aircraft operate like helicopters during landing, the tilt rotors produce highly impulsive noise owing to blade-vortex interactions (BVI). Thus, reducing BVI noise is a key enabling technology that will allow tilt rotors to operate in populated areas. Higher harmonic control (HHC) was shown to be highly effective in reducing BVI noise

on tilt rotors. For a three-bladed rotor, an HHC system generates low-amplitude blade-pitch oscillations two, three, and four times per rotor revolution that are superimposed with the primary control input for trim. In addition, practical applications of HHC to tilt rotors require the development of suitable signal processing techniques to identify the radiated BVI noise for feedback control. A method using pressure sensors mounted on the blades for identification and control of BVI noise was demonstrated in an 80- by 120-foot wind tunnel test of a full-scale XV-15 tilt rotor. The controller successfully reduced the BVI noise level by more than 5 decibels, as indicated by the measured noise contours under the rotor presented.
Derived from text
Active Control; Aeroacoustics; Tilt Rotor Aircraft; Wind Tunnel Tests

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*.

20040076852 Massachusetts Inst. of Tech., MA, USA
Cambridge 6-Bev Electron Accelerator
Livingston, M. S.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 171-186; In English; See also 20040076842; No Copyright; Avail: CASI; A03, Hardcopy

The Cambridge 6-bev electron accelerator is planned as a research facility in high-energy particle physics to be used by research scientists and their graduate students at MIT and Harvard and by qualified scientists from other laboratories. It will be integrated into the graduate teaching programs, and a major purpose is the training of research scientists. It is to be located near the Harvard cyclotron to take advantage of existing laboratory facilities, libraries, etc. This location close to other occupied buildings and residences imposes a serious responsibility of maintaining safe radiation levels at all occupied locations both within and without the project buildings. The project management and the interested scientists have accepted this responsibility. The design provides adequate shielding for the anticipated intensities by locating the accelerator in an underground shielded tunnel. In addition, however, radiation intensities will be carefully and continuously monitored to stay within safe levels. Attenuation measurements of the several types of penetrating radiations will be made at an early stage of operations when intensities will be low. Special shielding arrangements will be devised for locations in which intensities may rise above the safe level; and, if necessary, the accelerator beam intensity will be limited to prevent any overexposure to radiation. The accelerator is designed for a high repetition rate as compared with other multi-bev accelerators and will have a high average beam intensity. Present estimates of the maximum practical beam intensity lead to a time-average beam current of 0.5 micro a, although it may take months or years of development to achieve this intensity. At 6-bev energy this represents 3 kw of beam power as compared with 1 watt for the bevatron, 5 watts for the cosmotron, or 500 watts for the Chicago synchrocyclotron. This high intensity requires fixed, permanent radiation shielding which must be designed into the building housing the accelerator.
Author
Electron Accelerators; Radiation Shielding; Buildings

20040076854 Brookhaven National Lab., Upton, NY, USA
Brookhaven National Laboratory Proton Synchrotron
Lindenbaum, S. J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 28-37; In English; See also 20040076842; No Copyright; Avail: CASI; A03, Hardcopy

The shielding problem has always been with us at the cosmotron. As a matter of fact our maximum average intensity has been limited since the beginning of machine operations. We have made attempts to improve the shielding a step at a time and have gained a factor approximately 20 to 50 for most internal-beam experiments; however, the maximum available beam intensity has increased by a factor of several hundred; thus we have been fighting a losing battle. Furthermore, the recent development and considerable use of external proton beams have further increased the general radiation problem because of the introduction of new, less adequately shielded target areas.
Derived from text
Synchrotrons; Shielding; Proton Beams

20040076855 California Univ., Berkeley, CA, USA

University of California Radiation Laboratory Proton Synchrotron

Moyer, B. J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 38-44; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The plan view of the concrete distribution of the shielding at the Berkeley bevatron may be seen. The major part has a uniform thickness of 5 ft and a height of 15 ft. It is of ordinary structural concrete, density 2.4 g/cu cm, except for the middle one of the three horizontal courses which is of density 3.5 g/cu cm. There is no roof, and, as will be seen below, this is the major deficiency of the shielding. In the vicinity of the west tangent tank, which is the principal target region, the shielding is 10 ft thick as indicated. The obliquity with which high-energy nucleons and mesons from the target enter the shield gives an effective depth along their trajectories considerably greater than the normal thickness. Since the magnet has a double flux return path (i.e., H-magnet, rather than C-magnet), the magnet iron and copper coils surround the beam with an effective thickness of 2 to 3 ft except at the tangent tanks.

Derived from text

Synchrotrons; Protons; Shielding; Thickness

20040076856 California Univ., Berkeley, CA, USA

Build-up Factors

Moyer, B. J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957; 5 pp.; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

When a flux of penetrating radiation enters matter, it produces secondary radiations characteristic of the nature of the matter and of the primary radiation. The intensity and character of the secondary radiation relative to the surviving primary flux at any depth is of concern in any attempt to predict radiation fields outside shielding. In general, the "build-up factor" for any component of the secondary radiation is that factor by which the surviving primary flux, at the depth in question, must be multiplied to give the accompanying flux of the secondary component. Thus, if a single type of primary radiation, homogeneous in energy and monodirectional, is incident with flux density phi(sub 0) upon a shield in which its attenuation coefficient is mu, then the flux density at depth x of an ith component of the secondary radiation.

Derived from text

Attenuation Coefficients; Radiant Flux Density; Shielding

20040076859 Oak Ridge National Lab., TN, USA

Calculational Methods for Reactor Shielding

Blizard, E. P.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 112-116; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

Although the spectra of radiations from reactors differ strongly from those from high energy accelerators, nevertheless the approach to shielding calculations may well be in many respects quite similar. This arises from the fact that, even with the broad spectra evidenced in the leakage from reactors, the attenuation is often describable in terms of the attenuation from a single energy component. Since a great deal of effort, both experimental and theoretical, has been expended on the problem of shielding reactors, it is now thought that this problem is quite well understood, and it is hoped that information in the reactor-shielding field may profitably be transferred to the problems of high-energy accelerator shielding.

Author

Shielding; Computation; Reactor Design

20040076864 Argonne National Lab., IL, USA

Argonne National Laboratory 12.5-Bev Proton Synchrotron

Crosbie, E.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 167-170; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

In building a high-energy proton accelerator on the Argonne site, advantage can be taken of the large space available to provide for adequate shielding of personnel from radiation. The proposed location for the machine is sufficiently removed from existing buildings so that they will not be a factor in the shielding requirements. There is room to expand if needed. The Argonne accelerator is expected to provide 10(exp 12) protons/pulse of 12.5-bev protons. The pulse rate of one every 4 sec provides a time average circulating current of 2.5 10(exp 11) protons/sec. Provisions for both internal and external use of the beam are planned. The machine is composed of eight magnet sections, each having a length of 53.5 ft, and eight straight sections, each having an average length of 15 ft. The average radius of the machine is 89.3 ft. Within the magnet sections,

the beam is enclosed on all sides by approximately 30 in. of iron. The distance between the magnet iron and the beginning of the shield is approximately 15 ft. In making our preliminary calculations for the shielding requirements, we have been guided mainly by Reports PS/WG-1 and PS/WG-3 by Citron and Gentner for the 30-bev CERN proton accelerator. The method consists in applying what information is available concerning the building up and attenuation of the radiation produced by high-energy particles entering the top of the earth's atmosphere. The problems are similar except for differences caused by the higher density of the shielding material and the fact that the protons from the accelerator will be monoenergetic.
Derived from text
Synchrotrons; Proton Beams; Radiation Shielding

20040076870 Atomic Energy Commission, Oak Ridge, TN, USA
Data Required for Shielding Experiments with High-energy Particles
Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 117-123; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

The main topic in this discussion is the data required for good shielding computations and recommendations for shielding experiments with high-energy particles. I would like to broaden this to include also things about future computations on shielding, for a good reason: Everybody knows that measurements for shielding with high-energy particles are as time-consuming as any good physics experiment, and, if there is any competition, you know who usually wins. This means that most shielding measurements that have been brought to the attention of this group have been taken 'or, the fly,' that is, in the time between other measurements; they have not, of necessity, been as thorough as we would like. This means that, even though in some lower energy laboratories there may be more opportunities for doing shielding experiments, one has to rely on calculations in practice; and I think most of us feel, on the subject of calculations, that a great deal more work--say, of the kind O'Neill mentioned--could well be done in a more intensive way to get results. I would like to say one other thing: We all know, as demonstrated by Blizard's talk, that a great deal more work, such as that done by Cohen on shielding for reactors, should be done on accelerators. The accelerators are basically research tools and not production tools, and their efficiency cannot be measured in terms of money. Therefore, we should not expect that production of shields to given requirements for a minimum cost will ever be much emphasized.
Derived from text
Radiation Shielding; Energetic Particles; Experimentation

20040076871 Columbia Univ., NY, USA
Maximum Permissible Radiation Levels for High-energy Installations
Rossi, H. H.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 148-156; In English; See also 20040076842; No Copyright; Avail: CASI; A02, Hardcopy

Modern high-energy accelerators produce a variety of radiations which can enter into a variety of interactions with matter. However, for purposes of radiation protection, we are interested in the charged particles that ultimately traverse the tissues exposed. In order to evaluate the radiation hazard, we want to know two parameters: one is the energy delivered per unit mass, the quantity of radiation; the other is the energy density in the tracks of the charged particles that deliver the dose, which is a measure of the quality of the radiation. The quantity is now measured in rads, 1 rad being the amount of ionizing radiation that will impart 100 ergs per gram of exposed tissue. The quality is measured in terms of linear energy transfer (L.E.T.). The L.E.T. is usually measured in key per micron of water. The concept is virtually the same as dE/dx, which is well known to physicists. However, it applies only to those terms in the total energy loss which are locally dissipated. Thus, for instance, radiation terms are not included. The biological effectiveness of radiation is usually compared with that of X rays, which by definition have a relative biological effectiveness (rbe) of 1. If it requires 100 rad of X rays to induce a certain biological effect and if it takes, let us say, 50 rad of some other radiation to evoke the same effect, the latter is said to have an rbe of 2. For purposes of radiation protection it is convenient to have a unit which is an approximate measure of biological potency; the rem (roentgen equivalent man or mammal) is such a unit. The dose in rem is numerically equal to the absorbed dose in rads multiplied by the rbe. In the above example 100 rad of X rays with an rbe of 1 represents 100 rem, and, similarly, 50 rad of radiation having an rbe of 2 also represents 100 rem. The rem has been found useful in the formulation of permissible exposure limits, and all protection figures are now given in terms of this unit.
Author
Ionizing Radiation; Radiation Dosage; Flux Density; Linear Energy Transfer (Let)

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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*.

20040074477 Lawrence Livermore National Lab., Livermore, CA
Femtosecond Laser Processing of Fuel Injectors-A Materials Processing Evaluation
Stuart, B. C.; Wynne, A.; Dec. 16, 2000; 62 pp.; In English
Report No.(s): DE2004-15006882; UCRL-ID-141346; No Copyright; Avail: Department of Energy Information Bridge

Lawrence Livermore National Laboratory (LLNL) has developed a new laser-based machining technology that utilizes ultrashort-pulse (0.1-1.0 picosecond) lasers to cut materials with negligible generation of heat or shock. The ultrashort pulse laser, developed for the Department of Energy (Defense Programs) has numerous applications in operations requiring high precision machining. Due to the extremely short duration of the laser pulse, material removal occurs by a different physical mechanism than in conventional machining. As a result, any material (e.g., hardened steel, ceramics, diamond, silicon, etc.) can be machined with minimal heat-affected zone or damage to the remaining material. As a result of the threshold nature of the process, shaped holes, cuts, and textures can be achieved with simple beam shaping. Conventional laser tools used for cutting or high-precision machining (e.g., sculpting, drilling) use long laser pulses (10(sup -8) to over 1 sec) to remove material by heating it to the melting or boiling point (Figure 1.1a). This often results in significant damage to the remaining material and produces considerable slag. With ultrashort laser pulses, material is removed by ionizing the material. The ionized plasma expands away from the surface too quickly for significant energy transfer to the remaining material. This distinct mechanism produces extremely precise and clean-edged holes without melting or degrading the remaining material. Since only a very small amount of material ((approx)0.5 microns) is removed per laser pulse, extremely precise machining can be achieved. High machining speed is achieved by operating the lasers at repetition rates up to 10,000 pulses per second. As a diagnostic, the character of the short-pulse laser produced plasma enables determination of the material being machined between pulses. This feature allows the machining of multilayer materials, metal on metal or metal on ceramic where one material can be machined without damaging the next. Developed originally for the Stockpile Stewardship program of the Department of Energy, numerous industrial, medical and national security applications of the technology have emerged. The difference in machining ability of the ultrashort-pulse laser is dramatically illustrated in Figures 1.2 and 1.3. The clear presence of slag (resolidified molten material) is observable in Figure 1.2a where 1 mm thick stainless steel was cut with a 1(micro)m solid-state laser. By changing the pulse duration of the laser to the ultrashort regime ((approx) 10(sup -13) to 10(sup -12) sec), material is removed without melting and the formation of slag. A cross section of holes drilled in 304 stainless steel illustrates the lack of any heat affected zone or collateral damage in the remaining material. Note that the individual grain boundaries are intact up to the edge of the laser-machined surface.
NTIS
Lasers; Fuel Injection; Energy Transfer; Thermal Shock

20040074478 Lawrence Livermore National Lab., Livermore, CA
Ribbon Fiber with Multiple Antiguided Phase-Locked Gain Cores
Beach, R. J.; Feit, M. D.; Mitchell, S. C.; Cutter, K. P.; Dawson, J. W.; Nov. 20, 2002; 16 pp.; In English
Report No.(s): DE2004-15006884; UCRL-JC-148825; No Copyright; Avail: Department of Energy Information Bridge

We report on the first experimental demonstration of a scalable fiber laser approach based on phase-locking multiple gain cores in an antiguided structure. A novel fabrication technology is used with soft glass components to construct the multiple core fiber used in our experiments. The waveguide region is rectangular in shape and comprised of a periodic sequence of gain and no-gain segments having nearly uniform refractive index. The rectangular waveguide is itself embedded in a lower refractive index cladding region. Experimental results confirm that our five-core Nd doped glass prototype structure runs predominantly in two spatial antiguided modes as predicted by our modeling.
NTIS
Rectangular Waveguides; Fiber Lasers; Phase Locked Systems

20040074519 Lawrence Livermore National Lab., Livermore, CA
Recent X-ray Laser Experiments on the COMET Facility
Dunn, J.; Smith, R. F.; Nilsen, J.; Hunter, J. R.; Barbee, T. W.; Sep. 22, 2001; In English
Report No.(s): DE2004-15005869; UCRL-JC-145741; No Copyright; Avail: National Technical Information Service (NTIS)

The development of the transient collisional excitation x-ray laser scheme using tabletop laser systems with multiple pulse

capability has progressed rapidly in the last three years. The high small-signal gain and strong x-ray output have been demonstrated for laser drive energies of typically less than 10 J. We report recent x-ray laser experiments on the Lawrence Livermore National Laboratory (LLNL) Compact Multipulse Terawatt (COMET) tabletop facility using this technique. In particular, the saturated output from the Ni-like Pd ion 4d - 4p x-ray laser at 146.8(angstrom) has been well characterized and has potential towards a useable x-ray source in a number of applications. One important application of a short wavelength x-ray laser beam with picosecond pulse duration is the study of a high density laser-produced plasma. We report the implementation of a Mach-Zehnder type interferometer using diffraction grating optics as beam splitters designed for the Ni-like Pd laser and show results from probing a 600 ps heated plasma. In addition, gas puff targets are investigated as an x-ray laser gain medium and we report results of strong lasing on the n= 3 - 3 transitions of Ne-like Ar.
NTIS
X Ray Lasers; Interferometry

20040075066 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis of Uncertainties in Infrared Camera Measurements of a Turbofan Engine in an Altitude Test Cell
Morris, Thomas A.; Mar. 2004; 179 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422901; AFIT/GE/ENP/04-01; No Copyright; Avail: CASI; A09, Hardcopy

This research investigated the uncertainties in measuring the IR signature of a General Electric F110-GE-129 turbofan engine inside an altitude test cell. The requirements for the measurement system include the intensity and radiance of the engine surfaces in three bands of operation, two Medium Wave IR (MWIR) bands and one Long Wave IR (LWIR) band. The altitude test cell provides a venue for measuring the IR signature in simulated altitude operation, but the imaging process is laden with measurement uncertainty due to stray radiation from the facility structure, hot exhaust gases, and the measurement equipment itself. The atmosphere and a protective ZnSe window that shields the camera from the hot engine exhaust also introduce measurement uncertainty due to attenuation. Consequently, post-processing of the signature data is necessary to recover the engine signal, but they inject an additional level of measurement uncertainty into the imaging process. To assess the measurement uncertainty, a radiometric model of the altitude test cell is formulated. Specific measurement conditions at which the stray radiation is 5% or less of the total radiation are then derived, thereby decreasing the necessity for post-processing correction factors. These conditions are derived for the 3-4, 4.5-5, 8-9, and 8-12 micron bands using a parametric analysis. The fidelity of the model is increased by the inclusion of experimental data from the ZnSe window.
DTIC
Altitude Tests; Cameras; Infrared Radiation; Optical Countermeasures; Signatures; Turbofan Engines

20040075847 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Proceedings of the LADAR Calibration Facility Workshop, June 12-13, 2003
2003; In English
Report No.(s): PB2004-105177; NISTIR-7054; No Copyright; Avail: National Technical Information Service (NTIS)

The use and scope of LADAR applications continues to expand as the technology matures, but standard protocols or procedures for calibrating and testing of LADARs have yet to be developed. While selections of LADAR instruments are generally based on the manufacturer's specifications, there are no uniform definitions of such specifications nor are there uniform guidelines for their validation. As a first step towards developing agreement on these issues, a LADAR Calibration Facility workshop was convened at NIST on June 12-13, 2003. The proceedings of the workshop are presented in this report.
NTIS
Detectors; Tests; Calibrating; Optical Radar; Laser Range Finders

20040075908 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Semi-Analytical 6D Model of Space Charge Force for Dense Electron Bunches with a Large Energy Spread
Fubiani, G.; Dugan, G.; Leemans, W.; Esarey, E.; Bobin, J. L.; 2003; In English
Report No.(s): DE2003-815481; No Copyright; Avail: National Technical Information Service (NTIS)

Laser driven accelerators are capable of producing multi nC, multi MeV electron beams with transverse and longitudinal sizes on the order of microns. To investigate the transport of such electron bunches, a fast and fully relativistic space charge code which can handle beams with arbitrarily large energy spread has been developed. A 6-D macroparticle model for the beam is used to calculate the space charge fields at each time step. The collection of macroparticles is divided into longitudinal

momentum bins, each with a small spread in relative momentum. The macroparticle distribution in each momentum bin is decomposed into ellipsoidal shells in position space.
NTIS
Electron Beams; Accelerators; Space Charge; Electron Bunching

20040075909
Electron Acceleration Mechanisms in the Interaction of Ultrashort Lasers with Underdense Plasmas: Experiments and Simulations
Faure, J.; Lefebvre, E.; Malka, V.; Marques, J. R.; Amiranoff, F.; 2003; In English
Report No.(s): DE2003-815480; No Copyright; Avail: National Technical Information Service (NTIS)

An experiment investigating the production of relativistic electrons from the interaction of ultrashort multi-terawatt laser pulses with an underdense plasma is presented. Electrons were accelerated to tens of MeV and the maximum electron energy increased as the plasma density decreased. Simulations have been performed in order to model the experiment. They show a good agreement with the trends observed in the experiment and the spectra of accelerated electrons could be reproduced successfully. The simulations have been used to study the relative contribution of the different acceleration mechanisms: plasma wave acceleration, direct laser acceleration and stochastic heating.
NTIS
Acceleration (Physics); Plasmas (Physics); High Energy Electrons

20040077106 NASA Ames Research Center, Moffett Field, CA, USA
Photonic Switching Using Light Bullets
Goorjian, Peter M.; Research and Technology 1999; December 2000, pp. 50-51; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this work was to develop a faster, more efficient data switch for use in optical communications networks and optical signal process- ing systems. An optical device has been developed to perform ultrafast, all-optical switching by using light bullets to switch light bullets. This invention was granted U.S. Patents 5,651,079, July 22, 1997 and 5,963,683, October 5, 1999; it was based on computer simulations of the interactions of light bullets. in commerce, finance, education, health, government, security, and entertainment, together with the ever-increasing power of computers and data storage devices, is fueling a potentially massive demand for network interconnections, especially broadband The rapid proliferation of information technology services. Switching is an essential operation of all communications networks and digital computers and signal processing systems. Switching is presently a limiting factor in the speed of operation of optical communications and computing, because most commercial devices must use electrical forms of switching, and in the longer term electronic systems will become increasingly complex and costly. Network designers will turn increasingly to photonic transport and switching technologies. An all-optical switch would have the inherent advantages of higher speed and higher efficiency.
Derived from text
Computerized Simulation; Data Storage; Data Transmission; Optical Communication

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040074481 Lawrence Livermore National Lab., Livermore, CA
Simulation of Edge Plasmas in DIII-D Double-Null Configurations
Rensink, M. E.; Lasnier, C. J.; Petrie, T. W.; Porter, G. D.; Rognlien, T. D.; Sep. 06, 2001; 12 pp.; In English
Report No.(s): DE2004-15006867; UCRL-JC-143603; No Copyright; Avail: Department of Energy Information Bridge

We present fluid model simulation results for the edge plasma in the DIII-D tokamak with unbalanced double-null magnetic configurations, including cross field drifts. Input parameters are typical of low-power operation in DIII-D. For high-recycling the plasma tends to be detached from all divertor plates. Midplane plasma and electric field profiles are relatively insensitive to the magnetic imbalance. Divertor heat flux profiles exhibit sharp peaks due to cross-field drifts when the ion grad-B drift direction is away from the x-point toward the magnetic axis.
NTIS
Simulation; Plasmas (Physics); Tokamak Devices

20040074483 Lawrence Livermore National Lab., Livermore, CA

Electronic Structure of Dense Plasmas by X-ray Scattering

Gregori, G.; Glenzer, S. H.; Rogers, F. J.; Pollaine, S. M.; Froula, D. H.; Oct. 07, 2003; In English

Report No.(s): DE2004-15006468; UCRL-CONF-155622; No Copyright; Avail: National Technical Information Service (NTIS)

We present an improved analytical expression for the X-ray dynamic structure factor from a dense plasma which includes the effects of weakly bound electrons. This result can be applied to describe scattering from low to moderate Z plasmas, and it covers the entire range of plasma conditions that can be found in inertial confinement fusion experiments, from ideal to degenerate up to moderately coupled systems. We use our theory to interpret X-ray scattering experiments from solid density carbon plasma and to extract accurate measurements of electron temperature, electron density and charge state. We use our experimental results to validate various equation-of-state models for carbon plasmas.

NTIS

Electronic Structure; Dense Plasmas; X Ray Scattering

20040074507 Lawrence Livermore National Lab., Livermore, CA

Studies of Electron Transport and Isochoric Heating and Their Applicability to Fast Ignition

Key, M. H.; Amiranoff, F.; Anderson, C.; Batani, D.; Baton, S. D.; Oct. 30, 2003; In English

Report No.(s): DE2004-15006460; UCRL-CONF-152425; No Copyright; Avail: National Technical Information Service (NTIS)

Experimental measurements of electron transport and isochoric heating in 100 J, 1 ps laser irradiation of solid A1 targets are presented. Modeling with a hybrid PIC code is compared with the data and good agreement is obtained using a heuristic model for the electron injection. The relevance for fast ignition is discussed.

NTIS

Heuristic Methods; Heating; Ignition; Isochoric Processes

20040075185 Air Force Research Lab., Hanscom AFB, MA

Theoretical Relationship Between Maximum Value of the Post-Sunset Drift Velocity and Peak-to-Valley Ratio of Anomaly TEC

Basu, B.; Retterer, J. M.; de la Beaujardiere, O.; Valladares, C. E.; Kudeki, E.; Feb. 11, 2004; 5 pp.; In English

Contract(s)/Grant(s): F19628-02-C-0087; Proj-2311

Report No.(s): AD-A423087; AFRL-VS-HA-TR-2004-1081; No Copyright; Avail: CASI; A01, Hardcopy

Theoretical study of electron density distribution in the nighttime equatorial ionosphere shows that linear relationships with statistically significant correlation coefficients exist between the maximum value of the post- sunset plasma drift velocity and the peak-to-valley ratio of anomaly TEC. The %study is based on the low-latitude density model of Air Force Research Laboratory (AFRL) and the obtained relationships are valid for the longitudinal sector of Jicamarca incoherent scatter radar whose drift velocity measurements are used. The significance of this finding lies in the fact that the maximum value of the post-sunset vertical plasma drift velocity is an important parameter for determining both the intensity and the latitudinal distribution of equatorial scintillation. When the parameter is not available from any direct measurement, the linear relationships may be used to estimate it from the measured peak-to-valley ratio of anomaly TEC.

DTIC

Anomalies; Drift Rate; Electron Density (Concentration); Equatorial Regions; Sunset; Valleys

20040075187 Boston Univ., Boston, MA

Suprathermal Electron Isotropy in High-Beta Solar Wind and Its Role in Heat Flux Dropouts

Crooker, N. U.; Larson, D. E.; Kahler, S. W.; Lamassa, S. M.; Spence, H. E.; Jun. 20, 2003; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A423089; AFRL-VS-HA-TR-2004-1089; No Copyright; Avail: CASI; A01, Hardcopy

Time variations in plasma beta and a parameter which measures isotropy in suprathermal electron pitch angle distributions show a remarkably close correspondence throughout the solar wind. The finding implies that high-beta plasma, with its multiple magnetic holes and sharp field and plasma gradients, is conducive to electron pitch-angle scattering, which reduces heat flux from the Sun without field- line disconnection. Thus the finding impacts our understanding of signatures we use to determine magnetic topology in the heliosphere.

DTIC

Dropouts; Electrons; Heat Flux; Isotropy; Solar Wind; Thermodynamic Properties

20040075850 Princeton Univ., NJ

Confinement Studies of Auxiliary Heated NSTX Plasmas

LeBlanc, B. P.; Bell, M. G.; Bell, R. E.; Bitter, M. L.; Bourdelle, C.; 2003; In English

Report No.(s): DE2003-813692; PPPL-3810; No Copyright; Avail: National Technical Information Service (NTIS)

The confinement of auxiliary heated NSTX discharges is discussed. The energy confinement time in plasmas with either L-mode or H-mode edges is enhanced over the values given by the ITER97L and ITER98Pby(2) scalings, being up to 2-3 times L-mode and 1.5 times H-mode. TRANSP calculations based on the kinetic profile measurements reproduce the magnetics-based determination of stored energy and the measured neutron production rate. Power balance calculations reveal that, in a high power neutral beam heated H-mode discharge, the ion thermal transport is near neoclassical levels, and well below the electron thermal transport, which is the main loss channel. Perturbative impurity injection techniques indicate the particle diffusivity to be slightly above the neoclassical level in discharges with L-mode edge. High-harmonic fast-wave (HHFW) bulk electron heating is described and thermal transport is discussed. Thermal ion transport is found to be above neoclassical level, but thermal electron transport remains the main loss mechanism. Evidences of an electron thermal internal transport barrier obtained with HHFW heating are presented. A description of H-mode discharges obtained during HHFW heating is presented.

NTIS

Plasmas (Physics); Plasma Heating; Neutral Beams

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040074487 Helsinki Univ. of Technology, Espoo, Finland

Growth and Properties of GaAsN Structures

Toivonen, J.; 2003; 68 pp.; In English

Report No.(s): PB2004-105788; No Copyright; Avail: CASI; A04, Hardcopy

Recently, the addition of nitrogen into GaAs-based components has attracted considerable attention due to the high potential of the technique in many device applications. The N incorporation from dimethylhydrazine into GaAsN by metalorganic vapor phase epitaxy (MOVPE) was studied in this thesis. The incorporation efficiency of N into GaAs is very low and thus carefully optimized growth conditions are required. The electrical, structural, and optical properties of GaAsN were investigated with various experimental techniques. The luminescence intensity of the material degrades rapidly with increasing N composition due to the formation of nonradiative point defects. However, post-growth treatments, like laser treatment or annealing, can be used to recover the luminescence intensity.

NTIS

Gallium Arsenides; Structural Properties (Geology); Dimethylhydrazines; Electrical Properties

20040074493 Helsinki Univ. of Technology, Espoo

Superconducting Proximity Effect in Mesoscopic Metals

Heikkila, T.; 2002; 76 pp.; In English

Report No.(s): PB2004-105761; No Copyright; Avail: CASI; A05, Hardcopy

The relentless pace for miniaturization of electronic components has reached the limit where quantum-mechanical phenomena can be observed in the currents through submicron-size circuits. In this mesoscopic regime, the conduction electrons exhibit interference effects due to their wave nature, and inelastic scattering ceases to be efficient enough to break the intrinsic phase coherence of the electron waves. In macroscopic metallic wires, such phase-coherent phenomena can be found only in superconducting materials. This dissertation considers the phenomena encountered in heterostructures of superconductors (S) and mesoscopic normal, non-superconducting (N) metals. There, the superconducting order parameter, the pairing amplitude, penetrates into the normal-metal side inducing superconductive features in the normal-metal region near the interface.

NTIS

Circuits; Superconductors (Materials); Superconductivity; Proximity Effect (Electricity)

20040074990 Brookhaven National Lab., Upton, NY
Analog I/O Module Test System Based on EPICS CA Protocol and Activex CA Interface
Leng, Y.; Hoff, L.; 2003; 8 pp.; In English
Report No.(s): DE2004-15006422; BNL-71732-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Analog input (ADC) and output (DAC) modules play a substantial role in device level control of accelerator and large experiment physics control system. In order to get the best performance some features of analog modules including linearity, accuracy, crosstalk, thermal drift and so on have to be evaluated during the preliminary design phase. Gain and offset error calibration and thermal drift compensation (if needed) may have to be done in the implementation phase as well. A natural technique for performing these tasks is to interface the analog VO modules and GPIB interface programmable test instruments with a computer, which can complete measurements or calibration automatically. A difficulty is that drivers of analog modules and test instruments usually work on totally different platforms (vxworks VS Windows). Developing new test routines and drivers for testing instruments under VxWorks (or any other RTOS) platform is not a good solution because such systems have relatively poor user interface and developing such software requires substantial effort. EPICS CA protocol and ActiveX CA interface provide another choice, a PC and LabVIEW based test system. Analog 110 module can be interfaced from LabVIEW test routines via ActiveX CA interface. Test instruments can be controlled via LabVIEW drivers, most of which are provided by instrument vendors or by National Instruments. Labview also provides extensive data analysis and process functions. Using these functions, users can generate powerful test routines very easily. Several applications built for Spallation Neutron Source (SNS) Beam Loss Monitor (BLM) system are described in this paper.
NTIS
Analog Data; Modules; Systems Engineering

20040074996 Brookhaven National Lab., Upton, NY
Muon Cooling in the RFOFO Ring Cooler
Fernow, R. C.; Berg, J. S.; Gallardo, J. C.; Palmer, R. B.; Jun. 2003; 12 pp.; In English
Report No.(s): DE2004-15006337; BNL-71409-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

The performance of the ring described here compares favorably with the linear cooling channel used in the second U.S. Neutrino Factory Study. The 6D phase space density of an idealized ring is increased by a factor of 238, compared with the linear channel's factor of only 15. The simulations make use of fully realistic magnetic fields, and include absorber and rf cavity windows, and empty lattice cells for injection/extraction.
NTIS
Cooling; Extraction; Muons; Magnetic Fields

20040074997 Brookhaven National Lab., Upton, NY, University of Southern California, Los Angeles, CA
Very Fast Ramping Muon Synchrotron for a Neutrino Factory
Summers, D. J.; Berg, J. S.; Palmer, R. B.; Garren, A. A.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006336; BNL-71410-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

A 4600 Hz fast ramping synchrotron is studied as an economical way of accelerating muons from 4 to 20 GeV/c for a neutrino factory. Eddy current losses are minimized by the low machine duty cycle plus thin grain oriented silicon steel laminations and thin copper wires. Combined function magnets with high gradients alternating within single magnets form the lattice. Muon survival is 83%.
NTIS
Muons; Synchrotrons; Neutrinos

20040074998 Brookhaven National Lab., Upton, NY, Advanced Energy Systems, Inc., Fremont, CA, USA
Analysis of the Cross-Talk in a RF Gun Superconducting Cavity
Zhao, Y.; Cole, M. D.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006334; BNL-71419-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

A project to develop an all Niobium Superconducting RF Gun is underway at Brookhaven National Laboratory in collaboration with Advanced Energy Systems. The geometry of the gun requires that the power input and the pickup probes are on the same side of the cavity, which causes direct coupling between them, or crosstalk. At room temperature, the crosstalk causes serious distortion of the RF response. This paper addresses the phenomenon, the analysis and the simulation results as well as the measurements. A method is provided on how to extract the desired information from the confusing signal and allow

accurate measurements of the coupling between the probes and the cavity.
NTIS
Cavities; Superconductivity; Crosstalk

20040075000 Brookhaven National Lab., Upton, NY
Linear Model for Non-Isosceles Absorbers
Berg, J. S.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006332; BNL-71421-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
Previous analyses have assumed that wedge absorbers are triangularly shaped with equal angles for the two faces. In this case, to linear order, the energy loss depends only on the position in the direction of the face tilt, and is independent of the incoming angle. One can instead construct an absorber with entrance and exit faces facing rather general directions. In this case, the energy loss can depend on both the position and the angle of the particle in question. This paper demonstrates that and computes the effect to linear order.
NTIS
Adsorption; Energy Dissipation

20040075001 Brookhaven National Lab., Upton, NY, University of Southern California, Los Angeles, CA
Muon Storage Rings for 6D Phase-Space Cooling
Kirk, H.; Cline, D.; Fukui, Y.; Green, A.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006331; BNL-71422-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
We describe several storage ring designs for reducing the 6-dimensional phase space of circulating muon beams. These rings utilize quadrupole and dipole magnets as well as wedge-shaped, liquid-hydrogen, energy-loss absorbers and energy compensating rf cavities. We obtain evaluations of their cooling performance by particle tracking simulation. Such rings are potentially useful for future Neutrino Factories or Muon Colliders as well as for existing facilities in which cooled, intense muon beams could enhance their physics programs.
NTIS
Muons; Storage Rings (Particle Accelerators); Cooling

20040075003 Brookhaven National Lab., Upton, NY
Completion of Superconducting Magnet Production at BNL for the HERA Luminosity Upgrade
Wanderer, P.; Anerella, M.; Escallier, J.; Ghosh, A.; Jain, A.; 2003; 8 pp.; In English
Report No.(s): DE2004-15006329; BNL-71432-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
Brookhaven National Laboratory (BNL) has completed production of the superconducting multi-function magnets that are now installed as part of the HERA luminosity upgrade at DESY. The magnets, cryostats, and lead assemblies were designed and built at BNL. To fit inside the existing detectors, the coils plus cryostat structure had to meet a challenging radial budget (e.g. , 39 mm horizontally). Two types of magnets were needed and three of each type were built. Each magnet contained normal and skew quadrupole, normal and skew dipole, and sextupole coils. The magnets operate in the(approx)1.5 T solenoid field of a detector. The quadrupole coils produce gradients up to 13 T/m. The dipole coils generate fields up to 0.3 T. Coils were wound under computer control using either seven-strand round cable or a single strand. To simultaneously avoid excessive synchrotron radiation background scattered from the beam pipe and yet have a small cryostat, one type of magnet used a tapered coil structure. The cryogenic system incorporates cooling with both 40 K helium and supercritical helium. All of the coils were tested in liquid helium in a vertical dewar. Quench test results have been excellent. The field quality of the magnets has met the stringent requirements imposed on interaction region magnets. One magnet of each type was tested at BNL as a completed assembly to verify the performance of the leads and cryostats. Two of each type were tested at DESY and then installed in the Zeus and H1 experiments. The remaining magnets are spares. Final results of quench testing, field quality measurements and cryogenic performance are reported.
NTIS
Superconducting Magnets; Cryostats; Cryogenics; Synchrotron Radiation

20040075004 Brookhaven National Lab., Upton, NY, Princeton Univ., NJ, USA, Ioannina Univ., Greece
Concept Design of the Target/Horn System for the BNL Neutrino Oscillation Experiment
Simos, N.; Kirk, H.; Kahn, S.; Carrol, A.; Ludewig, H.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006328; BNL-71437-2003-CP; CAP-365-EXPER-03C; No Copyright; Avail: Department of Energy Information Bridge

The design concept for the integration of the target and the focusing horn system for the proposed BNL neutrino oscillation experiment is described in this paper. Also presented are issues associated with the functionality and thermo-mechanical response of the selected target intercepting the 28 GeV protons of the 1 MW upgraded AGS beam, the loading and mechanical response of the focusing horn subjected to high currents and energy deposited due to beam/target interaction, the integration of the two systems, and the heat removal schemes. The proposed target intercepts the 8.9 x 10(sup 13), 28 GeV protons with a 2.5 Hz cycle time over a spot that encloses the 3(sigma) of the beam. In the baseline. design the inner conductor of the aluminum horn encloses the target while allowing for an annular space for forced cooling. Approximately 250 kA pulse of current of 20(micro)s duration will flow through the horn at 2.5 Hz repetition rate inducing high compressive forces, vibration and heat. The paper addresses these issues of horn mechanical response, heat removal scenario, and useful life estimation including radiation damage.
NTIS
Neutrinos; Oscillations; Thermodynamics; Targets

20040075006 Brookhaven National Lab., Upton, NY
V-I Transition and n-Value of Multifilamentary LTS and HTS Wires and Cables
Ghosh, A. K.; 2003; 20 pp.; In English
Report No.(s): DE2004-15006326; BNL-71447-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
For low T, multifilamentary conductors like NbTi and Nb(sub 3)Sn, the V-I transition to the normal state is typically quantified by the parameter, n, defined by ((rho)/(rho)(sub c))= (I/I(sub c))(sup n). For NbTi, this parameterization has been very useful in the development of high Jc wires, where the n-value is regarded as an index of the filament quality. In copper-matrix wires with undistorted filaments, the n-value at 5T is(approx) 40-60, and drops monotonically with increasing field. However, n can vary significantly in conductors with higher resistivity matrices and those with a low copper fraction. Usually high n-values are associated with unstable resistive behavior and premature quenching. The n-value in NbTi Rutherford cables, when compared to that in the wires is useful in evaluating cabling degradation of the critical current due to compaction at the edges of the cable. In Nb(sub 3)Sn wires, n-value has been a less useful tool, since often the resistive transition shows small voltages(approx) a few(mu)V prior to quenching. However, in 'well behaved' wires, n is(approx) 30-40 at 12T and also shows a monotonic behavior with field. Strain induced I(sub c) degradation in these wires is usually associated with lower n-values. For high T(sub c) multifilamentary wires and tapes, a similar power law often describes the resistive transition. At 4.2K, Bi-2223 tapes as well as Bi-2212 wires exhibit n-values(approx) 15-20. In either case, n does not change appreciably with field. Rutherford cables of Bi-2212 wire show lower values of n than the virgin wire.
NTIS
Wire; Conductors; Electrical Resistivity

20040075007 Brookhaven National Lab., Upton, NY
Magnet Performance and RHIC Commissioning
Harrison, M.; 2003; 10 pp.; In English
Report No.(s): DE2004-15006330; BNL-71431-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The RHIC accelerator complex completed commissioning activities in 2000 and is presently operating for the first physics run. The complete ensemble of magnets was thus operating over an extended period for the first time. We review the magnet performance as well as relate machine performance characteristics and accelerator physics results to the various magnetic measurements made during the construction phase. The conclusions may be useful for the LHC Project.
NTIS
Magnetic Measurement; Linear Accelerators

20040075008 Brookhaven National Lab., Upton, NY
Engineering of the AGS Snake Coil Assembly
Anerella, M.; Gupta, R.; Kovach, P.; Marone, A.; Plate, S.; 2003; 8 pp.; In English
Report No.(s): DE2004-15006325; BNL-71449-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
A 30% Snake superconducting magnet is proposed to maintain polarization in the AGS proton beam, the magnetic design of which is described elsewhere. The required helical coils for this magnet push the limits of the technology developed for the RHIC Snake coils. First, fields must be provided with differing pitch along the length of the magnet. To accomplish this, a new 3-D CAD system ('Pro/Engineer' from PTC), which uses parametric techniques to enable fast iterations, has been employed. Revised magnetic field calculations are then based on the output of the mechanical model. Changes are made in

turn to the model on the basis of those field calculations. To ensure that accuracy is maintained, the final solid model is imported directly into the CNC machine programming software, rather than by the use of graphics translating software. Next, due to the large coil size and magnetic field, there was concern whether the structure could contain the coil forces. A finite element analysis was performed, using the 3-D model, to ensure that the stresses and deflections were acceptable. Finally, a method was developed using ultrasonic energy to improve conductor placement during coil winding, in an effort to minimize electrical shorts due to conductor misplacement, a problem that occurred in the RHIC helical coil program. Each of these activities represents a significant improvement in technology over that which was used previously for the RHIC snake coils. NTIS

Superconducting Magnets; Finite Element Method; Computer Programming; Conductors

20040075088 North Carolina Univ., Charlotte, NC

Inverse Nottingham Effects Cooling of Semiconductors with Resonant Tunneling

Tsu, Raphael; Mar. 31, 2004; 23 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0154

Report No.(s): AD-A422940; ARO-40067.1-EL; No Copyright; Avail: CASI; A03, Hardcopy

Heat removal by Inverse Nottingham Effect (INE) is a new concept utilizing hot electrons emitted from the semiconductor surface into the vacuum via field emission. The replenishment of hot electrons in the semiconductor as a result of reestablishment of thermal equilibrium constitutes cooling. To avoid heating from current crowding, tips are replaced by a double barrier resonant tunneling structure (DBRT) at the surface of a semiconductor to allow efficient field emission via resonant tunneling. We recognized that the most important Step is to achieve high emission from the semiconductor into the vacuum. A double barrier structure with Ga.5 AL.5 N as barrier material with GaN well is designed and chosen for the desired high emission. A CVD structure grown by Prof. A. Khan, on SiC substrate, taken to University Lyon to be measured by Prof. Binh, resulted in a breakthrough for field emission, with a threshold field of 50 V / micro(m), with stable FE current densities of 3xlO2A/cm2. (V. Seniet, V. Binh, J, Zbang, J.Yang, A.Khan and R. Tsu, APL 84, 1937, 2004). Although we have not succeeded in cooling due to problems created by radiation back from the anode, this breakthrough in field emission is an important by product of our research which can benefit various field, principally vacuum electronics, such as cold cathode for traveling wave tubes. In fact, the measured exceeded the calculated because we did not realize that the bulk of the high emission came from the effective lowering of the work function at the surface created by space charge in the quantum state. DTIC

Cooling; Resonant Tunneling; Semiconductors (Materials); Traveling Wave Tubes

20040075109 Massachusetts Inst. of Tech., Lexington, MA

Solid State Research

Shaver, David C.; Nov. 15, 2003; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002; Proj-221

Report No.(s): AD-A422977; 2003:4; ESC-TR-2003-083; No Copyright; Avail: CASI; A04, Hardcopy

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 2003. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations - including the Air Force, Army, DARPA, MDA, Navy, NSA, and OSD-and also by the DOE, NASA, and NIST.
DTIC

Quantum Electronics; Solid State

20040075678 NASA Marshall Space Flight Center, Huntsville, AL, USA

Nucleation and Crystallization as Induced by Bending Stress in Lithium Silicate Glass Fibers

Reis, Signo T.; Kim, Cheol W.; Brow, Richard K.; Ray, Chandra S.; 2003; 1 pp.; In English; Proceedings of the International Congress on Glass Conference, 21-25 Sep. 2003, Sao Paolo, Brazil; No Copyright; Avail: Other Sources; Abstract Only

Glass Fibers of Li2O.2SiO2 (LS2) and Li2O.1.6SiO2 (LS1.6) compositions were heated near, but below, the glass transition temperature for different times while subjected to a constant bending stress of about 1.2 GPa. The nucleation density and the crystallization tendency estimated by differential thermal analysis (DTA) of a glass sample in the vicinity of the maximum of the bending stress increased relative to that of stress-free glass fibers. LS2 glass fibers were found more resistant

to nucleation and crystallization than the Ls1.6 glass fibers. These results are discussed in regards to shear thinning effects on glass stability.
Author
Glass Fibers; Bending Fatigue; Crystallization; Thermal Analysis; Nucleation

20040075696 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solutal Convection Around Growing Protein Crystal and Diffusional Purification in Space
Lee, Chun P.; Chernov, Alexander A.; Growth; 2004; Volume 240, pp. 31-544; In English; International Symposium on Physical Sciences, 23-27 May 2004, Toronto, Canada; No Copyright; Avail: CASI; A01, Hardcopy

At least some protein crystals were found to preferentially trap microheterogeneous impurities. The latter are, for example, dimmer molecules of the crystallizing proteines (e.g. ferritin, lysozyme), or the regular molecules on which surfaces small molecules or ions are adsorbed (e.g. acetilated lysozyme) and modi@ molecular charge. Impurities may induce lattice defects and deteriorate structural resolution. Distribution of impurities between mother solution and gorwing crystal is defined by two interrelated distribution coefficients: kappa = rho(sup c, sub 2) and K = (rho(sup c, sub 2)/rho(sup c, sub 1)/rho(sub 2)/rho(sub 1). Here, rho(sub 2), rho(sub 1) and rho(sup c, sub 2) are densities of impurity (2) and regular protein (1) in solution at the growing interface and within the crystal ("c"). For the microheterogeneous impurities studied, K approx. = 2 - 4, so that kappa approx. - 10(exp 2) - 10(exp 3), since K = kappa (rho(sub 1)/rho(sup c, sub 1) and protein solubility ratio rho(sub 1)/rho(sub=p c, sub 2) much less than 1. Therefore, a crystal growing in absence of convection purifies mother solution around itself, grows cleaner and, probably, more perfect. If convection is present, the solution flow permanently brings new impurities to the crystal. This work theoretically addressed two subjects: 1) onset of convection, 2) distribution of impurities.
Derived from text
Proteins; Crystal Growth; Crystallization; Purification

20040075793 NASA Ames Research Center, Moffett Field, CA, USA
Nanoelectronic Devices for the 21st Century
Anantram, M. P.; Biegel, Bryan A.; Govindan, T. R.; Saini, Subhash; Yamada, Toshishige; Research and Technology 1997; September 1998, pp. 75-76; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Both physical and economic considerations indicate that the scaling era of complementary metal oxide semiconductor will run out of steam around the year 2010. However, physical laws also indicate that it is possible to compute at a rate of a billion times the present speeds with the expenditure of only 1 watt ot electrical power. NASA has long-term goals for which ultrasmall semiconductor devices will be needed in critical applications: high-performance, low-power, compact computers for intelligent autonomous vehicles and petaflop (10(exp 15)) computing technology are two key examples. Ames Research Center has developed a Green's-function-based code to calculate the transport properties of carbon nanotubes (CNTs). The single most important promise of CNTs with regard to device application is their use as quantum wires. An important question is how disorder affects the conductance of these low-dimensional systems. To obtain an understanding of this, both the low-bias conductance, as a function of the gate voltage (Fermi energy) and the conductance as a function oi the applied bias in a CNT for two models of disorders, have been computed. These calculations show that in the presence ot weak uniform disorder, the low-bias conductance exhibits a dip as the Fermi energy is swept across the intersection of the first and second sub-bands.
Derived from text
Semiconductor Devices; Quantum Wires; Cmos; Carbon Nanotubes

20040075864 Stanford Linear Accelerator Center, Stanford, CA, USA, Ecole Polytechnique, Palaiseau, France
PEP-II B-Factory and the BABAR Detector
Bonneaud, G.; 1998; 14 pp.; In English
Report No.(s): DE2003-813076; SLAC-PUB-9775; No Copyright; Avail: Department of Energy Information Bridge

I summarize the physics goals of the BABAR project. I give a brief status report on the PEP-II B-Factory progress. I then describe the requirements and chosen design for each of the BABAR detection systems. In conclusion, I give projections for the physics performance expected from the BABAR experiment.
NTIS
Detection; Physical Factors; Design Analysis

20040075865 Stanford Linear Accelerator Center, Stanford, CA, USA
Search for Beta(sup -) -> (tau(sup-)(overbar nv)) Recoiling Against a Fully Reconstructed B
Apr. 23, 2003; In English
Report No.(s): DE2003-813010; SLAC-PUB-9716; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Recoilings; Particle Motion

20040075866 Stanford Linear Accelerator Center, Stanford, CA, USA
Limits on the Lifetime Difference of Neutral B Mesons and on CP, T, and CPT Violation in B(sup O)(bar B)(sup O)
Mar. 27, 2003; In English
Report No.(s): DE2003-812978; SLAC-PUB-9696; No Copyright; Avail: National Technical Information Service (NTIS)
Using events in which one of two neutral B mesons from the decay of an(Upsilon)(4S) resonance is fully reconstructed, they set limits on thelifetime difference between the two neutral-B mass eigenstates and on CP, T, and CPT violation in B(sup 0)(bar B)(sup 0) mixing. Both CP and non-CP eigenstates were obtained from the 88 million(Upsilon)(4S)(yields) B(bar B) decays collected between 1999 and 2002 with the BABAR detector at the PEP-II asymmetric-energy B-Factory at SLAC. They determine six independent parameters governing mixing ((Delta)m,(Delta) (Lambda)/(Lambda)), CPT/CP violation (Rez, Imz), and CP/T violation (Im(lambda)(sub CP), vertical bar q/p vertical bar), where(lambda)(sub CP) characterizes B(sup 0) and(bar B)(sup 0) decays tostates of charmonium plus K(sub S)(sup 0) or K(sub L)(sup 0).
NTIS
Asymmetry; Charm (Particle Physics)

20040075867 Perugia Univ., Italy
BABAR Results on CP Violation in the B(0) System
Anulli, F.; Mar. 2003; In English
Report No.(s): DE2003-812943; SLAC-PUB-9085; No Copyright; Avail: National Technical Information Service (NTIS)
The BABAR detector, operating at the SLAC PEP-II asymmetric B Factory, has collected a sample of 32 million B(bar B) pairs by May 2001, at energies close to the(Upsilon)(4S) resonance. The measurement of sin2(beta)= 0.59(+/-) 0.14(stat)(+/-) 0.05(syst), performed with a study of time-dependent CP-violating asymmetries in neutral B decays, establishes CP violation at the 4(sigma) level. In addition, preliminary results on CP-violating asymmetries in the decay channel B(sup 0)(yields)(pi)(sup+)(pi)(sup -) are presented.
NTIS
CP Violation; Asymmetry; Detection

20040075868 Stanford Linear Accelerator Center, Stanford, CA, USA
NLC IR and e+e-/e-e-Compatibility Issues
Markiewicz, T. W.; Jun. 2002; In English
Report No.(s): DE2003-812616; SLAC-PUB-9634; No Copyright; Avail: National Technical Information Service (NTIS)
This paper collects and summarizes information presented at previous e- e- workshops. Firstly, the various options for reconfiguring magnets and power sources to convert the NLC to e- e- operation are discussed. Secondly, the expected backgrounds from pair creation at the interaction point are presented. Lastly, beam loss in the extraction line is discussed.
NTIS
Magnets; Losses

20040075882 Brookhaven National Lab., Upton, NY, Princeton Univ., NJ, USA
High-Field Pulsed Solenoid Magnet for Liquid Metal Target Studies
Kirk, H. G.; Iarocci, M.; Scaduto, J.; Weggel, R. J.; Mulholland, G.; Jun. 2003; 10 pp.; In English
Report No.(s): DE2004-15006335; BNL-71412-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
The target system for a muon collider/neutrino factory requires the conjunction of an intense proton beam, a high-Z liquid target and a high-field solenoid magnet. We describe here the design parameters for a pulsed solenoid, including the magnet cryogenic system and power supply, that can generate transient fields of greater than 10T with a flat-tops on the order of 1

second. It is envisioned to locate this device at the Brookhaven AGS for proof-of-principle testing of a liquid-jet target system with pulses of le13 protons.
NTIS
Accelerators; Solenoids; Magnets; Cryogenics; Muons

20040076883 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
Phase Motion of the Scalar pie pie Amplitudes in D+, D+(sub) pie-pie+pie+ Decays
Bediaga, I.; Aug. 2003; In English
Report No.(s): DE2003-812827; FERMILAB-CONF-03/223-E; No Copyright; Avail: National Technical Information Service (NTIS)

We make a direct and model-independent measurement of the low(pi)(sup+)(pi)(sup -) mass phase motion in the D(sup+)(yields)(pi)(sup -)(pi)(sup+)(pi)(sup+) decay. Our preliminary results show a strong phase variation, compatible with the isoscalar(sigma)(500) meson. This result confirms our previous result where we found evidence for the existence of this scalar particle using full Dalitz-plot analysis. We apply the Amplitude Difference (AD) method to the same Fermilab E791 data sample used in the preceding analysis. We also give an example of how we extract the phase motion of the scalar amplitude, looking at the f(sub 0)(980) in D(sub s)(sup+)(yields)(pi)(sup -)(pi)(sup+)(pi)(sup+) decay.
NTIS
Finite Difference Theory; Mesons; Phases; Motion

20040076884 NASA Marshall Space Flight Center, Huntsville, AL, USA
Crystallization from Solutions
Chernov, A. A.; January 2004; 1 pp.; In English; European Space Foundation-European Space Agency Workshop, 3-7 May 2004, Obernai, France
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

An overview of earlier published results on crystallization in microgravity of proteins, reolites and slightly soluble salts. Overview of existing directions for future experiments.
Author
Crystallization; Solutions; Microgravity

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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*.

20040076842 Atomic Energy Commission, Oak Ridge, TN, USA
Conference on Shielding of High-Energy Accelerators
December 06, 1957; 225 pp.; In English; Conference on Shielding of High-Energy Accelerators, 11-13 Apr. 1957, New York, NY, USA; See also 20040076843 - 20040076875
Report No.(s): TID-7545; No Copyright; Avail: CASI; A10, Hardcopy

Several reports were processed for inclusion into the NA&SD database from the Conference on Shielding of High-Energy Accelerators, regarding radiation shielding efforts at accelerator facililties and biological radiation effects on mammals.
CASI
Radiation Shielding; Accelerators; Radiation Effects

20040076845 Princeton Univ. Observatory, NJ, USA
Monte Carlo Calculations on the High-energy Radiation Component in the Shield
ONeill, G. K.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 89-91; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

This calculation had as its purpose the estimaUon of the early history of the star-producing component. It was assumed that the attenuation lengths for secondary neutrons could be found from cyclotron experiments. B. K. Harrison set up the calculation, which was run off in about tour weeks by an undergraduate. At the time the work was begun, we hoped that ordinary concrete would suffice as a shield; therefore, only single interactions in a nucleus were considered. For higher Z

materials, such as iron, later work b shows that on the cascade within a given nucleus this assumption is too conservative for particles of I bev or more but should not be seriously off for most of each cascade history. We projected the three space dimensions onto the two dimensions of the median plane and plotted 150 Monte Carlo histories for protons incident on an iron shield at a 45 angle. Protons, neutrons, and mesons were followed, each neutron being followed until an inelastic scattering at E < 20 Mev occurred. Five energy ranges were used between 0.05 and 3 bev. In each cascade interaction 50 Mev was assumed left in nuclear excitation.
Author (revised)
Monte Carlo Method; Radiation Shielding

20040076850 Stanford Univ., Stanford, CA, USA
Stanford University Linear Accelerator
Panofsky, W. K. H.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 55-57; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

I believe that some of the material about the Stanford linear accelerator is of general interest since most of our hazards are basically neutron problems; also, some of our problems are of interest to everybody facing the problem of safe operation with an external beam. I might mention that, in contrast to the figure given by Moyer for protons at the bevatron, the yield of neutrons for our 700-Mev electrons is about 0.2 to 0.3 neutron per electron. The shielding is sufficient so that if the beam is steered properly, the hazards during operation come primarily from the target area and can be minimized by catching the beam in the culverts. It is significant that there is a very large difference in radiation levels depending on the experimental setup. If we use a thin target and "bury" the beam, radiation levels are kept low. If we stop the beam entirely, the levels in the surrounding areas go up by quite a large factor; they run as high as 100 mr/hr at the back of the hill. We try to carry out as many runs as we can under minimum radiation conditions. Most of the counting areas are placed behind a separate shield, and even people who work there regularly are below tolerance at present. We feel, in general, that our shielding design of the machine thus far is adequate.
Author (revised)
Linear Accelerators; Radiation Shielding

20040076863 Harvard Univ., MA, USA
Harvard University Synchrocyclotron
Preston, W. M.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 25-26; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The Harvard synchrocyclotron started operation in 1949. It is located inside a shielding structure of ordinary concrete with walls varying from 3 to 8 ft in thickness and with a roof 5 ft thick. The shield is at the center of the 50- by 78-ft cyclotron building, which has 3-ft ordinary concrete walls and a thin roof. A 20-ton overhead crane permits the shielding to be moved. The control room is in the separate laboratory building. No access to the cyclotron building is permitted during operation of the machine, and all experiments are done by remote controls. Although the machine was designed for somewhat higher energies, for various reasons the maximum operating energy up to last year was 100 Mev. The extracted proton beam, obtained by scattering into a channel, had an intensity of a few times 10(exp 7) protons/sec. Under these conditions the shielding was more than adequate, the fast-neutron flux being far below permissible levels anywhere outside the cyclotron building. After nearly a year's shutdown for revisions, the cyclotron started operating again in the fall of 1956, with a maximum energy of 160 Mev. The external proton beam, which passes through the upper left-hand corner of the shield may reach an intensity of 10(exp 11) protons/ sec. After crossing the corner of the cyclotron building, which serves as the experimental area, the beam is stopped in a concrete blockhouse 20 by 10 by 10 ft. A neutron beam and a polarized proton beam can be brought out through the right-hand shield wall, but their intensity is far lower than that of the unpolarized proton beam.
Author (revised)
Synchrocyclotrons; Radiation Shielding

20040076865 Massachusetts Inst. of Tech., MA, USA
Massachusetts Institute of Technology Electron Synchrotron
Livingston, M. S.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 49; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The Massachusetts Institute of Technology 330-Mev synchrotron accelerates 10 (exp 9) electrons per sec to 330 Mev; 10 per cent of the energy goes into a collimated gamma-ray beam which passes through a shielding wail into an observing room.

All the significant background radiation arises either in the shielding wall or from targets placed in the gamma-ray beam. (The machine is self-shielded since its magnetic return path is outside the orbit radius.) The shield wall in the vicinity of the beam exit port is of lead, 2 ft thick (beam direction), 2 ft high, and 5 ft wide. The rest of the wall is mildly loaded concrete 3 ft thick. When the exit port is plugged up, the wall reduces radiation levels in the observing room to well below tolerance. When the exit port is open, the intensity near the beam catcher at the far side of the observing room is at about tolerance level but is much lower throughout the room. When a target is placed in the beam, the ionization observed with an air ionization chamber at 90 to the beam is about 1 mr/hr; it is somewhat more in directions downstream from the target. In general, it has been very easy to improve the shielding by a large factor whenever a sensitive experiment required it.
Author
Synchrotrons; Radiation Shielding

20040076867 National Bureau of Standards, USA
National Bureau of Standards Electron Synchrotron
Leiss, J. E.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 50-52; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

The electron synchrotron at the National Bureau of Standards is a 60-cycle, 180-Mev machine. It is generally operated with an internal contact target. X-ray yields of up to 0.05 watt/sq. cm at 1 meter from the X-ray target are generally available at our maximum energy; thus it is a machine of fairly high yield. While few careful shielding calculations have been made for our machine, certain shielding problems have occurred which are probably worthy of mention. These problems concern both personnel protection and the usefulness of the machine for experiments. Our most serious shielding problem is to make the accelerator rooms sufficiently clean for experiments. Here we have to consider both our synchrotron and our betatron, which are located in adjacent rooms. To appreciate the shielding problem here, one must consider the types of experimental work done. A large percentage of the experimental work in our laboratory is done with large NaI X-ray detectors. These may be as large as 5 in. in diameter by 9 in. long. In some cases there have been experiments using our betatron when i00-kev X rays were being counted while the synchrotron in the next room was being operated at energies above 100 Mev and with considerably higher yield. By phasing the two machines properly it is possible to be sure that the two yield pulses do not coincide; thus the major problem is due to slow neutrons (in particular to capture gamma rays from slow neutrons). There was a period of time when experiments on the two machines interfered to such an extent that it was not possible to do many experiments with both machines at the same time.
Author (revised)
Synchrotrons; Radiation Shielding

20040076873 Massachusetts Inst. of Tech., MA, USA
Attenuation
Williams, R. W.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 92-95; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

What happens to a high-energy beam in matter? We will concentrate mainly on the latter stages of the cascade, when absorption may be approximately exponential, and also stay mainly in the one-dimensional problem. The electron-photon cascade is the best-known example and is quite instructive. If a suitable power-law spectrum of particles is incident on matter, it will be propagated almost without change of spectral shape and with an absorption length depending on the exponent of the power law. In the practical case of a single incident electron, there is a build-up and then decay of the lower energy electrons; the lower the energy (relative to the primary energy), the more extensive the build-up (energy "diffuses" downward during the progress of the shower).
Derived from text
Electrons; Photon Beams; Cascades; Attenuation

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20040076977 Defence Science and Technology Organisation, Edinburgh, Australia
Using Speech Technology to Improve Transcriptions: An Exploratory Study
Yates, Alex; Cook, Ashley; Hashemi-Sakhtsari, Ahmad; March 2004; 63 pp.; In English
Report No.(s): DSTO-GD-0399; DODA-AR-013-068; Copyright; Avail: CASI; A04, Hardcopy

Modem speech technology is finding many new application areas within Defence. Transcription is one area where speech recognition technology is starting to replace manual methods. This adoption of speech technology is motivated by its potential to save transcribers significant amounts of time and physical effort. As part of their evaluation of military organisations, analysts from the Theatre Operational Analysis (TOA) Group within the Command and Control Division (CZD) transcribe recorded information that has been captured during interviews with Defence personnel. An exploratory study was conducted within TOA Group to look at ways of using commercial speech technology to assist in the transcribing of recorded interview material. This report describes the method used and the results obtained from that study. The report also compares traditional manual transcription approaches with newer approaches that make use of speech recognition technology. The qualitative and quantitative results obtained from this study will help to benchmark the utility of current commercial speech technology used for transcription.
Author
Command and Control; Speech Recognition

20040077170 NASA Ames Research Center, Moffett Field, CA, USA
Environmental Research Aircraft and Sensor Technology-New Technologies for Earth Science
Wegener, Stephen S.; Brass, James; Research and Technology 1999; December 2000, pp. 177; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Environmental Research Aircraft and Sensor Technology (ERAST) project is an Aerospace Technology Enterprise (NASA Headquarters Code R) program designed to provide focus for critical technology development and flight demonstration that reduces the technical and economic risk of using remotely piloted aircraft (RPA) as a means to collect scientific data in a timely and cost-effective manner. A government industry alliance (ERAST) is flying RPA in science missions with 400-pound (lb) (182 kilogram (kg)) payloads to altitudes of 55,000 feet (ft) (16.7 kilometers (km)).
Derived from text
Environmental Laboratories; Environmental Monitoring; Research Aircraft; Technology Assessment

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040075026 College of William and Mary, VA, USA
Space Radiation Effects Laboratory
[1969]; 254 pp.; In English; No Copyright; Avail: CASI; A12, Hardcopy

The SREL User's Handbook is designed to provide information needed by those who plan experiments involving the accelerators at this laboratory. Thus the Handbook will contain information on the properties of the machines, the beam parameters, the facilities and services provided for experimenters, etc. This information will be brought up to date as new equipment is added and modifications accomplished. This Handbook is influenced by the many excellent models prepared at other accelerator laboratories. In particular, the CERN Synchrocyclotron User's Handbook (November 1967) is closely followed in some sections, since the SREL Synchrocyclotron is a duplicate of the CERN machine. We wish to thank Dr. E. G. Michaelis for permission to draw so heavily on his work, particularly in Section II of this Handbook. We hope that the Handbook will prove useful, and will welcome suggestions and criticism.
Author
Laboratories; Extraterrestrial Radiation; Radiation Effects

20040075626 Consulting and Audit Canada, Ottawa, Canada
A Military C2 Professional's Thoughts on Visualization
Alward, Randy G.; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. KN2-1 - KN2-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are many facets to Visualization. The above vignettes are meant to stimulate discussion. Visualization is about enabling the mind of the decision maker, his staffs and knowledge workers in general. Information Technology Systems, indeed the network are but extensions of the mind. Your task is to understand it through observation and experiment, to train it through exercise and simulation, and to provide tools to empower it to visualize. Your work is a critical and necessary

enabler of the information age.Experiences from a command and control specialist are presented. Examples cited relate to electronic warfare and air traffic control.
Derived from text
Visual Perception; Decision Making

20040075697 NASA Marshall Space Flight Center, Huntsville, AL, USA
Comparing NASA and ESA Cost Estimating Methods for Human Missions to Mars
Hunt, Charles D.; vanPelt, Michel O.; March 11, 2004; 18 pp.; In English; International Society of Parametric Analysts 26th Internatuonal Conference, 10-12 May 2004, Frascati, Italy; No Copyright; Avail: CASI; A03, Hardcopy

To compare working methodologies between the cost engineering functions in NASA Marshall Space Flight Center (MSFC) and ESA European Space Research and Technology Centre (ESTEC), as well as to set-up cost engineering capabilities for future manned Mars projects and other studies which involve similar subsystem technologies in MSFC and ESTEC, a demonstration cost estimate exercise was organized. This exercise was a direct way of enhancing not only cooperation between agencies but also both agencies commitment to credible cost analyses. Cost engineers in MSFC and ESTEC independently prepared life-cycle cost estimates for a reference human Mars project and subsequently compared the results and estimate methods in detail. As a non-sensitive, public domain reference case for human Mars projects, the Mars Direct concept was chosen. In this paper the results of the exercise are shown; the differences and similarities in estimate methodologies, philosophies, and databases between MSFC and ESTEC, as well as the estimate results for the Mars Direct concept. The most significant differences are explained and possible estimate improvements identified. In addition, the Mars Direct plan and the extensive cost breakdown structure jointly set-up by MSFC and ESTEC for this concept are presented. It was found that NASA applied estimate models mainly based on historic Apollo and Space Shuttle cost data, taking into account the changes in technology since then. ESA used models mostly based on European satellite and launcher cost data, taking into account the higher equipment and testing standards for human space flight. Most of NASA's and ESA s estimates for the Mars Direct case are comparable, but there are some important, consistent differences in the estimates for: 1) Large Structures and Thermal Control subsystems; 2) System Level Management, Engineering, Product Assurance and Assembly, Integration and Test/Verification activities; 3) Mission Control; 4) Space Agency Program Level activities.
Author (revised)
NASA Space Programs; European Space Agency; Manned Mars Missions; Cost Estimates

20040075715 NASA Ames Research Center, Moffett Field, CA, USA
Star Formation Studies
Hollenbach, D.; Bell, K. R.; Cassen, P.; Research and Technology 1997; September 1998, pp. 116; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Center for Star Formation Studies, a consortium of scientists from the Space Science Division at Ames Research Center (ARC) and the Astronomy Departments of the University of California at Berkeley and Santa Cruz, conducts a coordinated program of theoretical research on star and planet formation. The Center supports postdoctoral fellows, senior visitors, and students; meets regularly at Ames to exchange ideas and to present informal seminars on current research; hosts visits of outside scientists; and conducts a summer week-long workshop on selected aspects of star and planet formation.
Derived from text
Star Formation; Planetary Evolution; Management Planning

20040075772 NASA Ames Research Center, Moffett Field, CA, USA
Surface Movement Advisor
Harke, Stan; Research and Technology 1997; September 1998, pp. 27; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Surface Movement Advisor (SMA) is a joint Federal Aviation Administration (FAA) and NASA project whose purpose is to help current airport facilities operate more efficiently. Currently installed and operation at at Atlanta- Hartsfield International Airport, SMA is demonstrating how advanced information systems technologies can be implemented to improve coordination and planning of ground airport traffic operations.
Author
Air Traffic; Ground Operational Support System; Project Management

20040076979 Defence Science and Technology Organisation, Edinburgh, Australia
Automation, Information Sharing and Shared Situation Awareness
Kardos, Monique; March 2004; 37 pp.; In English
Report No.(s): DSTO-GD-0400; DODA-AR-013-069; Copyright; Avail: Other Sources

Increasingly, the trend for military and other organisations is an increase in automation to improve the efficiency and effectiveness of staff in the workplace. In the military context, automated tools assisting in battlefield visualisation and mission planning may be implemented for these very purposes. Automation may, however, impact on the performance of military teams and affect the situation awareness (SA) necessary for good team functioning. This review examines the potential impacts and benefits of automation on information sharing, SA, planning, and team performance, as well as the concept of measuring SA. Several potential methods for measuring both shared and individual SA in various military contexts (i.e. during field exercises, Command Post Exercises and in laboratory-based experiments) are then briefly outlined. It concludes with a brief discussion of the need for further examination of the impact of automation, the need for training of staff, and the reality of the benefits imparted by the tools themselves.
Author
Automation; Information Dissemination; Performance Prediction

20040077074 NASA Ames Research Center, Moffett Field, CA, USA
Center for Health Applications of Aerospace Related Technologies (CHAART)
Wood, Byron; Beck, Louisa; Lobitz, Brad; Bobo, Matt; Schmidt, Cindy; Zheng, Jian; Research and Technology 1999; December 2000, pp. 163-164; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The goal of the Center for Health Applications of Aerospace Related Technologies (CHAART) is to promote the application of remote sensing (RS), geographic information systems (GIS), and related technologies to issues of human health through education, training, and technology transfer. The primary focus of CHAART in FY99 was to support existing, and develop new, collaborations in the application of RS/GIS to studies of human health and surveillance of infectious diseases. In FY99, CHAART completed another round in the training program for human health investigators. The goals of the training program have been to support human health investigators who integrate RS/GIS into their existing studies, and to facilitate the transfer of RS/GIS technologies to develop sustainable within-country capabilities. With these goals in mind, CHAART participated in several studies of remote sensing of various parasitic and infectious diseases around the world. At the end of FY99, CHAART had received new requests for RS/GIS training from investigators in India, Japan, Korea, Ghana, Ethiopia, Mali, Brazil, and the UK.
Derived from text
Geographic Information Systems; Infectious Diseases; Parasitic Diseases; Remote Sensing; Technology Transfer; Education

20040077077 NASA Ames Research Center, Moffett Field, CA, USA
Fires, Floods, and Deforestation: Disaster Management Using Remote Sensing Technology
Brass, James A.; Ambrosia, Vincent; Higgins, Robert; Research and Technology 1999; December 2000, pp. 170-171; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Worldwide, 70 major disasters requiring international assistance occur each year. These disasters result in 133,000 deaths, 140 million homeless, and $440 billion in property damage. In the last decade, U.S. property loss has averaged $54 billion per year. Obviously, disasters are expensive to manage and they result in destruction to homes and businesses, and loss of commerce and lives. Hazards Program, technology is being developed and tested to support the management mitigation of natural and man-made disasters. In cooperation with the U.S. Forest Service Riverside Fire Laboratory, an aircraft system has been developed to collect visible, infrared, and thermal data for disaster characterization and monitoring. The digital data are compressed onboard the aircraft and sent to the Internet for data distribution and information extraction.
Derived from text
Damage; Destruction; Digital Data; Disasters; Forest Fires; Floods

20040077083 NASA Ames Research Center, Moffett Field, CA, USA
Knowledge Management for Distributed Scientific Project Teams
Keller, Richard; Research and Technology 1999; December 2000, pp. 136; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Managing the information generated during the course of a scientific investigation is both a challenging and an essential task for NASA scientists. During an investigation, experimental records must be kept up-to-date and made accessible to all

members of a scientific team. After an investigation, a thorough set of records is essential for historical documentation, reproducibility, and overall scientific credibility . These information-management requirements are particularly challenging when scientific work is carried out by large, geographically distributed teams, but even for small, collocated teams or individual scientists, knowledge management has become a time-consuming, frustrating exercise. Ames researchers are developing a suite of sophisticated information-sharing tools to address these complex knowledge-management issues.
Derived from text
Information Management; World Wide Web; Data Bases

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20040074379 Lockheed Martin Corp., USA
Document Concurrence System
Muhsin, Mansour; Walters, Ian; June 20, 2003; 2 pp.; In English
Report No.(s): NASA/NP-2003-07-00027-SSC; SSC-00179; No Copyright; Avail: CASI; A01, Hardcopy

The Document Concurrence System is a combination of software modules for routing users' expressions of concurrence with documents. This system enables determination of the current status of concurrences and eliminates the need for the prior practice of manually delivering paper documents to all persons whose approvals were required. This system runs on a server, and participants gain access via personal computers equipped with Web-browser and electronic-mail software. A user can begin a concurrence routing process by logging onto an administration module, naming the approvers and stating the sequence for routing among them, and attaching documents. The server then sends a message to the first person on the list. Upon concurrence by the first person, the system sends a message to the second person, and so forth. A person on the list indicates approval, places the documents on hold, or indicates disapproval, via a Web-based module. When the last person on the list has concurred, a message is sent to the initiator, who can then finalize the process through the administration module. A background process running on the server identifies concurrence processes that are overdue and sends reminders to the appropriate persons.
Author
Computer Programs; Documents; Electronic Mail; Information Flow

20040074484, Coastal Environments, Inc., Baton Rouge, LA, USA
Refining and Revising the Gulf of Mexico Outer Continental Shelf Region High-Probability Mode for Historic Shipwrecks, Final Report. Volume 2: Technical Narrative
Pearson, C. E.; James, S. R.; Krivor, M. C.; El Darragi, S. D.; Cunningham, L. L.; Dec. 2003; In English
Report No.(s): PB2004-104713; No Copyright; Avail: National Technical Information Service (NTIS)

The objectives of this study were defined in the Request for Proposal issued by MMS in April 2000. These objectives are: 1. To update and expand the existing MMS GOMR shipwreck database by examining primary and secondary sources for shipwreck information. The existing shipwreck database will be expanded to include specific identifying characteristics of vessels potentially located on the OCS. 2. To determine the spatial correlation between: (a) shipwreck locations in the updated shipwreck database; (b) recorded seafloor hang sites listed on the MMS GOMR/NOAA sponsored 'Fisherman's Contingency Fund' or other published or private fisherman hang books; and (c) side-scan sonar targets and anomalies representing potential shipwrecks identified during previous OCS lease block surveys. Then, to ground-truth selected locations where hang sites and reported shipwreck locations appear to correlate to determine if hang sites are shipwrecks. 3. To conduct a marine magnetometer survey over several verified shipwreck sites using both the 'industry-standard' proton precession magnetometer and the new cesium magnetometer instrumentation to determine whether there is a significant difference in their performance in detecting shipwrecks. 4. Based on the results from objectives (1), (2), and (3) prepare a revised predictive model for shipwrecks in the GOMR, and recommend survey instrumentation and strategies that would be the most effective in locating these shipwrecks.
NTIS
Data Bases; Surveys; Refining; Ocean Bottom

20040075032 Illinois Univ., Urbana-Champaign, IL, USA
Graduate Student Researchers Program (GSRP)
Westerhoff, John; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NTG8-52912; No Copyright; Avail: CASI; A01, Hardcopy

An advanced concept in in-space transportation currently being studied is the Momentum-Exchange/Electrodynamic Reboost Tether System (MXER). The MXER system is a permanently orbiting platform designed to boost payloads from low earth orbit (LEO). Unlike conventional rockets that use propellants, MXER acts as a large momentum wheel, imparting a Av to a payload at the expense of its own orbital energy. After throwing a payload, the system reboosts itself using an electrodynamic tether to push against Earth s magnetic field and brings itself back up to an operational orbit to prepare for the next payload. The ability to reboost itself allows for continued reuse of the system without the expenditure of propellants. Considering the cost of lifting propellant from the ground to LEO to do the same Av boost at $10000 per pound, the system cuts the launch cost of the payload dramatically, and subsequently, the MXER system pays for itself after a small number of missions. As such, this technology is a valuable addition to NASA s mission for in-space transportation.
Author
Geomagnetism; Momentum; Propellants; Transportation

20040075048 Carnegie-Mellon Univ., Pittsburgh, PA
Information Assurance Science and Engineering Project
Longstaff, Tom; Wing, Jeannette; Mar. 2004; 80 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0523; Proj-IAST
Report No.(s): AD-A422193; AFRL-IF-RS-TR-2004-71; No Copyright; Avail: CASI; A05, Hardcopy

Creation of metrics, methodologies, and tools for the implementation of assurance in information system design and assessment processes. Develop a scientific framework for understanding and developing information assurance systems and for reasoning about the assurance aspects of these systems.
DTIC
Information Systems; Evaluation

20040075057 Commerce Energy NASA NLM Defense Information Cataloging Committee, Washington, DC
Persistent Identification: A Key Component of an E- Government Infrastructure
Mar. 23, 2004; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422869; CENDI-2004-2; No Copyright; Avail: CASI; A03, Hardcopy

As more U.S. federal government information is generated in digital form, it is increasingly important to develop a digital information infrastructure to ensure effective management and access. A key component of this infrastructure is persistent identification of digital information resources. Currently, many government resources do not have any uniform type of identification; individual agencies instead devise their own methods for naming sources such as internal reports, presentations, and other documents. One exception is for information posted on agency World Wide Web sites. These sites make use of Uniform Resource Locators (URLs) to identify specific Web pages and objects. Unfortunately, this approach directly associates the name of the digital object with a physical location. When the object is removed from its original location, the association between the name and the location of the object is "broken" and accessing the original name yields and error message. Broken links are a major barrier to expanding electronic government, since citizens require consistent, reliable, and accurate access to government information on the Web. Current methods ensuring the association between the object and the name require maintenance, and if this is not performed consistently the association remains broken. Addressing this problem requires incorporating methods for creating and maintaining persistent identification as a key component of the Federal Enterprise Architecture.
DTIC
Data Management; Internets; Security

20040075065 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis of the Current Air Force-Specific Status of Resources and Training System (SORTS) Reporting System
Jordan, Tia A.; Mar. 2004; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422896; AFIT/GLM/ENS/04-07; No Copyright; Avail: CASI; A05, Hardcopy

The status of resources and training system (SORTS) is a process that measures the health of units and wings in day-to-day preparedness and the ability to execute a major theater war or other scenario envisioned in the national security strategy. With

talk of the current reporting system not accurately reflecting units readiness, it is time to evaluate the system to identify key problems and re-design the process to better reflect units capabilities. The objective of this thesis was to inform Air Force leadership of the current state of the SORTS system to ensure it was adequate. By surveying current MAJCOM, Wing, Group, and Squadron leadership on their interpretations of how the system works, this thesis will determine if there are common problems that key users have encountered.
DTIC
Command and Control; Data Bases; Education; Information Retrieval; Information Systems

20040075075 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Investigation of the Role of Influence Behaviors in Information System Implementation: A Case Study of the Air Force Institute of Technology School of Engineering and Management Student Academic Support System
King, Mary M.; Mar. 2004; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422918; AFIT/GIR/ENV/04M-13; No Copyright; Avail: CASI; A06, Hardcopy

Organizations implement information systems (IS) for various reasons such as streamlining daily functions and keeping pace with changes in technology. Influence behaviors demonstrated by key leaders in reference to the implementation of such information systems play a key role in their acceptance and success. This research looks at a specific case of IS implementation and the role influence behaviors played in the successfulness of the system. This research is a case study of the Air Force Institute of Technology's (AFIT) implementation of an academic support system called my.afit. edu. Interviews and documentation gathered from key parties involved in the implementation provided a basis for understanding the implementation effort and the effect influence behaviors had on the successfulness. This research showed how the use of positive influence behaviors by key leaders results in a successful implementation effort. In addition to the use of positive influence behaviors by key leaders, the success of the implementation effort is tied to management and implementers and their ability to address user concerns early in the implementation effort.
DTIC
Engineering Management; Information Systems; Management Systems; Students; Support Systems

20040075083 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
List of U.S. Army Research Institute Research and Technical Publications
Simutis, Zita M.; Johnson, Edgar M.; Dec. 1999; 33 pp.; In English
Report No.(s): AD-A422934; No Copyright; Avail: CASI; A03, Hardcopy

The primary responsibility of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to maximize soldier effectiveness. ARI accomplishes its mission through research and development in the acquisition, training, utilization, and retention of Army personnel. ARI research and products affect every Army mission with a human performance component.
DTIC
Military Personnel; Human Performance; Training

20040075195 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Identifying the Benefits of Knowledge Management in the Department of Defense: A Delphi Study
Sasser, David P.; Mar. 2004; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423100; AFIT/GIR/ENV/04M-20; No Copyright; Avail: CASI; A06, Hardcopy

Knowledge Management (KM) has been identified as one of several enablers of the current Transformation effort in the Department of Defense (DoD). Knowledge management is "the attempt to recognize what is essentially a human asset buried in the minds of individuals, and leverage it into an organizational asset that can be accessed and used by a broader set of individuals on whose decisions the firm depends" (Davenport & Prusak, 1998). The ultimate goal of KM is to take advantage of this knowledge asset in order to provide some level of benefit to the organization (Davenport & Prusak, 1998; Nonaka, 1996). However, many in both the military and civilian information resource management communities believe that KM provides nothing beyond what is already accomplished with information management. Given that serious resources are already being committed to KM in the DoD, it follows that identifying the benefits derived from KM from a DoD perspective is highly desirable. Several organizations within the DoD have started using KM and are now interested in identifying and, subsequently, measuring its benefits to gauge success. While many studies have been undertaken to identify the benefits of KM in the commercial sector, similar efforts to investigate the benefits in a DoD context are lacking. Using

a Delphi study involving key DoD KM experts, this research aims to identify the major benefits associated with KM practice from a strictly DoD perspective. (27 tables, 8 figures, 45 refs.)
DTIC
Defense Program; Delphi Method (Forecasting); Identifying

20040075213 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Government Venture Capital: A Case Study of the In- Q-Tel Model
Belko, Michael E.; Mar. 23, 2004; 223 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423132; AFIT/GAQ/ENV/04M-01; No Copyright; Avail: CASI; A10, Hardcopy

The evolution of information technology (IT) has outpaced the federal acquisition system's ability to keep up. And as the USA security strategy increasingly demands information superiority to defeat its enemies, national security institutions cannot afford to lag behind the advancements in IT. The CIA addressed their inability to procure the cutting-edge technologies needed to meet their mission requirements and adopted an innovative acquisition strategy to bridge the gap. They engaged the IT sector through In-Q-Tel, a venture capital firm that invests Agency money in companies that could produce commercially viable technologies to fill the Intelligence Community's (IC) pressing IT shortfalls. This thesis explores two aspects of the In-Q-Tel model, whether In-Q-Tel creates relationships between the IC and promising technology companies that would not have occurred otherwise, and the contributions In-Q-Tel makes to its portfolio companies that contribute to their success. The results of this study suggest that In-Q-Tel has promoted new relationships between the IC and technology firms that were not actively seeking the government market as well as bringing the IC together with technology companies that had viable technology solutions but for various reasons could not connect with the right users within the IC. Findings also show that In-Q-Tel's technical validation of its portfolio companies' products, its established network of investors and technology users within the IC, and the capital provided to fund product development and$or operating expenses are highly valued by its portfolio companies and directly contributed to the companies' success.
DTIC
Communication Networks; Data Acquisition

20040075230 Arizona State Univ., Tempe, AZ
QOS and Control-Theoretic Techniques for Intrusion Tolerance
Ye, Nong; Apr. 2004; 80 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-1-0510; Proj-OIPG
Report No.(s): AD-A423167; AFRL-IF-RS-TR-2004-101; No Copyright; Avail: CASI; A05, Hardcopy

As we increasingly rely on information systems to support a multitude of critical operations, it becomes more and more important that these systems are able to deliver Quality of Service (QoS), even in the face of intrusions. This report examines two host-based resources, a router and a web server, and presents simulated models of modifications that can be made to these resources to make them QoS-capable. Two different QoS models are investigated for the router. The first model implements a router with a feedback control loop that monitors the instantaneous QoS guarantee and adjusts the router's admission control of new requests accordingly. The second router model, called Adjusted Weighted Shortest Processing Time, queues data packets according to a weight which is dependent on their initial priority weight and the amount of time they have awaited service. For the web server, six queuing disciplines are simulated and analyzed for their efficiency in delivering QoS. These disciplines are compared on the basis of selected QoS measurements, including lateness, drop rate, time-in-system and throughput. We find that there is not necessarily one best queuing rule to follow; the appropriate selection depends on the needs of that web server.
DTIC
Architecture (Computers); Computer Networks; Computer Programs; Control Systems Design; Intrusion

20040075236 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Exploring Content Management Issues in Air Force On-Line Communities of Practice: A Multiple Case Study Approach
, Jaime A.; Mar. 23, 2004; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423197; AFIT/GIR/ENV/04M-18; No Copyright; Avail: CASI; A04, Hardcopy

The practice of content management attempts regardless of platform to ensure that pertinent information is current, relevant, and presented in a usable manner. The Air Force Communities of Practice (CoPs) are hosted by AFMC/ DRW, The purpose of these CoPs is to facilitate and promote an environment of capturing and sharing knowledge among members of

a particular field task or common practice. As the host for these CoPs AFMC/DRW desires to increase CoP participation efficiency and effectiveness. Addressing existing or potential content management issues will help do so. This multiple-case study research observed and interviewed managers and members of eight active CoPs busted by AFMC/DRW. This research suggested that the interviewed CoPs currently use no formally documented content management processes. Some CoP members indicated developing formal content management processes and procedures establishing a good taxonomy and better defining roles and responsibilities of content owners may help solve future content management Issues.
DTIC
On-Line Systems

20040075253 National Defense Univ., Washington, DC
The Second Revolution
Stavridis, James; Jan. 1997; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423217; No Copyright; Avail: CASI; A02, Hardcopy

A paradox is emerging as the revolution in military affairs (RMA) moves ahead: the larger the magnitude of the revolution, the greater the possible long-term advantage to a potential enemy. Why? The answer lies in the second revolution. The system of systems--a complete architecture of detection, selection, display, targeting, and attack--will revolutionize war. Related; advances information warfare will complement and enhance the progress made in the first revolution. We will adjust and integrate these developments with new organizations, doctrine, and tactics, techniques, and procedures, many of which will be integrated into the Armed Forces by early in the next century, and other industrialized nations will gradually follow suit. Indeed, some components are already entering service, and others are being aggressively purchased, programmed and researched. Both doctrine and operational concepts are undergoing study and change. Joint Vision 2010 makes it clear the we are on the leading edge of this first revolution, evolving the military for a "challenging and uncertain future." We are moving into the first revolution.
DTIC
Technology Assessment; Warfare

20040075512 Institute for Defense Analyses, Alexandria, VA
Military History: A Selected Bibliography
Murray, Williamson; Mar. 2003; 83 pp.; In English
Contract(s)/Grant(s): DASW01-98-C-0067
Report No.(s): AD-A423012; IDA-D-2877; IDA/HQ-03-001526; No Copyright; Avail: CASI; A05, Hardcopy

Military historian Williamson Murray has prepared this selected bibliography as a guide to the vast body of military histories and as a reading program that could extend our understanding and comprehension of that terrible, yet intriguing, human phenomenon that is war. JAWP) is making it available to those individuals in DoD and the Services who feel that history can shed light on the problems they confront today. The bibliography is derived from the substantial literature on European and American military history The works were chosen for a variety of reasons: quality of scholarship, point of view subject matter, and readability. They are categorized by period and subject matter, and given a rating by the author. The first chapter contains an annotated list of twenty-five books that Dr. Murray considers essential to the library of a warfighter, scholar, or student of military history.
DTIC
Bibliographies

20040075529 President's Commission on Implementation of USA Space Exploration Policy, Washington, DC, USA
A Journey to Inspire, Innovate, and Discover
Aldridge, Edward C., Jr.; Fiorina, Carleton S.; Jackson, Michael P.; Leshin, Laurie A.; Lyles, Lester; Spudis, Paul D.; Tyson, Neil DeGrasse; Walker, Robert S.; Zuber, Maria T.; June 2004; 64 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

On January 14, 2004, President George W. Bush announced a new vision for America s civil space program that calls for human and robotic missions to the Moon, Mars, and beyond. This vision set forth goals of: returning the Space Shuttle safely to flight; completing the International Space Station (ISS); phasing out the Space Shuttle when the ISS is complete (about 2010); sending a robotic orbiter and lander to the Moon; sending a human expedition to the Moon as early as 2015, but no later than 2020; conducting robotic missions to Mars in preparation for a future human expedition; and conducting robotic exploration across the solar system. Such a focus for the American space program has not existed since the Apollo era and establishes a much-needed direction and purpose for our national space efforts. While discovery is the goal of space

exploration, the Commission is certain that the benefits here on Earth will make the journey at least as important as the destination. The long-term, ambitious space agenda advanced by the President for robotic and human exploration will significantly help the USA protect its technological leadership, economic vitality, and security. This ambitious path of exploration and the achievements made along the way will inspire the nation s youth, yield scientific breakthroughs, create high technology jobs, improve our industrial competitiveness, demonstrate America s leadership, and improve prosperity and the quality of life for all Americans. To sustain this program over many Presidential Administrations and Congressional sessions, our leaders must routinely explain and demonstrate the value, affordability, and credibility of the program to all Americans so that they accept ownership of it. The President has projected the annual resources available to NASA at roughly the same level as in the past, growing only slightly in the coming years. Within these annual levels, the journey will need to be managed within available resources using a "go as you can pay" approach, which allows specific exploration goals to be adjusted as technology advances and periodic milestones are achieved.
Derived from text
Presidential Reports; Space Transportation System Flights; Security; Solar System; Space Exploration

20040075548 University of Southern California, Baton Rouge, LA, USA
An Automated Approach to Reasoning Under Multiple Perspectives
deBessonet, Cary; 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG2-1468; No Copyright; Avail: CASI; A01, Hardcopy

This is the final report with emphasis on research during the last term. The context for the research has been the development of an automated reasoning technology for use in SMS (symbolic Manipulation System), a system used to build and query knowledge bases (KBs) using a special knowledge representation language SL (Symbolic Language). SMS interpreters assertive SL input and enters the results as components of its universe. The system operates in two basic models: 1) constructive mode (for building KBs); and 2) query/search mode (for querying KBs). Query satisfaction consists of matching query components with KB components. The system allows "penumbral matches," that is, matches that do not exactly meet the specifications of the query, but which are deemed relevant for the conversational context. If the user wants to know whether SMS has information that holds, say, for "any chow," the scope of relevancy might be set so that the system would respond based on a finding that it has information that holds for "most dogs," although this is not exactly what was called for by the query. The response would be qualified accordingly, as would normally be the case in ordinary human conversation. The general goal of the research was to develop an approach by which assertive content could be interpreted from multiple perspectives so that reasoning operations could be successfully conducted over the results. The interpretation of an SL statement such as, "{person believes [captain (asserted (perhaps)) (astronaut saw (comet (bright)))]}," which in English would amount to asserting something to the effect that, "Some person believes that a captain perhaps asserted that an astronaut saw a bright comet," would require the recognition of multiple perspectives, including some that are: a) epistemically-based (focusing on "believes"); b) assertion-based (focusing on "asserted"); c) perception-based (focusing on "saw"); d) adjectivally-based (focusing on "bight"); and e) modally-based (focusing on "perhaps"). Any conclusion reached under a line of reasoning that employs such an assertion or its associated implications should somehow reflect the employed perspectives. The investigators made significant progress in developing an approach that would enable a system to conduct reasoning operations over assertions of this kind while maintaining consistency in its knowledge bases. Significant accomplishments were made in the areas of: 1) integration and inferencing; 2) generation of perspectives, including wholistic ad composite views; and 3) consistency maintenance.
Author
Comets; Consistency; Knowledge Representation; Technology Utilization

20040075551 Congress of the USA, Washington, DC, USA
National Aeronautics and Space Administration Authorization Act, Fiscal Year 1989
November 17, 1988; 21 pp.; In English
Report No.(s): Pub-Law-100-685; No Copyright; Avail: CASI; A03, Hardcopy

To authorize appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes. Title I. National Aeronautics and Space Capital Development Program: Findings. Report on long-range Space Capital Development Program plan. Budget increase. Budget request. Title II. Fiscal year 1989 NASA and multiyear Space Station authorization: Authorization. Construction of facilities reprogramming. Special reprogramming authority for construction of facilities. Limitation on authority. Geographical distribution of research funds. Arrest authority. Advanced solid

rocket motor authority. Studies on microgravity research capability. Buy american. International space docking capability. John C. Stennis Space Center. Outer solar system exploration. Commercial space launch act authorization. Drug-free workplace. Space settlement
Derived from text
Congressional Reports; Integrated Mission Control Center; Space Commercialization; Space Programs

20040075605 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Enabling Technology for New Planning and Scheduling Paradigms
Jaap, John; Davis, Elizabeth; [2004]; 29 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: CASI; A03, Hardcopy

The Night Projects Directorate at NASA's Marshall Space Flight Center is developing a new planning and scheduling environment and a new scheduling algorithm to enable a paradigm shift in planning and scheduling concepts. Over the past 33 years Marshall has developed and evolved a paradigm for generating payload timelines for Skylab, Spacelab, various other Shuttle payloads, and the International Space Station. The current paradigm starts by collecting the requirements, called ?ask models," from the scientists and technologists for the tasks that are to be scheduled. Because of shortcomings in the current modeling schema, some requirements are entered as notes. Next, a cadre with knowledge of vehicle and hardware modifies these models to encompass and be compatible with the hardware model; again, notes are added when the modeling schema does not provide a better way to represent the requirements. Finally, the models are modified to be compatible with the scheduling engine. Then the models are submitted to the scheduling engine for automatic scheduling or, when requirements are expressed in notes, the timeline is built manually. A future paradigm would provide a scheduling engine that accepts separate science models and hardware models. The modeling schema would have the capability to represent all the requirements without resorting to notes. Furthermore, the scheduling engine would not require that the models be modified to account for the capabilities (limitations) of the scheduling engine. The enabling technology under development at Marshall has three major components: (1) A new modeling schema allows expressing all the requirements of the tasks without resorting to notes or awkward contrivances. The chosen modeling schema is both maximally expressive and easy to use. It utilizes graphical methods to show hierarchies of task constraints and networks of temporal relationships. (2) A new scheduling algorithm automatically schedules the models without the intervention of a scheduling expert. The algorithm is tuned for the constraint hierarchies and the complex temporal relationships provided by the modeling schema. It has an extensive search algorithm that can exploit timing flexibilities and constraint and relationship options. (3) An innovative architecture allows multiple remote users to simultaneously model science and technology requirements and other users to model vehicle and hardware characteristics. The architecture allows the remote users to submit scheduling requests directly to the scheduling engine and immediately see the results. These three components are integrated so that science and technology experts with no knowledge of the vehicle or hardware subsystems and no knowledge of the internal workings of the scheduling engine have the ability to build and submit scheduling requests and see the results. The immediate feedback will hone the users' modeling skills and ultimately enable them to produce the desired timeline. This paper summarizes the three components of the enabling technology and describes how this technology would make a new paradigm possible.
Author
Planning; Scheduling; Algorithms; Technological Forecasting; Space Shuttle Payloads

20040075607 NASA Marshall Space Flight Center, Huntsville, AL, USA
Test Planning Approach and Lessons
Parkinson, Douglas A.; Brown, Kendall K.; April 1, 2004; 10 pp.; In English; 52nd JANNAF Conference, 10-13 May 2004, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS8-01107; No Copyright; Avail: CASI; A02, Hardcopy

As NASA began technology risk reduction activities and planning for the next generation launch vehicle under the Space Launch Initiative (SLI), now the Next Generation Launch Technology (NGLT) Program, a review of past large liquid rocket engine development programs was performed. The intent of the review was to identify any significant lessons from the development testing programs that could be applied to current and future engine development programs. Because the primary prototype engine in design at the time of this study was the Boeing-Rocketdyne RS-84, the study was slightly biased towards LOX/RP-1 liquid propellant engines. However, the significant lessons identified are universal. It is anticipated that these lessons will serve as a reference for test planning in the Engine Systems Group at Marshall Space Flight Center (MSFC). Towards the end of F-1 and J-2 engine development testing, NASA/MSFC asked Rocketdyne to review those test programs. The result was a document titled, Study to Accelerate Development by Test of a Rocket Engine (R-8099). The "intent (of this study) is to apply this thinking and learning to more efficiently develop rocket engines to high reliability with improved

cost effectivenes" Additionally, several other engine programs were reviewed - such as SSME, NSTS, STME, MC-1, and RS-83- to support or refute the R-8099. R-8099 revealed two primary lessons for test planning, which were supported by the other engine development programs. First, engine development programs can benefit from arranging the test program for engine system testing as early as feasible. The best test for determining environments is at the system level, the closest to the operational flight environment. Secondly, the component testing, which tends to be elaborate, should instead be geared towards reducing risk to enable system test. Technical risk can be reduced at the component level, but the design can only be truly verified and validated after engine system testing.
Author
Engine Design; Engine Tests; Launch Vehicles; Liquid Propellant Rocket Engines; Planning; Space Shuttle Main Engine; Technological Forecasting

20040075615 Research and Technology Organization, Neuilly-sur-Seine, France
Massive Military Data Fusion and Visualisation: Users Talk with Developers
April 2004; 226 pp.; In English; Massive Military Data Fusion and Visualisation: Users Talk with Developers, 10-13 Sep. 2002, Halden, Norway; See also 20040075616 - 20040075639
Report No.(s): RTO-MP-105; AC/323(IST-036)TP/20; Copyright; Avail: CASI; C01, CD-ROM; A11, Hardcopy

The initiating NATO research group IST-021/RTG-007 (Multimedia Visualisation of Massive Military Data Sets) argues that visualisation is a lot more than the display of graphics on computer screens. Visualisation happens in the head of the user, and effective visualisation displays might be textual or pictorial, and might involve other modalities in addition to the visual. In its thinking about visualisation, IST-021/RTG-007 uses a reference model based on a three-level feedback process (see www.vistg.net). The participants at ITS-036/RWS-005 military users, system developers, and human factor scientists addressed the main issue of human information overload , but by disparate approaches. Data fusion uses algorithmic data reduction, whereas visualisation deals with displaying the data in comprehensible form. Presentations by experts in data fusion indicated that visualisation might have a much broader influence than just better presenting the outputs of data fusion algorithms; one example is to improve the human ability to direct sensor- and computer-resources.
Derived from text
Multisensor Fusion; Visual Perception; Decision Making; Information Systems

20040075620 MEDAV G.m.b.H., Uttenreuth, Germany
Information Visualisation, Counterterror Intelligence
Towsey, Michael; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 54-1 - 54-12; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The participants in Syndicate 4 were Denis Gouin, Zachary Jacobson, Kesh Kesavadas, Hans Joachim Kolb, Vincent Taylor, Johan Carsten Thiis and David Zeltzer. Portions of this report were authored by Michael Towsey. By consensus, the members of the Syndicate selected the broad area of information visualization as the topic of interest. In general, it is agreed that information visualization refers to the presentation of non-physical data with no obvious 3D referents, as typified, for example, by multidimensional sonar or financial data; concepts embodied in documents and the relationships among them, or the morale and readiness of military units. It was felt that the mission of the Syndicate was to: 1) Identify information visualisation issues in application domains of importance to NATO; 2) Identify and characterize the required capabilities and available technologies that address those domains; 3) Recommend research and development priorities with respect to the technologies involved. A number of application domains were considered, but due to the short time available to the Syndicate, this list was reduced to four, and ultimately only one application domain counterterror intelligence was addressed. This area is clearly of high priority to NATO, and at the same time, it is largely characterized by non-physical types of data that are problematic to present, and so counterterror intelligence is well-suited to consideration by Syndicate 4.
Author
Military Operations; Terrorism; Scientific Visualization; Visual Stimuli

20040075621 Swedish Defence Research Establishment, Linkoeping, Sweden
Information Taxonomy for Presentation, Selection and Design
Alne, Sveinung; Jungert, Erland; Utne, Kjetil; Harvey, Peter; Proulx, Pascale; Chipman, Susan; White, Dennis; Smestad, Tore; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 55-1 - 55-7; In English; See also 20040075615; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This report contains the ideas shared during our syndicate sessions. We tried to use these few hours of brainstorming to come up with guidelines about how to improve future visualization techniques to address military issues. The results of our discussions consist of a) Advice on how the industry, the research community and user representatives should work together to best serve the military needs; b) A preliminary look at how sensors and weapons capabilities, performance and constraints could be presented; c) Additional areas of research that were identified while considering military issues, and d) Some guidelines about how to evaluate a visualization tool.
Author
Scientific Visualization; Information Theory; Taxonomy

20040075622 Consulting and Audit Canada, Ottawa, Canada
Personal Decision Support Aids for Special Operations
Alward, Randy; Fricker, Liz; Kaster, Annette; Steinberg, Alan; Hjelmstad, Jens; Rasmussen, Per Husmann; CarlosdaSilvaVerissimo, Jose; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 51-1 - 51-13; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Syndicate 1 identified three criteria upon which to guide its work; the subject must be useful to NATO, it should have a counter-terrorism focus given recent events and it should produce results within 18 months. In response, a concept was developed to provide powerful improvements in capability for NATO teams of special operations soldiers, applicable to counter-terrorism and a diversity of other operational missions. The goal is to facilitate coordinated action within a small unit and to provide improved situation awareness to the individual soldiers.
Author
Decision Support Systems; Military Personnel; Military Operations

20040075623 Danish Defence Research Establishment, Copenhagen, Denmark
NATO Task Group on Information Fusion
Rasmussen, Per Husmann; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 13-1 - 13-5; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Task Group on Information Fusion (TgonIF) is a task group affiliated to the NATO Research Technology Organisation (RTO) / Information Systems Technology (IST) Panel. The task group is addressing the importance and difficulty of fusing the always increasing variety and quantity of information produced by the full spectrum of sensors and sources during the ever changing type of military operations. The first part of this report is a slightly updated version of the official status report made by the chairman of the task group, Gaetan Thibault from DRDC (Valcartier), Canada, and presented at the 9th IST Panel Business meeting taking place 30-31 May 2002 in Estoril Portugal. The second part is a sample of examples taken from a course in Intelligence for OOTW given by WOl Dave Steer, Defence Intelligence and Security Centre, Chicksands, UK.
Author (revised)
North Atlantic Treaty Organization (NATO); Multisensor Fusion

20040075624 Health Canada, Canada
VITA in Use: Technology Watch
Jacobson, Zachary; McIntyre, S. G.; Romet, Tiit; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 16-1 - 16-6; In English; See also 20040075615; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The potential wealth to be discovered from mining large data sets or electronic text files for nuggets of knowledge is an alluring prospect. Textual displays, however, do not lend themselves easily to the task as the results still require reading and analysis before the analyst/user can acquire new knowledge from the information therein. Visual displays, on the other hand, attempt to perform some of the preliminary cognitive analysis. VITA, a 'Visual Interface for Text Analysis', is a 3-dimensional paradigm to identify the relations found among meanings or concepts represented in the elements in large text corpora. The paradigm has been realized as a working software application used to direct computer-based document searches. It allows a user, via mouse and keyboard action, to interact with search mechanisms - e.g. search engines on the Internet, such as Google and AltaVista - to present visually the sets and relationships of documents. VITA has control features that allow visual clustering of like documents, thus enabling quick refinement of the search process. The visual features of VITA also support the observation and investigation of the, sometimes unexpected, relationships among documents. VITA can also be used to

help in reducing document search complexity. Originally conceptualized as a response to the problem of comprehending the results of large computer-based document searches, VITA has the potential for broader applications in text mining and knowledge discovery. One such application is Technology Watch. 'Tech Watch' is a methodology used to identify technology trends and make strategic investments in science and technology research and procurement. It looks for strengths, gaps and trends within the national and international technology scenes to incorporate into long-term planning. Defence R&D Canada is investigating various tools for potential use in their Tech Watch project and proposed that VITA demonstrate its applicability for this problem. This paper shows how VITA responded in the practical situation and discusses how it might be adapted to future Tech Watch problems.
Author
Data Mining; Texts; Applications Programs (Computers); Internet Resources

20040075625 Norwegian Battle Lab. and Experimentation, Bodo, Norway
Future Decision Centre (FDC)
Johansen, Tom; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. KN1-1 - KN1-4; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Future Decision Centre (FDC) enables Display of Several Databases (fused together) in a 3-D Map System, in such a way that the information is intuitively understandable for Decision markers from both Military Commands & Civilian Crisis Management Institutions/Organisations. Today there is a Challenge for Decision Makers on Strategic & Operational Levels to get a sufficient grasp of the situation (awareness) at the Level. At the same time the Strategic and/or Operational Level sometimes has a need to engage (or to be kept Updated) directly on Tactical Scenarios/Operations. The FDC enables this kind of Scenarios Diving , without loosing Track of the overall picture. The overwhelming amount of Information on all Levels creates a Demand of Fuse Databases into one Recognized picture, which at all times is directly relevant to the Scenario the audience is observing. The FDC aims at creating such a Picture, and is able to present it on a FDC Table . Also there is a Challenge to improve the Land Picture, and it is clearly unbalanced when it is compared to Sea/Air Picture. The FDC does not directly improve this unbalance, but indirectly contribute to improve this Picture, as it intends to fuse different scenarios into one COP.
Author
Data Bases; Decision Making

20040075632 MEDAV G.m.b.H., Uttenreuth, Germany
Approaches to the Evaluation of Intelligence. Massive Military Data Fusion and Visualisation: Users Talk with Developers
Kolb, Hans-Joachim; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. 14-1 - 14-3; In English; See also 20040075615; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Traditionally, intelligence gathering has involved three areas of technology: sensor and signal processing, database technology and evaluation technology. The current pace of globalization, the rapid penetration of Internet usage and continuing advances in sensor sophistication mean that vast amounts of information are being gathered, as never before. Traditional intelligence processing methods are feeling the strain. MEDAV GmbH is a developer of intelligence processing hardware and software. For the past 20 years, we have been engaged in studies and commercial projects for the German Federal Armed Forces and for other German and international government agencies. Our business is to predict and respond rapidly to the needs of the intelligence community. Over the past 20 years, MEDAV has developed integrated intelligence processing packages, that acquire, automatically evaluate, archive and interactively evaluate both signals and text documents.
Derived from text
Military Operations; Multisensor Fusion; Data Processing

20040075633 Office of Naval Research, USA
Data Source Discovery in Coalition Operations
Barton, Robert J., III; Hall, David; Pack, Robert; Silvervarg, Karin; Bjoerke, Jan Terje; Taylor, Martin; Massive Military Data Fusion and Visualisation: Users Talk with Developers; April 2004, pp. S2-1 - S2-11; In English; See also 20040075615; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The group addressed the issue of information and data source discovery in a real-time NATO or coalition operational

environment. The group analyzed a conceptual approach to the design of an interactive visualization system to be used for data resource discovery. Needs and requirements are discussed through a process of answering (in part) six key questions that would guide system design. The group chose a use-case for illustration. The group concludes by recommending that the issue of data resource discovery, understanding, and availability in a NATO operation be further studied.
Author
Data Mining; Military Operations; Information Systems

20040075649 NASA, Washington, DC, USA
Aerospace Technology Enterprise
January 2004; 83 pp.; In English
Report No.(s): NASA-NP-2003-06-306-HQ; No Copyright; Avail: CASI; A05, Hardcopy

Topics considered include: 1. The NASA vision. To improve life here; to extend life to there; and to find life beyond. 2. The NASA mission. To understand and protect our home planet; to explore the universe and search for life; and to inspire the next generation of explorers ... as only NASA can.
CASI
Aerospace Engineering; Aerospace Sciences; NASA Space Programs

20040075842 General Accounting Office, Washington, DC
Information Technology: Homeland Security Should Better Balance Need for System Integration Strategy with Spending for New and Enhanced Systems
May 2004; 34 pp.; In English
Report No.(s): PB2004-105511; GAO-04-509; No Copyright; Avail: CASI; A03, Hardcopy

The Department of Homeland Security (DHS) faces the daunting task of bringing together 22 diverse agencies to lead efforts to protect the homeland. Among the challenges posed by this transformation is integrating these agencies' diverse information technology (IT) systems: mission support, administration, and infrastructure (e.g., networks). GAO was asked to determine (1) whether DHS has defined its IT systems integration strategy and (2) how DHS is ensuring that IT investments made by component agencies (specifically focusing on the Federal Emergency Management Agency, the Transportation Security Administration, and the Coast Guard) are aligned with the department's strategic direction.
NTIS
Systems Engineering; Financial Management; Information Management; Systems Integration; Transportation

20040075904 Oak Ridge National Lab., TN
Cross-Cutting Studies and State-of-the-Practice Reviews: Archive and Use of ITS-Generated Data
Hu, P.; Boundy, B.; Truett, T.; Chang, E.; Gordon, S.; Apr. 30, 2002; In English
Report No.(s): DE2003-814082; ORNL/TM-2002/120; No Copyright; Avail: National Technical Information Service (NTIS)

Intelligent Transportation Systems (ITS) provide and use information about transportation conditions to improve system performance in such areas as safety, mobility, efficiency and environmental impacts. Typically, ITS generates massive amounts of data about the state of travel that are used primarily by transportation authorities to effectively operate and manage their transportation systems, and by private individuals and industry to manage trips. These primary uses provide short-term, real-time information regarding the transportation systems current conditions and driver and passenger choices. A broad spectrum of stakeholders could benefit from ITS-generated data to meet their data needs in planning, operations and maintenance, administration, training, modeling, simulations, and development of control strategies. In the context of ADUS, the term 'ITS-generated data' refers to those data generated by ITS that are primarily used 'in managing system operations and providing information on system conditions and choices to the public.' Specifically, ADUS refers to data generated from any one of the nine components that make up the ITS infrastructure: (1) freeway management, (2) incident management, (3) arterial management, (4) electronic fare payment, (5) electronic toll collection, (6) transit management, (7) highway-rail intersections, (8) emergency management, and (9) regional multimodal traveler information.
NTIS
Information Systems; Transportation; Simulation

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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.

20040075884 NASA Marshall Space Flight Center, Huntsville, AL, USA
Film Processing Module for Automated Fiber Placement
Hulcher, A. Bruce; [2004]; 22 pp.; In English; SAMPE Conference, 19 May 2004, Long Beach, CA, USA
Contract(s)/Grant(s): 09-26-RD-00-EV-00; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation describes fiber placement technology which was originally developed by Marshall Space Flight Center (MSFC) for the fabrication of fiber composite propellant tanks. The presentation includes an image of the MSFC Fiber Placement Machine, which is a prototype test bed, and images of some of the machine's parts. Some possible applications for the machines are listed.
CASI
Fabrication; Fiber Composites; Test Stands

20040077146 NASA Ames Research Center, Moffett Field, CA, USA
Urban Dynamics: Analyzing Land Use Change in Urban Environments
Acevedo, William; Richards, Lora R.; Buchanan, Janis T.; Wegener, Whitney R.; Research and Technology 1999; December 2000, pp. 174-175; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In FY99, the Earth Resource Observation System (EROS) staff at Ames continued managing the U.S. Geological Survey's (USGS) Urban Dynamics Research program, which has mapping and analysis activities at five USGS mapping centers. Historic land use reconstruction work continued while activities in geographic analysis and modeling were expanded. Retrospective geographic information system (GIS) development - the spatial reconstruction of a region's urban land-use history - focused on the Detroit River Corridor, California's Central Valley, and the city of Sioux Falls, South Dakota.
Derived from text
Land Use; Cities; Geographic Information Systems; Urban Research

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SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20040076955 NASA Marshall Space Flight Center, Huntsville, AL, USA
The GLAST Burst Monitor
Meegan, Charles A.; 2004; 1 pp.; In English; American Physical Society Meeting 2004, 1-4 May 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Gamma Ray Large Area Space Telescope (GLAST) observatory, scheduled for launch in 2007, comprises the Large Area Telescope (LAT) and the GLAST Burst Monitor (GBM). spectral changes that are known to occur within GRBs. between the NASA Marshall Space Flight Center, the University of Alabama in Huntsville, and the Max Planck Institute for Extraterrestrial Physics. It consists of an array of NaI and BGO scintillation detectors operating in the 10 kev to 25 MeV range. The field of view includes the entire unocculted sky when the observatory is pointing close to the zenith. The GBM will enhance LAT observations of GRBs by extending the spectral coverage into the range of current GRB databases, and will provide a trigger for reorienting the spacecraft to observe delayed emission from bursts outside the LAT field of view. GBM is expected to trigger on about 200 bursts per year, and will provide on-board locations of strong bursts accurate to better than 10 degrees.
Author
Gamma Rays; Gamma Ray Telescopes; Gamma Ray Bursts; Electric Potential; Launching; Field of View; Electrical Measurement

20040077130 NASA Ames Research Center, Moffett Field, CA, USA

Identification of Hydrocarbons in the Diffuse Interstellar Medium

Pendleton, Yvonne J.; Allamandola, Louis J.; Research and Technology 1999; December 2000, pp. 114-115; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Of relevance to both astrophysics and astrobiology is the nature and evolution of organic material in the interstellar medium (ISM), because the "final" material available for incorporation into planetary systems will determine, in part, the composition of primitive planetesimal bodies, including those capable of delivering organic material to planets within habitable zones. One interstellar feature of primary relevance, the 3.4-micron hydrocarbon absorption band, has been the focus of a recent investigation into the origin and evolution of the carbonaceous component of the diffuse ISM. The remarkable similarity of the interstellar 3.4-micron band to that seen in the extract of carbonaceous meteorites has further spurred the interest in the origin of the -CH2- and -CH3 groups that result in the interstellar band. Organic residues created in the laboratory, through the energetic processing of ice mixtures and through electric discharge experiments on hydrocarbon plasmas, have resulted in many claims of spectral matches to the interstellar 3.4-micron band. The laboratory work has been essential in revealing much about the nature of the carrier, and there is consensus that the interstellar band arises from saturated aliphatic hydrocarbons. However, the exact identity of the species responsible for the interstellar band has not yet been revealed. In an effort to further constrain the properties of the true carrier of the interstellar bands, the 3.4-micron laboratory band has been investigated further through the compilation of a database of hydrocarbon candidates from astrophysics laboratories around the world. The laboratory candidates have been compared in detail over the 2- to 9-micron range to the interstellar data from ground-based, airborne, and space observations. Many candidate materials can now be ruled out on the basis of constraints placed upon them from the interstellar data. The interstellar line of sight used in this comparison is toward a star that lies behind the primarily diffuse interstellar medium dust; therefore, contributions from dense molecular cloud ices are insignificant. The Infrared Space Observatory has provided a comprehensive view of this sight line, and it reveals the absence of any strong absorption bands in the 5- to 8-micron portion of the interstellar spectrum. The upper limit of the hydrocarbon bands in the 5- to 8-micron region to those detected at 3.4 microns provides useful constraints upon the laboratory residues. Most of the laboratory residues yield large absorptions in the 5- to 8-micron region, especially those produced through the processing of ices. The most likely candidates remaining are those produced through plasma processing of hydrocarbons. This finding is consistent with recent reports of the 3.4-micron hydrocarbon absorption detected in the outflow of a carbon star rich in the acetylene C2H2) molecule. Observations of additional interstellar lines of sight through diffuse interstellar medium dust and additional laboratory experiments aimed at the questions posed in this study will be the next steps along the path toward identifying the hydrocarbons in the diffuse ISM. Dust from the diffuse ISM is incorporated into dense molecular clouds, out of which the next generation of stars and planetary systems form. Identification of the diffuse ISM hydrocarbons, which appear so similar to those seen in carbonaceous meteorites, is important to pursue.

Derived from text

Hydrocarbons; Interstellar Matter; Organic Materials; Astrophysics; Solar System

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040074344 Alabama Univ., Huntsville, AL, USA

Thermal Iron K and Alpha: Line Emission from the X-Ray Binary GX 339-4

Xu, Y. D.; Zhang, S. N.; Zhang, X. L.; Liu, D. B.; Chen, L.; Xu, H. G.; You, J. H.; New Astronomy; August 2003; Volume 8, No. 6, pp. 575-580; In English

Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

The accretion rate of the black hole candidate X-ray binary GX 339-4 in the ‘off’ state is low, and an advection dominated accretion flow (ADAF) is present. Hydrogen-like and helium-like iron Kbalpha; emission lines at 6.7 and 6.95 keV from hot plasma of ADAF can be produced by recombination-cascade processes with moderately high intensities, which are markedly distinguished from the fluorescent iron Kα line at approximately 6.4 keV. We show that the observational features of GX 339-4 can be explained by the ADAF model, if the iron abundance is more than 10 times the solar value, though the reason for such a high abundance is still unclear. We suggest that the increase of the accretion rate makes GX 339-4 change from off, low, intermediate, to high and very high states, and the line center of iron Kbalpha; will therefore shift from

approximately 6.83 to approximately 6.4 keV, i.e. to the fluorescent disc-line, since the disappearance of the ADAF due to its high accretion rate.
Author
Emission Spectra; Iron; K Lines; X Ray Binaries; High Temperature Plasmas; Black Holes (Astronomy)

20040074345 Alabama Univ., Huntsville, AL, USA
A New Method to Resolve X-Ray Halos around Point Sources with Chandra Data and Its Application to Cygnus X-1
Yao, Yangsen; Zhang, Shuang Nan; Zhang, Xiao-Ling; Feng, Yu-Xin; The Astrophysical Journal; September 2003; Volume 594, No. 1, pp. L43-L46; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

With excellent angular resolution, good energy resolution, and a broad energy band, the Chandra Advanced CCD Imaging Spectrometer (ACIS) is the best instrument for studying the X-ray halos around some Galactic X-ray point sources caused by the dust scattering of X-rays in the interstellar medium. However, the direct images of bright sources obtained with the ACIS usually suffer from severe pileup. Making use of the fact that an isotropic image could be reconstructed from its projection in to any direction, we can reconstruct the images of the X-ray halos from the data obtained with the High Energy Transition Grating Spectrometer (HETGS) and/or in continuos clocking (CC) mode. These data have no or less serious pileup and enable us to take full advantage of the excellent angular resolution of Chandra. With the reconstructed high-resolution images, we can probe the X-ray halos as close as 1" to their associated point sources. Applying this method to Cygnus X-1 observed with the Chandra HETGS in CC mode, we derived an energy-dependent radial halo flux distribution and concluded that in a circular region (2' in radius) centered a the point source: (1) relative to the total intensity, the fractional halo intensity is about 15% at keV and drops to aboout 5% at approximately 6 keV (2) about 50% of the halo photons are within the region of a radius less than 40 inches and (3) the spectrum of the pooint source is slightly distorted by the halo contamination.
Author
Halos; X Ray Binaries; Point Sources; CCD Cameras; X Ray Astrophysics Facility; Imaging Spectrometers

20040074346 Hong Kong Polytechnic, Kowloon, Hong Kong
Does the Iron K and Alpha: Line of Active Galactic Nuclei Arise from the Cerenkov Line-like Radiation?
You, J. H.; Liu, D. B.; Chen, W. P.; Chen, L.; Zhang, S. N.; The Astrophysical Journal; December 2003; Volume 599, No. 1, pp. 164-172; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

When thermal relativistic electrons with isotropic distribution of velocities move in a gas region or impinge upon the surface of a cloud that consists of a dense gas or doped dusts, the Cerenkov effect produces peculiar atomic or ionic emission lines, which is known as the Cerenkov line - like radiation. This newly recognized emission mechanism may find wide applications in high-energy astrophysics. In this paper we tentatively adopt this new line emission mechanism to discuss the origin of the iron Kα feature of active galactic nuclei (AGNs). The motivation of this research is to attempt a solution to a problem encountered by the "disk fluorescence line" model, i.e. , the lack of temporal response of the observed iron Kα line flux to the changes of the X-ray continuum flux. If the Cerenkov line emission is indeed responsible significant ly for the iron Kα feature, the conventional scenario around the central supermassive black holes of AGNs would need to be modified to accomodate more energetic, more violent, and much denser environments than previously thought.
Author
Active Galactic Nuclei; Cerenkov Radiation; Iron; K Lines; Line Spectra; Astrophysics

20040074454 Johns Hopkins Univ., Baltimore, MD, USA
Central Stars of Planetary Nebulae in the LMC
Bianchi, Luciana; May 31, 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10364; No Copyright; Avail: CASI; A01, Hardcopy

In FUSE cycle 2's program B001 we studied Central Stars of Planetary Nebulae (CSPN) in the Large Magellanic Could. All FUSE observations have been successfully completed and have been reduced, analyzed and published. The analysis and the results are summarized below. The FUSE data were reduced using the latest available version of the FUSE calibration pipeline (CALFUSE v2.2.2). The flux of these LMC post-AGB objects is at the threshold of FUSE's sensitivity, and thus special care in the background subtraction was needed during the reduction. Because of their faintness, the targets required many orbit-long exposures, each of which typically had low (target) count-rates. Each calibrated extracted sequence was

checked for unacceptable count-rate variations (a sign of detector drift), misplaced extraction windows, and other anomalies. All the good calibrated exposures were combined using FUSE pipeline routines. The default FUSE pipeline attempts to model the background measured off-target and subtracts it from the target spectrum. We found that, for these faint objects, the background appeared to be over-estimated by this method, particularly at shorter wavelengths (i.e., < 1000 A). We therefore tried two other reductions. In the first method, subtraction of the measured background is turned off and and the background is taken to be the model scattered-light scaled by the exposure time. In the second one, the first few steps of the pipeline were run on the individual exposures (correcting for effects unique to each exposure such as Doppler shift, grating motions, etc). Then the photon lists from the individual exposures were combined, and the remaining steps of the pipeline run on the combined file. Thus, more total counts for both the target and background allowed for a better extraction.
Author
Stars; Planetary Nebulae; Magellanic Clouds; Ultraviolet Astronomy

20040074456 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Gas Density Discontinuities in Merging Clusters
Mushotzky, Richard, Technical Monitor; Markevitch, Maxim; June 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13250; No Copyright; Avail: CASI; A01, Hardcopy

In a number of galaxy clusters, Chandra has discovered a new phenomenon, the sharp gas density edges. Depending on the sign of the temperature jump across the edge, these features may either be bow shocks or cold fronts. While the merger origin of the bow shocks is unambiguous, what causes cold fronts is not entirely clear, as they are observed both in mergers and in relaxed clusters. The purpose of the study of A3376, an interesting cluster with density edges, is to understand the origin of cold fronts and to look for possible shocks. This cluster also has a radio halo, and comparison of an X-ray temperature map and radio image may shed light on the nature of the cluster radio halos, which is our secondary goal. The XMM data for A3376 have been obtained, processed and cleaned. Most of the preliminary analysis, including deriving a temperature map, is complete. We also have Chandra data for this cluster, and intend to compare and combine the two datasets. We are well underway toward determining the dynamical state of A3376 and the nature of its gas density discontinuities.
Author
Galactic Clusters; Gas Density; Discontinuity; Halos

20040075018 NASA Marshall Space Flight Center, Huntsville, AL, USA
Results of a Deep Chandra Observation of the Crab Nebula and Pulsar
Weisskopf, M. C.; Becker, W.; Elsner, R.; Kahn, S.; Kolodziejczak, J.; Murray, S.; ODell, S.; Paerels, F.; Shibazaki, N.; Swartz, D., et al.; Bulletin of the American Astronomical Society; October 2000; Volume 32, pp. 1248; In English; HEAD Meeting
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

The Crab Nebula and pulsar were observed for a total of 150 ksec with the LETG/HRC-S combination aboard the Chandra X-Ray Observatory in 2000, January. One of the principal aims of the experiment was to study the emission of from the pulsar as a function of pulse phase. Neutron stars are believed to be formed with core temperatures of T(sub c) approx. 10(sup 11) K. As the pulsar is the youngest known neutron star with an age of only 940 yrs, it should be possible to observe thermal emission from the hot stellar surface which in turn constrains equations of state. The pulsar, on the other hand, is a powerful non-thermal emitter, powering an X-ray bright synchrotron nebula which, in Einstein and ROSAT observations, overshadowed the fainter thermal surface emission. Making use of the high angular resolution provided by Chandra we were able to detect X-rays from the Crab-pulsar at all pulse phases. We discuss whether this detection is indeed of thermal emission or of a faint synchrotron component of the pulsed emission from the magnetosphere. We further report on dynamical effects observed in the pulsar-wind outflow and the analysis of the LETG spectral data, especially near the oxygen edge. The results of the spectral analysis has interesting implications for the composition of the interstellar medium.(c) 2000.: American Astronomical Society. All rights reserved
Author
Crab Nebula; Pulsars; X Ray Astronomy

20040075024 Johns Hopkins Univ., Baltimore, MD, USA
[Predicting Spectra of Accretion Disks Around Galactic Black Holes]
Krolik, Julian H.; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9187; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this grant was to construct detailed atmosphere solutions in order to predict the spectra of accretion disks around Galactic black holes. Our plan of action was to take an existing disk atmosphere code (TLUSTY, created by Ivan Hubeny) and introduce those additional physical processes necessary to make it applicable to disks of this variety. These modifications include: treating Comptonization; introducing continuous opacity due to heavy elements; incorporating line opacity due to heavy elements; adopting a disk structure that reflects readjustments due to radiation pressure effects; and injecting heat via a physically-plausible vertical distribution.
Derived from text
Accretion Disks; Black Holes (Astronomy); Pressure Effects

20040075029 Johns Hopkins Univ., Baltimore, MD, USA
Planetary Nebulae in the MW, LMC, SMC: Results from FUSE and HST data
Herald, J. E.; Bianchi, L.; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAS5-32985; NAS5-26555; NAG5-12294; NRA-99-01-LTSA-029; No Copyright; Avail: CASI; A01, Hardcopy

We use FUSE and HST data to study Planetary Nebulae (PN) systems in the Milky Way, LMC and SMC. Theoretically, metallicity affects several aspects of the post-AGB evolution, including mass-loss and the yield of processed material, which are important factors in the chemical evolution of galaxies. Therefore, it is very important to study PNe in different environments. In Bianchi's FUSE programs, we observed CSPN in the Milky Way (Cycle 1), LMC (Cycle 2) and SMC (Cyde 3), representing a range of metallicities from solar to 1/10th solar. The far-UV range reveals the spectrum of the central star (CSPN), uniquely enabling a direct estimate of the ionizing source parameters. Combined with archive HST data, these spectra provide a measurement of T(sub eff), log g, L(sub bol), abundances, wind velocity and mass-loss rate for these post-AGB stars. Additionally, these spectra provide a measurement of the circumstellar H2 and HI, which added to the mass of the central star and of the ionized shell allows us to test theoretical initial-final mass relations, and to put together a complete picture of the star's evolution.
Author
Planetary Nebulae; Milky Way Galaxy; Stellar Evolution; Stellar Spectra; Chemical Evolution; Asymptotic Giant Branch Stars; Metallicity

20040075038 Alabama Univ., Huntsville, AL, USA
A Chandra Spectroscopic Survey of Persistent Black Hole Candidates
Cui, Wei; Feng, Y. X.; Zhang, S. N.; Bautz, M. W.; Garmire, G. P.; Schulz, N. S.; The Astrophysical Journal; September 2002; Volume 576, No. 1, pp. 357-365; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

We present results from observations of persistent black hole candidates with the High-Energy Transmission Gratings on board the Chandra X-Ray Observatory. The sources include LMC X-1, LMC X-3, GRS 1758-258, and Cyg X-1. Along with the published results on 1E 1740.7-2942, we have completed a high-resolution spectroscopic survey of such systems. The observed X-ray spectra of LMC X-1 and LMC X-3 show no prominent discrete features, while absorption edges (Mg K and Si K) are detected in the spectrum of GRS 1758-258. The edges are likely to be of interstellar origin. In most cases, the X-ray continuum can be described well by models that are often adopted in low-resolution studies of black hole candidates: a multitemperature disk spectrum plus a Comptonization component. However, the relative contribution of the two components varies greatly among different sources. For instance, only the disk component is present for LMC X-1 and GRS 1758-258, while the Comptonized component is required for other sources. We discuss general issues related to obtaining disk parameters from modeling X-ray continuum.
Author
X Ray Astronomy; X Ray Spectra; Black Holes (Astronomy)

20040075128 Radex, Inc., Bedford, MA
Evaporation of High Speed Sporadic Meteors
Murad, Edmond; Roth, C.; Jan. 2004; 5 pp.; In English
Contract(s)/Grant(s): F19628-98-C-0054; Proj-5021
Report No.(s): AD-A422999; AFRL-VS-HA-TR-2004-1072; No Copyright; Avail: CASI; A01, Hardcopy

Recent measurements conducted at the Arecibo Observatory report high-speed sporadic meteors having velocities near 50 km/s. The results seem to indicate a bimodal velocity distribution in the sporadic meteors (maxima at approximately 20 km/s

and approximately 50 km/s). The particles have a maximum mass of approximately 1 microgram. This paper will present an analysis of the ablation of 1 microgram meteoroids having velocities of 20, 30, 50 and 70 km/s. The calculations show that there is fractionation even for the fast meteoroids, the effect being particularly noticeable for the 1 microgram sporadic particles, and less so for the heavier particles. The relevance of the calculations to the radar observations of the sporadic meteors will be discussed. (5 figures, 24 refs.)
DTIC
Ablation; Atmospheric Entry; Evaporation; Fractionation; High Speed; Meteoroids; Thermodynamics

20040075130 California Inst. of Tech., Pasadena, CA
Three-Dimensional Structure of Turbulent Scalar Fields with Applications in Aerooptics
Dimotakis, Paul E.; Martin, Christopher; Apr. 12, 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0102
Report No.(s): AD-A423001; AFRL-SR-AR-TR-04-0247; No Copyright; Avail: CASI; A03, Hardcopy

This program aimed to develop an interferometric technique for mitigating the effects of turbulence on visible- light imaging, complementary to techniques such as Adaptive Optics (AO) or speckle imaging. This technique employs a rotation shearing interferometer and high-speed, low-noise digital imaging system. Where an AO system would employ a complex high-bandwidth, electro-mechanical system to mitigate the effects of turbulence, this interferometric technique relies on a novel (low-cost) optical design, high-speed detector electronics, and digital post-processing to obtain images. One significant advantage of this technique is the use of a large-format detector that enables correction of aberrating fields with power at far higher wave numbers than AO systems can accommodate. Efforts have continued to analytically characterize the performance and limitations of this technique, and to analyze previously obtained astronomical data. Internal alignment algorithms have been automated to improve real-time performance. The read noise of the existing digital imaging system has been reduced, and its mechanical interface has been improved. Work has begun on a next-generation hybrid CMOS-CCD imaging system. (11 figures, 6 refs.)
DTIC
Digital Systems; Image Processing; Interferometers; Interferometry; Optical Measurement; Scalars; Turbulence

20040075241 Air Force Research Lab., Hanscom AFB, MA
Some Statistical Properties of the Decay Phase of SEP-Events
Kechskemety, K.; Daibog, E. I.; Kahler, S. W.; Logachev, Yu I.; Jan. 2003; 5 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423202; AFRL-VS-HA-TR-2004-1082; No Copyright; Avail: CASI; A01, Hardcopy

Generalized parameters characterizing the state of the interplanetary medium (IM) include the functional form and the rate of decline of charged particle flux in solar energetic particle (SEP) events. The shape of the particle flux decline is of particular importance: power-law time dependence indicates the dominance of diffusive propagation, whereas exponential-law, decline emphasizes adiabatic deceleration and convection. A statistical investigation extended for a long period suggests that about 90% of SEP decays are characterized by exponential declines. Variation of the decay time with energy and angular distance of the observer from the flare are considered as well.
DTIC
Coronal Mass Ejection; Interplanetary Space; Magnetic Fields; Solar Cosmic Rays; Statistical Distributions

20040075258 Naval Observatory, Washington, DC
The Motion of the Observer in Celestial Navigation
Kaplan, George H.; Jan. 1996; 8 pp.; In English
Report No.(s): AD-A423226; No Copyright; Avail: CASI; A02, Hardcopy

The object of celestial navigation is the determination of the latitude and longitude of a vessel at a specific time, through the use of observations of the altitudes of celestial bodies. Each observation defines a circle of position on the surface of the Earth, and the small segment of the circle that passes near the observer's estimated position is represented as a line of position (LOP). A position fix is located at the intersection of two or more LOPs. This construction works for a fixed observer or simultaneous observations. However, if the observer is moving, the LOPs from two consecutive observations do not necessarily intersect at a point corresponding to the observer's position at any time; if three or more observations are involved, there may be no common intersection. Since celestial navigation normally involves a single observer on a moving ship, something has to be done to account for the change in the observer's position during the time required to take a series of

observations. This report reviews the methods used to deal with the observer's motion. A basic familiarity with the procedures, terminology, and notation of celestial navigation is assumed.
DTIC
Celestial Navigation

20040075543 Gemini Observatory, USA
Gemini Observatory Newsletter, No. 28
June 2004; 32 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This issue includes articles on a new nebula, using queues to schedule observing time, partner office reports from each of the countries participating in Gemini Observatory, and relationships among irregular satellites of Jupiter and Saturn. The titles of the other articles in this issue are: Public Information and Outreach (PIO); Recent Scientific Highlights; Engineering Report; Gemini Leads Solid State Laser Development; SOAR's Mirror Visits the Gemini South Coating Facility; Gemini-South's Near-Infrared Spectrograph Gets '3-D Vision.'
CASI
Observatories; Observation Scheduling; International Cooperation

20040075608 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Deep Near-Infrared Survey of the N 49 Region around the Soft Gamma-Ray Repeater 0526-66
Klose, S.; Henden, A. A.; Geppert, U.; Greiner, J.; Guetter, H. H.; Hartmann, D. H.; Kouveliotou, C.; Luginbuhl, C. B.; Stecklurn, B.; Vrba, F. J.; [12 March 2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We report the results of a deep near-infrared survey of the vicinity of supernova remnant N49 in the Large Magellanic Cloud (LMC), which contains the soft gamma-ray repeater (SGR) 0526-66. Two of the four confirmed SGRs are potentially associated with compact stellar clusters. We thus searched for a similar association of SGR0526-66, and find the unexplored young stellar cluster SL 463 at a projected distance of approx. 30 pc from the SGR. This constitutes the third cluster-SGR link, and lends support to scenarios in which SGR progenitors originate in young, embedded clusters. If real, the cluster-SGR association constrains the age and thus the initial mass of these stars. In addition, our high-resolution images of the super- nova remnant N49 reveal an area of excess K-band flux in the southeastern part of the SNR. This feature coincides with the maximum flux area at 8.28 microns as detected by the Midcourse Space Experiment (MSX satellite), which we identify with IRAS 052594607.
Author
Gamma Rays; High Resolution; Spaceborne Experiments; Supernova Remnants; Surveys; Infrared Astronomy

20040075612 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Burst and Transient Source Experiment (BATSE) Earth Occultation Catalog
Wilson-Hodge, Colleen A.; [2004]; 1 pp.; In English; Beyond Einstein: From the Big Bang to Black Holes, 12-15 May 2004, San Mateo, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The hard X-ray sky was continuously monitored with the BATSE experiment on the Compton Gamma Ray observatory using the Earth Occultation method. Known sources were monitored twice every orbit and transients could be detected at about the approx. 50 mCrab level on a daily basis. I will summarize the results from our catalog of 179 monitored sources, highlighting observations of black holes and energy spectra for the 83 firmly detected sources and FITS files for all 179 sources. This web database can serve as a guide and comparison tool for future observations with EXIST.
Author
X Ray Astronomy; Gamma Ray Observatory

20040075712 NASA Ames Research Center, Moffett Field, CA, USA
Primary Accretion in the Protoplanetary Nebula
Cuzzi, J. N.; Hogan, R. C.; Paque, J. M.; Dobrovolskis, A. R.; Research and Technology 1997; September 1998, pp. 103-104; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

One of the major unsolved problems regarding the origin of planetary systems is the process by which the first sizeable objects (comets, asteroids, etc.) formed from solids that entered the protoplanetary nebula as micron-sized dust grains. Until recently there was little or no theoretical understanding of the key processes that characterize this epoch. The focus at Ames Research Center has recently been on three-dimensional (3-D) direct numerical simulations of particles in turbulence. Previously, it has been shown that the size of particles most strongly concentrated (by orders of magnitude) is in good

agreement with the millimeter-size, molten "chondrules" which dominate primitive meteorites-and has never been explained before.
Derived from text
Planetary Systems; Nebulae; Dust; Meteorites; Comets; Three Dimensional Models

20040075799 NASA Ames Research Center, Moffett Field, CA, USA
Discovery of Polycyclic Aromatic Hydrocarbon Ions in NGC 1333
Sloan, Gregory; Allamandola, Lou; Bregman, Jesse; Hudgins, Doug; Hayward, Tom; Devito, Becky; Research and Technology 1997; September 1998, pp. 120; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Since the discovery of unidentified infrared emission bands in 1973, their origin has been assigned to several different carriers. Although the first suggestion that these bands were due to polycyclic aromatic hydrocarbons (PAHs) occurred in 1984, the lack of a good match between laboratory spectra of PAHs and the interstellar features prevented a conclusive identification. The large discrepancy between the relative band intensities observed in the laboratory and those observed in astronomical sources has recently been resolved by laboratory spectra of ionized PAHs. Specifically, the relative strengths of the emission features due to C-H bending modes (8.6 and 11.3 microns) are too strong relative to the C-C modes (6.2 and 7.7 microns) in laboratory spectra of neutral PAHs, but ionized PAHs provide a good match with astronomical spectra. The laboratory spectra of ionized PAHs show an additional weak band near 10 microns; they also show that the 11.3-micron band is shifted to shorter wavelengths by 3%-5%.
Derived from text
Polycyclic Aromatic Hydrocarbons; Infrared Spectra; Emission Spectra; Galaxies

20040077062 NASA Ames Research Center, Moffett Field, CA, USA
The SOFIA Water-Vapor Monitor
Roellig, Thomas L.; Cooper, Robert; Glukhaya, Anna; Rennick, Michael; Shiroyama, Brian; Research and Technology 1999; December 2000, pp. 115; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Stratospheric Observatory for Infrared Astronomy (SOFIA), a 3-meter class telescope mounted in a Boeing 747 aircraft, is being developed for NASA by a consortium consisting of the University Space Research Association, Raytheon E-Systems, and United Airlines. This new facility will be a replacement for the retired Kuiper Airborne Observatory that used to fly out of Moffett Field. As part of this development, NASA Ames Research Center is providing an instrument that will measure the integrated amount of water vapor seen along the telescope line of sight. Since the presence of water vapor strongly affects the astronomical infrared signals detected, such a water-vapor monitor is critical for proper calibration of the observed emission. The design of the water-vapor monitor is now complete, and engineering model units (EMUS) have been constructed for all of the important subassemblies.
Derived from text
Water Vapor; Sofia (Airborne Observatory); Infrared Radiation; Aerospace Systems; Calibrating

20040077078 NASA Ames Research Center, Moffett Field, CA, USA
AIRES: The SOFIA Facility Spectrometer
Erickson, Edwin; Haas, Michael; Colgan, Sean; Research and Technology 1999; December 2000, pp. 106-107; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

An Ames team was selected by peer review to build AIRES, the airborne infrared echelle spectrometer for SOFIA, the Stratospheric Observatory for Infrared Astronomy. The objective is to develop a facility-class spectrometer for use by the international astronomical community. AIRES will be delivered to the Universities Space Research Association (USRA), NASA's prime contractor for SOFIA, who will operate facility instruments for scientists with approved observing programs. SOFIA is a uniquevatory currently under development. A Boeing 747 will be equipped to carry a 2.7-meter telescope to be operated at altitudes up to 45,000 feet, allowing infrared astronomical observations that are impossible from Earth. Being developed jointly by NASA and Deutsche Forschungsanstalt fur Luft-und Raumfahrt (DLR), the German Aerospace Center, SOFIA will be based at Ames with operations beginning in late 2002.
Derived from text
Sofia (Airborne Observatory); Infrared Spectrometers; Airborne Equipment; Infrared Astronomy

20040077126 NASA Ames Research Center, Moffett Field, CA, USA
Conceptual Study of NGST Science Instruments
Greene, Thomas; Ennico, Kimberly; Research and Technology 1999; December 2000, pp. 108-109; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Next-Generation Space Telescope (NGST), the successor of the Hubble Space Telescope, is scheduled for launch in the year 2008. NGST will make unprecedented discoveries in the realms of galaxy formation, cosmology, stellar populations, star formation, and planetary systems. The telescope is currently in the conceptual design phase of development, and Ames has been involved in defining and studying the scientific instrumentation it will need to conduct its observations. Along with scientists at the University of Arizona (Kimberly Ennico, Jill Bechtold, George Rieke, Marcia Rieke, Jim Burge, Roland Sharlot, and Rodger Thompson), and in partnership with Lockheed Martin (Larry Lesyna and the Advanced Technology Center staff), Ames has led and completed a conceptual study of the entire NGST scientific instrument complement. This team was one of several international teams selected to study NGST science instruments. The Ames-led team conducted trade studies of specific instrument technologies and implementations, and developed a comprehensive integrated science instrument module (ISIM) concept.
Derived from text
Spaceborne Telescopes; Galactic Evolution; Star Formation; Stellar Systems; Planetary Systems

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040074336 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Stellar Imager (SI)"Vision Mission"
Carpenter, Ken; Danchi, W.; Leitner, J.; Liu, A.; Lyon, R.; Mazzuca, L.; Moe, R.; Chenette, D.; Karovska, M.; Allen, R., et al.; [2004]; 1 pp.; In English; 204th Meeting fo the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA; Copyright; Avail: Other Sources; Abstract Only

The Stellar Imager (SI) is a "Vision" mission in the Sun-Earth Connection (SEC) Roadmap, conceived for the purpose of understanding the effects of stellar magnetic fields, the dynamos that generate them, and the internal structure and dynamics of the stars in which they exist. The ultimate goal is to achieve the best possible forecasting of solar/stellar magnetic activity and its impact on life in the Universe. The science goals of SI require an ultra-high angular resolution, at ultraviolet wavelengths, on the order of 100 micro-arcsec and thus baselines on the order of 0.5 km. These requirements call for a large, multi-spacecraft (less than 20) imaging interferometer, utilizing precision formation flying in a stable environment, such as in a Lissajous orbit around the Sun-Earth L2 point. SI's resolution will make it an invaluable resource for many other areas of astrophysics, including studies of AGN s, supernovae, cataclysmic variables, young stellar objects, QSO's, and stellar black holes. ongoing mission concept and technology development studies for SI. These studies are designed to refine the mission requirements for the science goals, define a Design Reference Mission, perform trade studies of selected major technical and architectural issues, improve the existing technology roadmap, and explore the details of deployment and operations, as well as the possible roles of astronauts and/or robots in construction and servicing of the facility.
Author
Angular Resolution; Cataclysmic Variables; Formation Flying; Imaging Techniques; Interferometers; Magnetic Effects; Stellar Magnetic Fields; Ultraviolet Radiation

20040074520 Lawrence Livermore National Lab., Livermore, CA
SCUBA Observations of High Redshift Radio Galaxies
Reuland, M.; Rottgering, H.; van Breugel, W.; Mar. 11, 2003; In English
Report No.(s): DE2004-15005841; UCRL-JC-152104; No Copyright; Avail: National Technical Information Service (NTIS)

High redshift radio galaxies (HzRGs) are key targets for studies of the formation and evolution of massive galaxies.The role of dust in these processes is uncertain. We have therefore observed the dust continuum emission from a sample of > 3 radio galaxies with the SCUBA bolometer array. We confirm and strengthen the result found by Archibald et al. (1), that HzRGs are massive starforming systems and that submillimeter detection rate appears to be primarily a strong function of redshift. We also observed HzRG-candidates that have so far eluded spectroscopic redshift determination. Four of these have been detected, and provide evidence that they may be extremely obscured radio galaxies, possibly in an early stage of their evolution.
NTIS
Radio Galaxies; Radio Sources (Astronomy); Spectroscopy

20040075017 Alabama Univ., Huntsville, AL, USA
Low-Frequency Coherence Break in the Soft X-Ray State of GRS 1915+105
Ji, Jian-Feng; Zhang, Shuang-nan; Qu, Jin-Lu; Li, Ti-Pei; The Astrophysical Journal; February 2003; Volume 584, No. 1, pp. L23 - L26; In English
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

We present results from the analysis of X-ray power density spectra and coherence when GRS 1915+105 is in soft states. We use three data sets that belong to mu, phi, and delta classes as found in the work of Belloni et al. We find that the power density spectra appear t o be complex, with several features between 0.01 and 10 Hz. The coherence deviates from unity above a characteristic frequency. We discuss our results from different models. The corona size in the sphere-disk model implied by this break frequency is on the order of 10(exp 4) GM/c(exp 2), which is unphysical. Our results are more consistent with the prediction of the model of a planar corona sustained by magnetic flares, in which the characteristic frequency is associated with the longest timescale of an individual flare, which is about 8 s.
Author
X Ray Astronomy; X Ray Spectra; Power Spectra; X Ray Binaries; Coherent Electromagnetic Radiation

20040075137 Assurance Technology Corp., Carlisle, MA
Space Radiation Environments for Parts Selection/Test Considerations in Typical Satellite Orbits
Mullen, E. G.; Oct. 31, 2003; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-02-C-0086; Proj-4400
Report No.(s): AD-A423015; AFRL-VS-HA-TR-2004-1019; No Copyright; Avail: CASI; A03, Hardcopy

This document contains the results of a space radiation environment study that can be the basis for parts selection and radiation tradeoff architectures for several typical spacecraft orbits used (or contemplated for use) by DoD and other government agencies. The radiation levels calculated can be used to select and test components for many spaceflight systems and subsystems. This report provides the first step in developing a comprehensive test program plan to examine all deleterious space effects that could degrade or disrupt sensor systems from meeting their mission goals regarding both performance and lifetime. The radiation levels recommended in this report represent a reasonable near worst case environment for all of near-Earth space out to geosynchronous altitudes. The recommended levels are such as to have low risk for mission lifetime without providing an overly cautious approach that could reduce program flexibility in the selection of components and inflate costs beyond program budget constraints.
DTIC
Aerospace Environments; Extraterrestrial Radiation; Satellite Orbits

20040075156 Air Force Research Lab., Hanscom AFB, MA
Probing the Magnetic Polarity Structure of the Heliospheric Current Sheet
Kahler, S. W.; Crooker, N. U.; Larson, D. E.; Aug. 13, 2003; 10 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423038; AFRL-VS-HA-TR-2004-1088; No Copyright; Avail: CASI; A02, Hardcopy

We use solar wind heat-flux electrons to determine the solar magnetic polarities of the inter-Planetary magnetic field (IMF) close to the heliospheric current sheet (HCS) around the time of the last solar minimum in 1995-1996. At that time the tilt angle of the HCS was very low and solar activity was minimal, allowing the Wind spacecraft-to probe the polarities of the fields close to the HCS during a time relatively free of transient interplanetary coronal mass ejections (ICMEs). During the three periods we examined, all solar polarity boundaries predicted from Stanford source surface (SS) maps were observed. During 34 days in which the SS magnetic neutral line skimmed within 3 deg of the ecliptic, only six tangential excursions into opposite solar polarities were observed. The distribution of the durations of magnetic polarity sectors was very similar to that reported earlier for solar maximum in 1978-1982, showing no increase in sectors which might be expected for a spacecraft trajectory roughly tangential to a corrugated HCS separating regions of opposite polarity.
DTIC
Current Sheets; Heliosphere; Magnetic Field Configurations; Magnetic Fields; Polarity; Solar Wind

20040075158 Air Force Research Lab., Hanscom AFB, MA
Coronal Shocks and Solar Energetic Proton Events
Cliver, E. W.; Kahler, S. W.; Reames, D. V.; Jan. 2003; 5 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423041; AFRL-VS-HA-TR-2004-1087; No Copyright; Avail: CASI; A01, Hardcopy

From July 1996 - June 2001, < 50% of favorably- located metric type II radio bursts had associated solar energetic protons (SEPs). When western hemisphere metric 115 were accompanied by decametric-hectometric(DH; 1-14 MHz) type II emission, their association with ^20 MeV SEP events was 90% vs. only 25% for metric 115 without a DH counterpart. Overall, 82% (63%) of all SEP events with visible disk origins were associated with metric (DH) type 115, with percentage associations increasing with SEP event size to 88% (96%), respectively, for ^20 MeV SEP events with peak intensities > 10-1 pr cm-2 s-1 sr-1 MeV-1. Our results are consistent with the following (not mutually exclusive) possibilities: (1) large ^20 MeV SEP events result from strong shocks that call persist well beyond ^3 R.; (2) shock acceleration is most efficient above ^3 R.; (3) shocks that survive to ^3 R. are more likely to have broad longitudinal extents.
DTIC
Coronas; Shock Waves; Solar Cosmic Rays; Solar Flares; Solar Protons

20040075160 Air Force Research Lab., Hanscom AFB, MA
Unusual Large-Scale Flaring Structure
Chertok, I. M.; Hudson, H. S.; Kahler, S. W.; Dec. 2002; 5 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423043; AFRL-VS-HA-TR-2004-1086; No Copyright; Avail: CASI; A01, Hardcopy

The Yohkoh/SXT data of August 21, 1999 displayed a spectacular transient brightening of a large-scale double whip- like structure extending through the corona to a length greater than 950 Mm. The transient originated at a relatively small middle-latitude soft X-ray bright point (XBP), which was also visible in the EUV range and had a small underlying Halpha plage with a bipolar magnetic configuration. The structure developed in the high-temperature (>2.5 MK) soft X- ray emission to both sides of the XBP during a few tens of minutes and could be recognized for about two hours. The observations suggest sudden energy release during the interaction of the magnetic structures of the XBP and the filament channel.
DTIC
Solar Flares

20040075163 Air Force Research Lab., Hanscom AFB, MA
Solar Fast Wind Regions as Sources of Gradual 20 MeV Solar Energetic Particle Events
Kahler, S. W.; Jan. 2003; 5 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423046; AFRL-VS-HA-TR-2004-1085; No Copyright; Avail: CASI; A01, Hardcopy

If production of solar energetic particles (SEPs) near the Sun is due to shocks driven by coronal mass ejections (CMEs), then SEP acceleration in slow rather than fast solar wind streams should be favored because both the Alfven and solar wind flow speeds are higher in the fast wind streams. We identify SOHO LASCO fast west-limb or halo CMEs that occurred when the Earth was in fast wind streams indicated by low values of the solar wind 07/06 ratios from the ACE satellite. Those CMEs would be expected to be associated with fewer or weaker SEP events than comparable CMEs in slow wind regions. However, we find no differences between the fast CMEs in fast wind and the fast CMEs in slow wind in terms of their associated SEP intensities or SEP-associated CME speeds.
DTIC
Energetic Particles; Solar Corpuscular Radiation; Solar Flares; Solar Storms; Solar Wind

20040075203 Air Force Research Lab., Hanscom AFB, MA
Summary of LARC Particle Asymptotic Changes From Geomagnetic Reference Field Models: 1955 to 1995
Storini, M.; Smart, D. F.; Shea, M. A.; Jan. 2002; 14 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A423117; AFRL-VS-HA-TR-2004-1091; No Copyright; Avail: CASI; A03, Hardcopy

A high-order (10th) mathematical model for the quiescent geomagnetic field from Epoch 1955.0 to Epoch 1995.0 was used to calculate the asymptotic directions of vertically incident cosmic ray particles at the LARC location (62 deg 12' 09" S - 58 deg 57' 42" W, South Shetlands King George Island, Fildes Bay Ardley Cove, 40 m a.s.l.). The digital computer- based studies were made at spaced intervals of rigidity in a wide range extending from a value sufficiently high (20.00 GV), such that free particle access is ensured, to a low value at which it may confidently he assumed that access would be forbidden (2.00 GV) for this Antarctic location. A summary of the obtained results is given.
DTIC
Geomagnetism

20040075204 Texas Univ., Austin, TX

Spatial Intensity Gradients of Impulsive Particle Events and Supradiffusive Magnetic Fields

Ragot, B. R.; Kahler, S. W.; Jan. 2003; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A423119; AFRL-VS-HA-TR-2004-1083; No Copyright; Avail: CASI; A01, Hardcopy

The low-energy ion intensity profiles of impulsive solar energetic particle (SEP) events display both sharp (< 2. 5 min) local gradients and larger scale (1-6 hour) dropouts, indicative of fast crossfield transport on the larger scales in spite of restricted short-scale transport. Rapid variations and modulations within the few-hour long channels of enhanced intensity are also observed. We show that these features are a signature of strong supradiffusion of magnetic field lines in the inner heliosphere.

DTIC

Charged Particles; Magnetic Fields

20040075237 Air Force Research Lab., Hanscom AFB, MA

The Cosmic Ray Ground Level Enhancement of 6 November 1997

Lovell, J. L.; Duldig, M. L.; Humble, J. E.; Shea, M. A.; Smart, D. F.; Jan. 2002; 5 pp.; In English

Contract(s)/Grant(s): NF20-050697.97; OPP-9528122; Proj-2311

Report No.(s): AD-A423198; AFRL-VS-HA-TR-2004-1092; No Copyright; Avail: CASI; A01, Hardcopy

The relativistic solar proton event of 6 November 1997 resulted in the first ground-level enhancement (OLE) of solar cycle 23. The earliest onset was around 1215 UT but was up to 15 minutes later at some neutron monitor locations. The time of maximum intensity also varied significantly over the world-wide neutron monitor network. The modeled particle distributions and spectra are presented. The apparent particle arrival direction is found to be largely consistent with propagation outward from the sun along interplanetary magnetic field lines.

DTIC

Augmentation; Cosmic Rays; Magnetic Fields; Solar Cosmic Rays; Sun

20040075238 Air Force Research Lab., Hanscom AFB, MA

The Local Time Dependence of the Anisotropic Solar Cosmic Ray Flux

Smart, D. F.; Shea, M. A.; Jan. 2003; 7 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A423199; AFRL-VS-HA-TR-2004-1090; No Copyright; Avail: CASI; A02, Hardcopy

The distribution of the solar cosmic radiation flux over the earth is not uniform, but the result of complex phenomena involving the interplanetary magnetic field, the geomagnetic field and latitude and longitude of locations on the earth. The latitude effect relates to the geomagnetic shield; the longitude effect relates to local time. For anisotropic solar cosmic ray events the maximum particle flux is always along the interplanetary magnetic field direction, sometimes called the Archimedean spiral path from the sun to the earth. During an anisotropic solar cosmic ray event, the locations on the earth viewing "sunward" into the interplanetary magnetic field direction will observe the largest flux (when adjustments are made for the magnetic latitude effect). To relate this phenomena to aircraft routes, for anisotropic solar cosmic ray events that occur during "normal quiescent" conditions, the maximum solar cosmic ray flux (and corresponding solar particle radiation dose) will be observed in the dawn quadrant, ideally at about O6 hours local time.

DTIC

Anisotropy; Flux (Rate); Solar Cosmic Rays; Time Dependence

20040075239 Air Force Research Lab., Hanscom AFB, MA

Onsets of Solar Cycle 23 Ground Level Events as Probes of Solar Energetic Particle Injections at the Sun

Kahler, S. W.; Simnett, G. M.; Reiner, M. J.; Jan. 2003; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A423200; AFRL-VS-HA-TR-2004-1084; No Copyright; Avail: CASI; A01, Hardcopy

The inferred solar injection times of the first arriving particles of solar energetic particle ?SEP) events can be compared with solar eruptive events to provide information of how those particles were accelerated near the Sun. The injection times are best inferred from high- energy electrons and protons with long mean free paths in space. We use the neutron monitor counting rate profiles and space-based near-relativistic electron intensity profiles of the 10 ground level events (GLEs) of solar cycle 23 to determine the initial solar injection times of the SEP:s. Those times are compared with microwave, metric and

decametric/hectometric (DH) radio burst and solar CME observations to determine the radiative signature% of early SEP injections. The space-borne solar observations of the current cycle 23 are far superior to those during GLEs of early cycles, allowing a more definitive description of solar events at the times of SEP injection.
DTIC
Energetic Particles; Solar Activity; Solar Cycles; Solar Energy; Sun

20040075680 NASA Marshall Space Flight Center, Huntsville, AL, USA
Background Studies for EXIST
Wilson, Colleen A.; Pendleton, G. N.; Fishman, G. J.; [2004]; 1 pp.; In English; Beyond Einstein: From the Big Bang to Black Holes, 12-15 May 2004, San Mateo, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We present results from a study of the trapped proton and electron background for several orbital inclinations and altitudes. This study includes time dependent effects. In addition we describe a 3 component cosmic background model developed at the University of Southampton, UK. The three components are cosmic diffuse gamma rays, atmospheric albedo gamma rays, and cosmic ray protons. We present examples of how this model was applied to BATSE and discuss its application to EXIST.
Author
Protons; Electrons; Cosmic Rays

20040075692 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Achromatic Light Curve of the Optical Afterglow of GRB 030226 at a Redshift of z Approximately 2
Klose, S.; Greiner, J.; Rau, A.; Henden, A. A.; Hartmann, D. H.; Zeh, A.; Masetti, N.; Guenther, E.; Stecklum, B.; Lindsay, K., et al.; [15 August 2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Abstract. We report on optical and near-infrared (NIR) follow-up observations of the afterglow of GRB 030226, mainly performed with the telescopes at ESO La Silla and Paranal, with additional data obtained at other places. Our first observations started 0.2 days after the burst when the afterglow was at a magnitude of R approximately equal to 19 . One week later the magnitude of the afterglow had fallen to R=25, and at two weeks after the burst it could no longer be detected (R > 26). Our VLT blueband spectra show two absorption line systems at redshifts z = 1.962 +/- 0.001 and at z = 1.986 +/- 0.001, placing the redshift of the burster close to 2. Within our measurement errors no evidence for variations in the line strengths has been found between 0.2 and 1.2 days after the burst. An overabundance of alpha-group elements might indicate that the burst occurred in a chemically young interstellar region shaped by the nucleosynthesis from type II supernovae. The spectral slope of the afterglow shows no signs for cosmic dust along the line of sight in the GRB host galaxy, which itself remained undetected (R > 26.2). At the given redshift no supernova component affected the light from the GRB afterglow, so that the optical transient was essentially only powered by the radiation from the GRB fireball, allowing for a detailed investigation of the color evolution of the afterglow light. In our data set no obvious evidence for color changes has been found before, during, or after the smooth break in the light curve approximately 1 day after the burst. In comparison with investigations by others, our data favor the interpretation that the afterglow began to develop into a homogeneous interstellar medium before the break in the light curve became apparent.
Author
Afterglows; Light Curve; Red Shift; Gamma Ray Astronomy; Gamma Ray Bursts

20040075695 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Multi-Wavelength Search for a Counterpart of the Unidentified Gamma-ray Source 3EG J2020+4017 (2CG078+2)
Becker, Werner; Weisskopf, Martin C.; Arzoumanian, Zaven; Lorimer, Duncan; Camilo, Fernando; Elsner, Ronald F.; Kanbach, Gottfried; Reimer, Olaf; Swartz, Douglas A.; Tennant, Allyn F., et al.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In search of the counterpart to the brightest unidentified gamma-ray source 3EG J2020+4017 (2CG078+2) we report on new X-ray and radio observations of the gamma-Cygni field with the Chandra X-ray Observatory and with the Green Bank Telescope (GBT). We also report on reanalysis of archival ROSAT data. With Chandra it became possible for the first time to measure the position of the putative gamma-ray counterpart RX J2020.2+4026 with sub-arcsec accuracy and to deduce its X-ray spectra1 characteristics. These observations demonstrate that RX J2020.2+4026 is associated with a K field star and therefore is unlikely to be the counterpart of the bright gamma-ray source 2CG078+2 in the SNR G78.2+2.1 as had been previously suggested.
Author
Radio Astronomy; X Ray Astronomy; Pulsars; Gamma Ray Sources (Astronomy)

20040075700 Bishop's Univ., Lennoxville, Quebec, Canada

Theoretical Considerations on the Properties of Accreting Millisecond Pulsars

Nelson, Lorne A.; Rappaport, Saul; Astrophysical Journal; June 2004; Volume 598, pp. 431-445; In English

Contract(s)/Grant(s): NAG5-12522; NAG5-8368; Copyright; Avail: Other Sources

We examine a number of evolutionary scenarios for the recently discovered class of accretion-powered millisecond X-ray pulsars in ultracompact binaries, including XTE JO929-314 and XTE J1751-305. These systems have very short orbital periods of Porb = 43.6 and 42.4 minutes, respectively, and extremely small mass functions. We focus on a particular scenario that can naturally explain the present-day properties of these systems. This model invokes a donor star that was either very close to the main-sequence turnoff at the onset of mass transfer or had sufficient time to evolve during the mass-transfer phase. We have run a systematic set of binary evolution calculations with a wide range of initial conditions.

Author (revised)

Pulsars; X Ray Binaries; Stellar Evolution

20040075704 Massachusetts Inst. of Tech., Cambridge, MA, USA

Accretion onto Fast X-Ray Pulsars

Rappaport, S. A.; Fregeau, J. M.; Spruit, H.; Astrophysical Journal; May 1, 2004; Volume 606, pp. 436-443; In English

Contract(s)/Grant(s): NAS5-30612; NAG5-12522; Copyright; Avail: Other Sources

The recent emergence of a new class of accretion-powered, transient, millisecond X-ray pulsars presents some difficulties for the conventional picture of accretion onto rapidly rotating magnetized neutron stars and their spin behavior during outbursts. In particular, it is not clear that the standard paradigm can accommodate the wide range in M(i.e., approx. greater than a factor of 50) over which these systems manage to accrete and the high rate of spindown that the neutron stars exhibit in at least a number of cases. When the accretion rate drops sufficiently, the X-ray pulsar is said to become a "fast rotator," and in the conventional view, this is accompanied by a transition from accretion to "propellering," in which accretion ceases and the matter is ejected from the system. On the theoretical side, we note that this scenario for the onset of propellering cannot be entirely correct because it is not energetically self-consistent. We show that, instead, the transition is likely to take place through disks that combine accretion with spindown and terminate at the corotation radius. We demonstrate the existence of such disk solutions by modifying the Shakura-Sunyaev equations with a simple magnetic torque prescription. The solutions are completely analytic and have the same dependence on M and a (the viscosity parameter) as the original Shakura-Sunyaev solutions, but the radial profiles can be considerably modified, depending on the degree of fastness. We apply these results to compute the torques expected during the outbursts of the transient millisecond pulsars and find that we can explain the large spin-down rates that are observed for quite plausible surface magnetic fields of approx. 10(exp 90 G.

Author

X Rays; Pulsars; Stellar Rotation

20040075719 NASA Ames Research Center, Moffett Field, CA, USA

The Structure of the Solar Nebula

Bell, K. Robbins; Cassen, P.; Research and Technology 1997; September 1998, pp. 113; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The coplanarity of the planets in our solar system suggests that they all formed from a flattened gaseous nebula which has since dispersed (the "solar nebula"). The existence of similar protoplanetary disks in other systems has recently been confirmed by Hubble Space Telescope observations which show flattened nebulae in silhouette against the hot background of the Great Nebula in Orion. Many of the disks observed there are probably being eroded away by radiation from the massive, bright stars that illuminate the nebula and so wi11 never form planetary systems (see also in this report the paper by Hollenbach et al.). Nevertheless, their direct observation confirms that solar nebula analogs and thus planetary systems may be common. This report describes recent research into the structure of the solar nebula which suggests that planets may have formed in darker, colder environments than generally believed. Even with direct observations of solar nebula analogs, numerical and analytic models must be used to determine conditions deep inside at the planet-forming midplane. Work has been continued in this field bv deriving temperature and density profiles for a variety of possible protoplanetary disk phases. The models encompass early solar nebula analogs appropriate for times when material spiraled rapidly in through the disk to land on the young Sun and the disk as thick and dominated the radiation emitted from the systems, to later analogs in which the flow of material was small and the disk was thin and energetically less important. The models also consider systems in which the stellar mass is larger or smaller than the mass of the Sun so that it will be clear which differences are a result of real variation in mechanism and which are merely a result of the differences in the stellar mass oi the central star. One of the

key conclusions made (along with collaborators T. Henning and H. Klahr of the University of jena, Germany) was that throughout most of the lifetime of the disk and throughout much of its radial extent, the disk surface is shielded from radiation by the central star. Because of a lack of detailed models, it has often been assumed that disks are either essentially fiat or curve continuously up Lvard so that their surfaces are illuminated everywhere by light from the central star. Detailed studies, however, show that the shape of the disk's surface is controlled by the local temperature-dependence of the opacity. Because the opacity diminishes at lower temperatures, the disk becomes more optically thin as one moves radially outward, and the thickness of the disk decreases. Inner annuli thus shield outer annuli from stellar radiation. At early times, when mass flow through the disk was large and local energy generation strong, this was probably not a large effect. At later times, however, when planet formation is thought to have been most important, a cooler environment may have shortened the timescales ot planet formation by enhancing the effect of self-gravitation in the coagulation of micron-size dust particles into macroscopic bodies or by decreasing the relative velocities between planetesimals themselves, thus allowing for speedier assembly into protoplanets.
CASI
Solar Nebula; Gravitational Effects; Stellar Mass; Planetary Evolution; Hubble Space Telescope; Microparticles

20040075727 NASA Ames Research Center, Moffett Field, CA, USA
Molecules in Stellar Photospheres
Carbon, Duane; Goorvitch, David; Cohen, Martin; Research and Technology 1997; September 1998, pp. 114; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Absorption lines from molecular species dominate the spectra of all cool stars, whether they are high luminosity giants and supergiants or faint dwarfs of the lower main sequence. The density and strength of the molecular transitions are so great that their presence profoundly affects the structure of the outermost stellar layers, the stellar photospheres. Because the cool stars are so important in a variety of astrophysical contexts, a program aimed at accurately modeling their photospheres and emergent spectra is being conducted. In FY97, the database has been used in the study of the infrared spectrum of sunspots. This investigation has provided a valuable check on the accuracy of the molecular line parameters in the database. The spectra of cool stars provide relatively poor tests of molecular parameters simply because their temperatures, gravities, and, particularly, compositions are not known with much accuracy. Since accurate sunspot models are available and the solar abundances are well studied, high-resolution sunspot spectra are an excellent standard for comparison. Observed sunspot spectra have been systematically compared with theoretical spectra computed using the molecular line database. In addition to evaluating the accuracy of the massive H20 line list developed at Ames Research Center, the line parameters for CO, SiO, and OH have been checked. Comparison of theoretical and observed sunspot spectra reveals significant discrepancies in the strengths and positions of many OH transitions. This result strongly suggests the need for additional laboratory and theoretical work on the energy-level structure and dipole-moment function of this important molecular species. The molecular database has also been used to generate spectra for several cool stars: Alpha Boo, Alpha Tau, and RX Boo. In the case of the red giant Alpha Tau, an important infrared flux standard, observed and theoretical fluxes are being compared over more than three decades of wavelength, from 1 micron to beyond 1 millimeter. Although still in its early stages, the comparison of millimeter fluxes suggests significant modifications to accepted models of Alpha Tau.
Author
Photosphere; Stellar Spectra; Atmospheric Chemistry; Astrophysics; Infrared Radiation

20040075731 NASA Ames Research Center, Moffett Field, CA, USA
NICMOS Images of Orion
Erickson, Edwin F.; Kaufman, Michael; Colgan, Sean; Research and Technology 1997; September 1998, pp. 115; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The Near infrared Camera and Multi-Object Spectrometer (NICMOS) was installed on the Hubble Space Telescope during a space shuttle servicing mission in February 1997. Using NICMOS, early release observations of the nearest region to Earth where massive stars are being formed-the belt of the constellation Orion-were obtained. These images reveal intricate structures in both the near-infrared continuum and in emissions from molecular hydrogen. Numerous H2-emitting knots have been resolved.
Author
Orion Constellation; Massive Stars

20040075897 Massachusetts Inst. of Tech., Cambridge, MA, USA
Formation, Evolution, and Population Synthesis of Binary Systems Containing Collapsed Stars
West, Donald, Technical Monitor; Rappaport, Saul; June 03, 2004; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12522; No Copyright; Avail: CASI; A01, Hardcopy

During the period September 1, 2002 through August 31, 2003 we have been supported in part by a small NASA 'bridge" grant NAG5-12522 to continue our theoretical investigations of the "Formation, Evolution, and Population Synthesis of Binary Systems Containing Collapsed Stars". This research includes theoretical studies of the formation and evolution of several different types of interacting binary systems containing collapsed stars. Four papers were completed under the auspices of this grant: 1. Theoretical Consideration on the Properties of Accreting Millisecond Pulsars. 2. Accretion Onto Fast X-Ray Pulsars. 3. The Effects of Binary Evolution on the Dynamics of Core Collapse and Neutron-Star. Author

Binary Stars; Evolution (Development); Pulsars; Formation

20040076858 Brookhaven National Lab., Upton, NY, USA
Skyshine
Lindenbaum, S. J.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 101-111; In English; See also 20040076842; No Copyright; Avail: CASI; A03, Hardcopy

The term "skyshine" generally refers to the indirect radiation from a source which originally proceeds upward from the surface of the earth and is then scattered back to a point near the surface of the earth by one or many collisions with air nuclei which may be elastic or inelastic. Some scattering from the earth will also be involved. One practical problem which I shall treat is the limit on the effectiveness of "berrier shielding" due to skyshine. Barrier shielding means the erection of a barrier or shielding wall between the source of radiation and a given point such that the amount of direct radiation reaching the point is negligible. The second problem is that of determining the long-distance behavior of a source of radiation surrounded by air. In particular, suppose that a machine or other radiation source is surrounded by a shield and that there is a definite radiation level outside the shield. In order to estimate the intensity of the radiation level at, say, several hundred or several thousand feet from the source, one might naturally think of using the inverse-square law and then allowing for the attenuation of the outgoing flux by interaction with the air nuclei. Therefore, one would offhand expect the radiation level to fall off with distance faster than the inverse-square law. Because of scattering and interaction with air nuclei, we will find that the radiation level decreases with distance more slowly than the inverse-square law, for distances of to several thousand feet. Derived from text

Radiant Flux Density; Radiation Sources; Scattering

20040076879 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Neutron Detection Technique
Oblath, N. S.; Poon, A. W. P.; Aug. 11, 2000; In English
Report No.(s): DE2003-815469; No Copyright; Avail: National Technical Information Service (NTIS)

The Sudbury Neutrino Observatory (SNO) has the ability to measure the total flux of all active flavors of neutrinos using the neutral current reaction, whose signature is a neutron. By comparing the rates of the neutral current reaction to the charged current reaction, which only detects electron neutrinos, one can test the neutrino oscillation hypothesis independent of solar models. It is necessary to understand the neutron detection efficiency of the detector to make use of the neutral current reaction. This report demonstrates a coincidence technique to identify neutrons emitted from the(sup 252)Cf neutron calibration source. The source releases on average four neutrons when a (sup 252)Cf nucleus spontaneously fissions.
NTIS

Neutron Counters; Oscillations; Detection; Calibrating

20040076880 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Study of the Effects of D2O Circulation
Oblath, N. S.; Poon, A. W. P.; Sep. 12, 2000; In English
Report No.(s): DE2003-815468; No Copyright; Avail: National Technical Information Service (NTIS)

The Sudbury Neutrino Observatory (SNO) has been collecting data since November 1999. The study of whether or not the D(sub 2)O circulation affects the data is an important part of understanding how the SNO detector behaves. This report looks at several characteristics of the data to determine to what extent the D(sub 2)O circulation affects the data. We found

that there is no evidence for any dependence of event rates in the cleaned data sets on the state of D(sub 2)O circulation. NTIS
Neutrinos; Data Acquisition

20040077079 NASA Ames Research Center, Moffett Field, CA, USA
Identification of Nitriles in the Interstellar Medium
Pendleton, Yvonne J.; Research and Technology 1999; December 2000, pp. 113-114; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The interstellar 4.62-micron band (2165 wavenumber) may be an important contributor to the cyanide (CN) inventory of material available for incorporation into newly forming planetary systems. This band is seen in absorption along lines of sight that pass through icy grains in front of embedded protostars. Therefore, the identification of the inter-stellar band is important for two reasons: for the astrophysical understanding of organic material in the dense cloud environment, and for the potential relevance to the origin of life, because extraterrestrial sources of CN groups may have been necessary if the early Earth had a nonreducing environment.
Derived from text
Interstellar Matter; Nitriles; Cyanides; Biological Evolution; Organic Materials

20040077114 NASA Ames Research Center, Moffett Field, CA, USA
Composition of Dust Along the Line of Sight Toward the Galactic Center
Chiar, Jean; Tielens, Alexander; Whittet, Douglas; Research and Technology 1999; December 2000, pp. 104-105; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The composition of dust and ice along the line of sight to the galactic center (GC) has been investigated through analysis of midinfrared spectra (2 - 13 microns) from the Short Wavelength Spectrometer on the Infrared Space Observatory ISO). The path to the GC samples both diffuse interstellar matter and dense molecular cloud environments by performing a phenomenological comparison with well-studied sightlines known to sample these distinct environments. We have been able to separate spectral absorption features arising in these components toward the GC. Dust absorption features along the lines of sight toward Sagittarius A* Sgr A*) and the Quintuplet sources (GCS3 and GCS4) are the primary targets in this endeavor. Molecular cloud material is unevenly distributed across the GC. Measurements of absorption features due to abundant solid-state species, such as water/ice and carbon dioxide, reveal that there is more molecular cloud material along the line of sight toward Sgr A* than toward the Quintuplet sources. The Sgr A* sightline has a rich, solid-state infrared spectrum that also reveals strong evidence for the presence of solid methane, ammonia, and formic acid in the molecular cloud ices.
Derived from text
Galactic Structure; Dust; Ice; Spectrum Analysis; Molecular Clouds; Interstellar Matter

20040077127 NASA Ames Research Center, Moffett Field, CA, USA
The Center for Star Formation Studies
Hollenbach, D.; Bell, K. R.; Cassen, P.; Laughlin, G.; Research and Technology 1999; December 2000, pp. 110-111; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Center for Star Formation Studies is a consortium of scientists from the Space Science Division at Ames and the Astronomy Departments of the University of California at Berkeley and Santa Cruz. Under the directorship of D. Hollenbach, this consortium conducts a coordinated program of theoretical research on star and planet formation and supports postdoctoral fellows, senior visitors, and students. Consortium members meet regularly at Ames to exchange ideas and present informal seminars on current research; a week-long workshop on selected aspects of star and planet formation occurs each summer.
Derived from text
Star Formation; Interstellar Matter; Stellar Mass Accretion; Molecular Clouds

20040077131 NASA Ames Research Center, Moffett Field, CA, USA
The Interstellar Production of Biologically Important Organics
Sandford, Scott A.; Bernstein, Max P.; Dworkin, Jason; Allamandola, Louis J.; Research and Technology 1999; December 2000, pp. 116-117; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

One of the primary tasks of the Astrochemistry Laboratory at Ames Research Center is to use laboratory simulations to study the chemical processes that occur in dense interstellar clouds. Since new stars are formed in these clouds, their materials may be responsible for the delivery of organics to new habitable planets and may play important roles in the origin of life.

These clouds are extremely cold (less than 50 kelvin), and most of the volatiles in these clouds are condensed onto dust grains as thin ice mantles. These ices are exposed to cosmic rays and ultraviolet (UV) photons that break chemical bonds and result in the production of complex molecules when the ices are warmed (as they would be when incorporated into a star-forming region). Using cryovacuum systems and UV lamps, this study simulates the conditions of these clouds and studies the resulting chemistry. Some of the areas of progress made in 1999 are described below. It shows some of the types of molecules that may be formed in the interstellar medium. Laboratory simulations have already confirmed that many of these compounds are made under these conditions.
Derived from text
Interstellar Matter; Biological Evolution; Molecular Clouds; Chemical Reactions

20040077132 NASA Ames Research Center, Moffett Field, CA, USA
Illumination of Young Stellar Disks
Bell, K. Robbins; Research and Technology 1999; December 2000, pp. 118; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The planets in our solar system formed from a gaseous disk known as the solar nebula. Disk-shaped nebulae thought to be analogous to the solar nebula are now commonly observed around solar mass stars younger than a few million years in nearby regions such as the Taurus-Auriga molecular cloud and the Orion Nebula. Images of these disks are obtained with facilities such as the Hubble Space Telescope; spectra are obtained with the Infrared Astronomical Observatory and various ground-based observatories such as the Keck Telescope on Mauna Kea on the island of Hawaii. Studying these systems provides insight into the development of our own planetary system as well as clues into the likelihood of the evolution of similar life-bearing systems around other stars.
Derived from text
Biological Evolution; Disks (Shapes); Infrared Radiation; Molecular Clouds; Solar Nebula; Stellar Mass

20040077134 NASA Ames Research Center, Moffett Field, CA, USA
Planetary Rings
Cuzzi, J. N.; Lissauer, J.; Mosqueira, I.; Showalter, M.; Research and Technology 1999; December 2000, pp. 120-121; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In addition to the natural curiosity inspired by their unusual appearances, planetary rings present a unique dynamical laboratory for understanding the properties of collisional particle disks that might help us understand the accretion of the planets. Ames maintains the Planetary Data System s Rings Node (http://ringmaster.arc.nasa.gov/), which archives and distributes ring data from NASA s spacecraft missions and from Earth-based observatories. The entire archive of images from the Voyager missions to the giant planets is now available on line, with catalogs to help users find the images they need. All the images of Saturn obtained by the Hubble Space Telescope (HST) during 1995, when the rings were seen edge-on to Earth, are available.
Derived from text
Data Systems; Gas Giant Planets; Planetary Rings

20040077141 NASA Ames Research Center, Moffett Field, CA, USA
The Calculation of Molecular Opacities
Freedman, Richard; Research and Technology 1999; December 2000, pp. 124; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The theoretical modeling of the properties and emergent spectra of extra solar giant planets and brown dwarfs requires an accurate and detailed knowledge of the sources of molecular opacity in these objects. In the past few years, many new extra solar planets and brown dwarfs have been discovered using new observational techniques and better, larger telescopes. In order to better understand the physical properties of these new objects and to relate their properties to the properties of other solar systems, astronomers have been using computer-generated models to reproduce their observed properties. This scenario allows a direct comparison between theory and observations and helps to constrain physical properties such as mass, radius, and chemical composition. An accurate theoretical model requires a thorough knowledge of the molecular opacities of a large number of different species, because the temperature in the atmospheres of these objects spans a range from 100 kelvin up to several thousand degrees. Because of the wide range of physical conditions encountered, modelers need molecular opacities up to a range of temperatures that go far beyond the normal range of molecular data from laboratory studies. The purpose of

this research is to extend the range of available molecular opacities up to the higher temperatures needed by the modelers. Derived from text

Opacity; Gas Giant Planets; Mathematical Models; Brown Dwarf Stars

20040077142 NASA Ames Research Center, Moffett Field, CA, USA

Stability and Chaos in Planetary Systems

Laughlin, Gregory; Research and Technology 1999; December 2000, pp. 127-128; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

One of the major news stories of the year was the detection of multiple planets around a Sun-like star Upsilon Andromedae). Aside from being a first detection, this discovery was very interesting because the arrangement of the three planets in the Upsilon Andromedae system is drastically different from the arrangement of our own system. The two outer Upsilon Andromedae planets are considerably more massive than Jupiter, and they have orbits that are much more eccentric than those of the major planets in our system. However, the radial velocity observations used to make the discovery can determine only lower limit for the planetary masses. Furthermore, there were several different data sets compiled by competing teams of observers. Two important questions thus remained, both of which were addressed by Ames-based theoretical research: a) What is the true mass of the planets? and b) Which set of published orbital parameters best represents the true configuration of the system? Work in FY99 focused extensively on these questions, and examined other aspects of the general problem of planetary orbital stability.

Derived from text

Andromeda Constellation; Planetary Orbits

20040077167 NASA Ames Research Center, Moffett Field, CA, USA

Stability of the Upsilon Andromedae Planetary System

Lissauer, Jack J.; Rivera, Eugenio; Research and Technology 1999; December 2000, pp. 128; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

This project studies the dynamical properties of planetary systems that are consistent with the observational data on the three-planet system orbiting the nearby main sequence star Upsilon Andromedae. Some configurations consistent with the data originally announced by the discovery team are found to be stable for at least one billion years, whereas in other configurations planets can be ejected into interstellar space in less than 100,000 years. The typical path to instability involves the outer planet exciting the eccentricity of the orbit of the middle planet to such high values that it ventures close to the inner planet. In some stable systems a secular resonance between the outer two planets prevents close approaches between them by aligning their longitudes of periastron (that is, the orientations of their elliptical orbits). In relatively stable systems, test particles (which can be thought of as representing asteroids or Earth-like planets that are too small to have been detected to date) can survive for long periods of time between the inner and middle planets, as well as exterior to the outer planet. No stable orbits between the middle and outer planets were found.

Author

Andromeda Constellation; Planetary Orbits; Stability

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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*.

20040074380 Johns Hopkins Univ., Baltimore, MD, USA

Central Stars of Planetary Nebulae in the SMC

Bianchi, Luciana; May 31, 2004; 2 pp.; In English

Contract(s)/Grant(s): NAG5-12294; No Copyright; Avail: CASI; A01, Hardcopy

In FUSE cycle 3's program C056 we studied four Central Stars of Planetary Nebulae (CSPN) in the Small Magellanic Could. All FUSE observations have been successfully completed and have been reduced and analyzed. The observation of one object (SMP SMC 5) appeared to be off-target and no useful stellar flux was gathered. For another observation (SMP SMC 1) the voltage problems resulted in the loss of data from one of the SiC detectors, but we were still able to analyze the remaining data. The analysis and the results are summarized below. The FUSE data were reduced using the latest available version of the FUSE calibration pipeline (CALFUSE v2.4). The flux of these SMC post-AGB objects is at the threshold of

FUSE S sensitivity, and the targets required many orbit-long exposures, each of which typically had low (target) count-rates. The background subtraction required special care during the reduction, and was done in a similar manner to our FUSE cycle 2 BOO1 objects. The resulting calibrated data from the different channels were compared in the overlapping regions for consistency. The final combined, extracted spectra of each target was then modeled to determine the stellar and nebular parameters. The FUSE spectra, combined with archival HST spectra, have been analyzed using stellar atmospheres codes such as TLUSTY and CMFGEN to derive photospheric and wind parameters of the central stars, and with ISM models to determine the amount and temperature of the surrounding atomic and molecular hydrogen. We have combined these results with those of our cycle 4 (D034) program (CSPN of the LMC) in Herald & Bianchi 2004a (paper in preparation, will be submitted to ApJ in June 2004). Two of the three SMC objects analyzed were found to have significantly lower stellar temperatures than had been predicted using nebular photoionization models, indicating either a hotter ionizing companion or the existence of strong shocks in the nebular environment. The analysis also revealed that some objects are surrounded by significant quantities of hot (e.g., 1000- 2000 K) molecular H2, similar to what we found for some LMC and Galactic CSPN (Herald & Bianchi 2002, 2003a, b, 2004b, c, d).
Author
Planetary Nebulae; Magellanic Clouds; Galaxies; Photoionization

20040075034 Michigan Univ., Ann Arbor, MI, USA
MGS Radio Science Electron Density Profiles: Interannual Variability and Implications for the Martian Neutral Atmosphere
Bougher, S. W.; Engel, S.; Hinson, D. P.; Murphy, J. R.; Journal of Geophysical Research; March 25, 2004; ISSN 0148-0227; Volume 109, No. E3; 13 pp.; In English
Contract(s)/Grant(s): NAG5-12567; Copyright; Avail: Other Sources

Martian electron density profiles provided by the Mars Global Surveyor (MGS) Radio Science (RS) experiment over the 95-200 km altitude range indicate what the height of the electron peak and the longitudinal structure of the peak height are sensitive indicators of the physical state of the Mars lower and upper atmospheres. The present analysis is carried out on five sets of occultation profiles, all at high solar zenith angles (SZA). Variations spanning 2 Martian years are investigated near aphelion conditions at high northern latitudes (64.7 - 77.6 N) making use of four of these data sets. A mean ionospheric peak height of 133.5 - 135 km is obtained near SZA = 78 - 82 deg.; a corresponding mean peak density of 7.3 - 8.5 x l0(exp 4)/qu cm is also measured during solar moderate conditions at Mars. Strong wave number 2 - 3 oscillations in peak heights are consistently observed as a function of longitude over the 2 Martian years. These observed ionospheric features are remarkably similar during aphelion conditions 1 Martian year apart. This year-to-year repeatability in the thermosphere-ionosphere structure is consistent with that observed in multiyear aphelion temperature data of the Mars lower atmosphere. Coupled Mars general circulation model (MGCM) and Mars thermospheric general circulation model (MTGCM) codes are run for Mars aphelion conditions, yielding mean and longitude variable ionospheric peak heights that reasonably match RS observations. A tidal decomposition of MTGCM thermospheric densities shows that observed ionospheric wave number 3 features are linked to a non-migrating tidal mode with semidiurnal period (sigma = 2) and zonal wave number 1 (s = -1) characteristics. The height of this photochemically determined ionospheric peak should be monitored regularly.
Author
Mars Global Surveyor; Electron Density (Concentration); Atmospheric Circulation; Mars Environment; Mars Atmosphere

20040075498 General Electric Co., Daytona Beach, FL, USA
Survey of the Physical and Environmental Parameters of the Moon
Niedz, F. J.; Kopal, Zdenek; February 1963; 238 pp.; In English
Contract(s)/Grant(s): NASw-410; No Copyright; Avail: CASI; A11, Hardcopy

This document presents, in summary, a compilation of the physical and environmental parameters of the moon. A determined attempt has been made to be objective at all times. Many of the physical sciences are presented in sufficient depth to adequately identify the basic information available. It is expected that the appropriate references will be consulted when additional detail is required. It is obvious both from the text and the reference material that divergent opinions prevail and uncertainties exist in almost every phase of lunar science; e.g., the existence of the lunar bulge, the thickness of the dust layer, etc. No pretense is made to resolve these differences, but by bringing together many references, it is hoped that some contribution will be made in lunar science. The subject index will be of particular value since it relates the reference section by subject. A glossary of terms used throughout the text is also provided.
Author
Moon; Lunar Environment; Physical Properties; Selenology; Optical Properties; Surface Properties

20040075527 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Measurement Scale of the SOLIS Vector Spectromagnetograph

Jones, Harrison P.; Harvey, John W.; Henney, Carl J.; Keller, Christoph U.; Malanushenko, Olena M.; 2004; 1 pp.; In English; 204th American Astronomical Society Meeting, 30 May - 3 Jun. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Longitudinal magnetograms obtained with thc SOLIS Vector Spectromagnetograph (VSM) during a cross-calibration period are compared with similar data from the NASA/NSO Spectromagnetograph (SPM) at the NSO/Kitt Peak Vacuum Telescope as well as with SOHO/MDI and GONG magnetogram. The VSM began observation at the University of Arizona agricultural test site and collaborative observations were obtained with both the VSM and SPM from 2003 Aug 05 through 2003 Sep 21 where the SPM was officially retired. The VSM replaces the SPM and continues the 3O-year NSO/Kitt Peak synoptic magnetogram record. Magnetograms are compared by equating histograms and, for selected examples, by pixel-by-pixel comparison of co-registered images. The VSM was not corrected for polarization crosstalk and was operated without hast guiding. Solar activity was at best moderate during this period. Over the range of observed fields, the VSM magnetograms show greatly improved sensitivity but are otherwise virtually identical with "raw" SPM magnetogram. GONG magnetograms are also closely comparable with the SPM while MDI flux values tend to be stronger by a factor of 1.2 - 1.4. Dependence of the results on seeing will be discussed. Partial funding for this work was provided through Solar and Heliospheric Research Supporting Research and Technology grants from NASA's Office of Space Sciences. Author

Cross Correlation; Flux Quantization; Magnetic Signatures; Solar Activity

20040075559

Improved Mars Upper Atmosphere Climatology

Bougher, S. W.; 2004; 11 pp.; In English

Contract(s)/Grant(s): NAG5-12567; No Copyright; Avail: CASI; A03, Hardcopy

The detailed characterization of the Mars upper atmosphere is important for future Mars aerobraking activities. Solar cycle, seasonal, and dust trends (climate) as well as planetary wave activity (weather) are crucial to quantify in order to improve our ability to reasonably depict the state of the Mars upper atmosphere over time. To date, our best information is found in the Mars Global Surveyor (MGS) Accelerometer (ACC) database collected during Phase 1 (Ls = 184 - 300; F10.7 = 70 - 90) and Phase 2 (Ls = 30 - 90; F10.7 = 90 - 150) of aerobraking. This database (100 - 170 km) consists of thermospheric densities, temperatures, and scale heights, providing our best constraints for exercising the coupled Mars General Circulation Model (MGCM) and the Mars Thermospheric General Circulation Model (MTGCM). The Planetary Data System (PDS) contains level 0 and 2 MGS Accelerometer data, corresponding to atmospheric densities along the orbit track. Level 3 products (densities, temperatures, and scale heights at constant altitudes) are also available in the PDS. These datasets provide the primary model constraints for the new MGCM-MTGCM simulations summarized in this report. Our strategy for improving the characterization of the Mars upper atmospheres using these models has been three-fold : (a) to conduct data-model comparisons using the latest MGS data covering limited climatic and weather conditions at Mars, (b) to upgrade the 15-micron cooling and near-IR heating rates in the MGCM and MTGCM codes for ad- dressing climatic variations (solar cycle and seasonal) important in linking the lower and upper atmospheres (including migrating tides), and (c) to exercise the detailed coupled MGCM and MTGCM codes to capture and diagnose the planetary wave (migrating plus non-migrating tidal) features throughout the Mars year. Products from this new suite of MGCM-MTGCM coupled simulations are being used to improve our predictions of the structure of the Mars upper atmosphere for the upcoming MRO aerobraking exercises in 2006. A Michigan website, containing MTGCM output fields from previous climate simulations, is being expanded to include new MGCM-MTGCM simulations addressing planetary wave influences upon thermospheric aerobraking fields (densities and temperatures). In addition, similar MTGCM output fields have been supplied to the MSFC MARSGRAM - 200X empirical model, which will be used in mission operations for conducting aerobraking maneuvers.
Author

Accelerometers; Atmospheric Circulation; Atmospheric Density; Atmospheric General Circulation Models; Atmospheric Temperature; Mars Atmosphere; Near Infrared Radiation

20040075670 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Prospecting Jupiter in the Thermal Infrared: Temperatures and Dynamics

Flasar, F. M.; Kunde, V. G.; Achterberg, R. K.; Conrath, B. J.; Simon-Miller, A. A.; Nixon, C. A.; Gierasch, P. J.; Romani, P. N.; Bezard, B.; Irwin, P., et al.; January 2004; 3 pp.; In English; Copyright; Avail: Other Sources

We present for the first time detailed maps of charged temperatures and winds in Jupiter's stratosphere, from infrared

spectra acquired during the Cassini swingby of Jupiter. The maps reveal a high-altitude equatorial jet 1140 m s-', as strong as the cloud-top winds. It may result from wave forcing and be analogous to the quasi-biennial oscillation in the earth's stratosphere. The maps give the best characterization of the motions of stratospheric waves, and they better define the vertical penetration of the auroral hot spots into the stratosphere.
Author
Jupiter Atmosphere; Stratosphere; Infrared Spectra

20040075716 NASA Ames Research Center, Moffett Field, CA, USA
Solar System Dynamics
Lissauer, Jack J.; Research and Technology 1997; September 1998, pp. 108-109; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Progress has been made on several theoretical problems related to the dynamical structure of the solar system. Models of the early phases of the growth of solid planetary embryos on eccentric orbits were developed and used to calculate accretion rates and the accumulation of rotational angular momentum. It was found that eccentricities of the magnitude believed to be present during this period modify planetary growth rates and angular momentum accumulation only slightly, relative to the case of planets on circular orbits.
Derived from text
Solar System; Solar System Evolution; Planetary Orbits

20040075725 NASA Ames Research Center, Moffett Field, CA, USA
Amino Acids in Meteorites
Lerner, Narcinda R.; Research and Technology 1997; September 1998, pp. 97; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

Strecker synthesis has been proposed as a source of amino acids in meteorites. Detection in the Murchison meteorite of carbonyl compounds, the precursors of the amino acids in the Strecker synthesis, and of a-hydroxy acids, important by-products of the Strecker synthesis, supports this conjecture. In order to determine if hvdroxy acids retain their carbon-bonded hydrons better than amino acids, deuterium exchange of a-hydroxy acids in deuterium oxide (D20) was investigated at temperatures in excess of 393 kelvin. No measurable loss of hydrogen was observed. Considerable deuterium exchange is observed for a-amino acids under such conditions. These results suggest that the Strecker synthesis i s not responsible for the amino acids and hydroxy acids in the Murchison meteorite. In order to completely rule out the Strecker synthesis, the deuterium content of amino acid-hydroxy acid pairs such as glycine- glycolic acid or alanine-lactic acid need to be measured.
Author (revised)
Murchison Meteorite; Amino Acids; Meteoritic Composition

20040075732 NASA Ames Research Center, Moffett Field, CA, USA
Cratering Rates on the Galilean Satellites
Zahnle, Kevin; Dones, Luke; Research and Technology 1997; September 1998, pp. 111-112; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

In the inner solar system, impact craters are made mostly by asteroids and long-period comets. The Jupiter family of comets, whose comets are in relatively short-period,low-inclination orbits dominated dynamically by gravitational interactions with jupiter, is relatively unimportant. These roles are reversed in the outer solar system. Asteroids rarely reach as far as Jupiter, and long-period comets are more or less uniformly distributed. The Jupiter-family comets, which swarm about Jupiter, are relatively the most important source of cratering in the vicinity of Jupiter. The purpose of this project was to determine the absolute cratering rates on the Galilean satellites, and to use those rates to estimate surface ages on io, Europa, Ganymede, and Callisto.
Author
Galilean Satellites; Europa; Cratering; Ganymede; Io

20040075749 NASA Ames Research Center, Moffett Field, CA, USA
Transient Meteor Activity
Jenniskens, Peter; Research and Technology 1997; September 1998, pp. 107-108; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

In 1997, Ames Research Center proved to be uppermost in studies of transient meteor activity. Meteor storms and lesser outbursts are spectacular natural phenomena that have eluded systematic study with modern techniques. During an outburst, meteor rates increase above the normal annual activity for a period that typically ranges from 1 to 14 hours. Little is known about why it sometimes "rains stars" at night. An answer to this question is key to the information that is particular to these events. For example, outbursts provide a unique window on how comets shed the large millimeter-to-centimeter-size dust grains that contain most of the mass lost by comets in the form of dust.
Derived from text
Meteoroid Concentration; Storms; Transient Oscillations

20040075776 NASA Ames Research Center, Moffett Field, CA, USA
Implementing a Strategy for Mars Exopaleontology
Farmer, Jack D.; DesMarais, David J.; Research and Technology 1997; September 1998, pp. 94-95; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

In exploring for a record of ancient Martian life, the goals, methods, and assumptions differ substantially from those required in exploring for extant life. To differentiate this activity from the conventional discipline of exobiology, the exploration of ancient extraterrestrial life is referred to as exopaleontology. The practical task facing exopaleontology is to define a strategy for exploring Mars' fossil record during the decade-long exploration program that lies ahead. Consideration of the quality of paleontological information preserved under different geological conditions is important in order to develop a strategy with broad applicability. To help guide site selection during the Mars Global Surveyor (MGS) Program, a site-selection strategy for exopaleontology-based on microbial fossilization processes in a variety of extreme environments regarded to be good analogs for early Earth and Mars-was developed.
Author
Extraterrestrial Life; Mars (Planet); Paleontology

20040076920 Hawaii Univ., Honolulu, HI, USA
The Diversity of Martian Volcanic Features as Seen in MOC Images and MOLA Topographic Data
Mouginis-Mark, Peter J.; June 15, 2004; 8 pp.; In English
Contract(s)/Grant(s): NAG5-9576; No Copyright; Avail: CASI; A02, Hardcopy

This project focused on the evolution of the summit areas of Martian volcanoes. By using data collected from the Mars Orbiter Camera (MOC) and Mars Laser Altimeter (MOLA) instruments, we tried to better understand the diversity of constructional volcanism on Mars, and hence further understand eruption processes. We investigated the styles of volcanism on the major volcanic constructs (Olympus, Arsia, Pavonis, and Ascraeus Montes), and also studied the role of magma-volatile interactions within the shallow subsurface of these volcanoes and the surrounding areas. Theoretical models for internal processes within volcanoes, including the thermal influences of dike intrusions on pre-existing volatiles, were developed based on our identification of landform distributions. Our work provided new insights into the diversity of volcanism on Mars, and the distribution of Martian volatiles in space and time. Highlights of our results include: 1) The identification of large ash deposits at the summit of Arsia Mons; 2) The study of a large flank eruption on Elysium Mons and the estimation of the effusion rate needed to produce the observed lava channel; 3) The quantitative description of dike intrusion into volatile-rich terrain to explain the origin of Hrad Vallis; 4) The identification of constructional ridges on top of very young lava flows from Olympus Mons, with the interpretation that these ridges were formed by very recent phreatomagmatic eruptions; and 5) The characterization of the dimensions and slope distributions on 18 volcanic edifices on Mars.
Author (revised)
Mars Volcanoes; Mars Global Surveyor; Topography; Geomorphology

20040076982 Massachusetts Univ., Amherst, MA, USA
Mars Data Analysis Program
McGill, George E.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12158; No Copyright; Avail: Other Sources; Abstract Only

Grant NAGS12158 addressed a major NASA objective concerning the possibility of a palm ocean or large lake in the northern lowlands of Mars. Our overall approach for this study was an analysis of the graben-bounded giant polygons of Utopia Planitia, but specifically those grabens that define circles rather than open polygons. These circular grabens overlie buried impact craters, and the grabens form because of differential compaction of the overlying material over crater rims and floors. Several years ago, I predicted that the graben circles would bound depressions, and that the depths of these depressions

would scale with the diameters of the graben circles. These predictions have been verified by earlier analysis. During this one-year grant (with one-year no-cost extension) we greatly increased the sample size and validated the earlier research robustly. What remained unexplained was why most of the graben circles in Utopia Planitia were double. A new model, involving volumetric compaction rather than simply 2-D compaction, satisfactorily explains the double rings and also provides a measure of relative thickness of the cover material burying the craters as a function of radial distance from the center of the Utopia Basin. Only two materials are likely candidates for the compacting cover material: volcanic ash, or wet sediment. The water in the wet sediment is largely responsible for the volumetric compaction; dry ash will compact vertically but experiences very limited lateral shrinkage. Thus the depressions within the circular grabens and the model explaining the double rings strongly favor wet sediment and thus provide evidence in favor of a past body of standing water in the northern lowlands. Publications supported entirely or in part by this grant are listed below.
Author
Mars Surface; Data Acquisition; Data Processing; Water; Volcanoes

20040077059 NASA Ames Research Center, Moffett Field, CA, USA
Astrobiology Leonid Meteor Shower Mission
Jenniskens, Peter; Butow, Steven J.; Fonda, Mark; Research and Technology 1999; December 2000, pp. 95-96; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The anticipated 1999 Leonid meteor storm provided a unique opportunity to study the nature and composition of meteoroids. Because the timing and intensity of the Leonid showers can be deter- mined to within acceptable parameters to plan observing campaigns, NASA Ames Research Center and the USA Air Force IUSAF) jointly sponsored the Leonid Multi-Instrument Aircraft Campaign (Leonid MAC). The airborne campaign produced a wealth of data, images, and spectra that will result in new insights on the nature of cometary debris and the significance of meteors as a seeding mechanism for organics on young planets.
Derived from text
Debris; Exobiology; Leonid Meteoroids; Meteoroid Showers

20040077080 NASA Ames Research Center, Moffett Field, CA, USA
Primary Accretion in the Protoplanetary Nebula
Cuzzi, J. N.; Hogan, R. C.; Desch, S. J.; Paque, J. M.; Dobrovolskis, A. R.; Research and Technology 1999; December 2000, pp. 122-123; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

"Primitive" objects in the meteorite record represent the first large bodies to accumulate in the protoplanetary nebula-a vast data set that has had little context for interpretation. The accretion of primitive bodies almost certainly occurred in the presence of gas. Ames efforts focus on numerical modeling of particle-gas interactions in turbulent flows, and understanding meteorite properties in the light of theoretical models.
Derived from text
Nebulae; Meteorites; Mathematical Models; Gas Flow

20040077082 NASA Ames Research Center, Moffett Field, CA, USA
Mars Atmosphere and Climate
Hollingsworth, Jeffrey L.; Haberle, Robert M.; Schaeffer, James; Research and Technology 1999; December 2000, pp. 124-126; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Furthering our understanding of the global atmospheric circulation on Mars i s the focus of this research at Ames Research Center. As in Earth s atmosphere, Mars atmospheric circulation exhibits variability over a vast range of spatial and temporal scales. In this endeavor, the primary tool used is the Ames Mars General Circulation Model (MGCM). The MGCM is a time-dependent, three-dimensional, numerical model of the hydrodynamic state of the atmosphere as determined by self-consistent algorithms for radiative (for example, solar and infrared absorption, emission and scattering in the planet s tenuous and frequently dust-laden atmosphere) and near-surface processes (for example, a boundary- layer dissipation associated with atmospheric turbulence). In parallel efforts, spacecraft data from the recent Mars Pathfinder mission and the ongoing Mars Global Surveyor (MGS) mission are utilized to validate the climate-simulation results, while at the same time both mechanistic and full-up MGCM simulations can offer a global context for the remotely sensed data.
Derived from text
Mars Atmosphere; Atmospheric General Circulation Models

20040077108 NASA Ames Research Center, Moffett Field, CA, USA

Impacts and Meteorite Organic Compounds

Cooper, George; Horz, Friedrich; Oleary, Alanna; Chang, Sherwood; Research and Technology 1999; December 2000, pp. 92; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The majority of meteorites that contain organic compounds are thought to originate in the asteroid belt. Impacts among asteroids and impacts between asteroids and comets with the planets generate heat and pressure that may have altered or destroyed preexisting organic matter (depending upon impact velocities). Very little is known about the impact- related chemical evolution of organic matter relevant to this stage of the cosmic history of biogenic elements and compounds. At Ames Research Center, research continues in an effort to understand the effects of impacts on organic compounds. One experimental approach i s to subject mixtures of organic compounds, embedded in the matrix of a meteorite, to simulated hypervelocity impacts using a vertical gun. By choice of suitable targets and projectile materials, the compounds are subjected to simulated impacts, resulting in various pressures in the range of 100 to 400 kilobar. Each pressure can then be converted by mathematical equations into the corresponding impact velocity that an actual asteroid or meteorite would have experienced. Author

Organic Materials; Chemical Evolution; Asteroids; Meteorites

20040077113 NASA Ames Research Center, Moffett Field, CA, USA

Observations of Extrasolar Planets

Castellano, Tim; Research and Technology 1999; December 2000, pp. 103-104; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In the last several years, more than 30 planets have been discovered orbiting other stars. All discoveries to date have been by the radial velocity method whereby extremely small variations in the speed of the star relative to Earth are used to infer the presence of an unseen orbiting companion. More than 20% of the planets discovered orbit their parent stars for periods of less than a week. For these short-period orbits, 10% will be oriented such that the planet will periodically pass in front of the star as seen from Earth. An alternate method of detecting extrasolar planets employing high-precision measurements of the brightness of the stars can confirm the existence of the planet and obtain its mass and radius. This technique was convincingly demonstrated when the first-ever measurement of the dimming of a star (HD 209458) because of the passage of an orbiting planet occurred in late 1999. This "extrasolar planetary transit" was discovered independently by two groups and widely reported in the news media.

Derived from text

Radial Velocity; Extrasolar Planets; Detection

20040077115 NASA Ames Research Center, Moffett Field, CA, USA

Organic Matter in the Outer Solar System

Cruikshank, Dale P.; Roush, Ted L.; Pendleton, Yvonne J.; DalleOre, Cristina; Owen, Tobias C.; Geballe, Thomas R.; deBergh, Catherine; Khare, Bishun; Research and Technology 1999; December 2000, pp. 106; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Many solid bodies in the outer solar system are covered with ices of various compositions, including water, carbon dioxide, methane, nitrogen, and other molecules that are solid at the low temperatures that prevail there. These ices have all been detected by remote sensing observations made with telescopes on Earth, or more recently, spacecraft in orbit (notably Calileo at Jupiter). The data also reveal other solid materials that could be minerals or complex carbon- bearing organic molecules. A study in progress using large ground-based telescopes to acquire infrared spectroscopic data, and laboratory results on the optical properties of complex organic matter, seeks to identify the non-icy materials on several satellites of Saturn, Uranus, and Neptune. The work on the satellites of Saturn i s in part preparatory to the Cassini spacecraft investigation of the Saturn system, which will begin in 2004 and extend for four years.

Derived from text

Organic Materials; Gas Giant Planets; Ice; Water; Carbon Dioxide

20040077133 NASA Ames Research Center, Moffett Field, CA, USA

Detection of an Extrasolar Planet

Borucki, William J.; Cadlwell, Douglas; Koch, David G.; Webster, Larry D.; Jenkins, Jon M.; Ninkov, Zoran; Showen, Robert; Research and Technology 1999; December 2000, pp. 119-120; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this research is to determine the occurrence frequency and the properties of extrasolar planets. Information on the number, size, mass, spacing, and composition of the planets in other planetary systems is needed to refine our models of planetary system formation and the processes that gave rise to their present configurations. The recent discoveries provide tantalizing glimpses of the large variety of planetary systems that exist and make it possible to begin an investigation of the role of the giant planets. To obtain information on the statistical properties of dependencies of these properties, it is necessary to observe many of these objects for a variety of stellar spectral types and stellar compositions, and for a range of semi-major axes.
Derived from text
Planetary Evolution; Gas Giant Planets; Extrasolar Planets; Statistical Distributions; Planetary Composition; Planetary Systems

20040077143 NASA Ames Research Center, Moffett Field, CA, USA
Hydrodynamic Simulations of Asteroid Impacts on Venus
Zahnle, Kevin; Korycansky, Donald G.; Research and Technology 1999; December 2000, pp. 128-129; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

In this study, numerous two-dimensional (2-D) high-resolution hydrodynamical simulations of asteroids striking the atmosphere of Venus were performed. The computations used ZEUS, a grid- based Eulerian hydro-code designed to model the behavior of gases in astrophysical situations. The numerical experiments address a wide range of impact parameters (velocity, size, and incidence angle), but the focus is on 1 -, 2-, and 3-kilometer- diameter asteroids, because asteroids of these sizes are responsible for most of the impact craters on Venus. Asteroids in this size range disintegrate, ablate, and decelerate in the atmosphere, yet retain enough impetus to make large craters when they strike the ground. Smaller impactors usually explode in the atmosphere without cratering the surface.
Author
Venus Atmosphere; Asteroids; Two Dimensional Models

20040077144 NASA Ames Research Center, Moffett Field, CA, USA
Onboard Autonomy and Contingent Planning for Rovers
Bresina, J. L.; Washington, R.; Smith, D. E.; Golden, K.; Research and Technology 1999; December 2000, pp. 129-130; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

The Pathfinder mission demonstrated the potential for robotic Mars exploration, but at the same time indicated the need for increased rover autonomy. The highly ground-intensive control with infrequent communication and high latency limited the effectiveness of the Sojourner rover. This project set out to increase the flexibility and robustness of Mars rovers by developing a contingent sequence language, a contingent planner/scheduler to support generation of such sequences, and an onboard executive system that can execute contingent sequences, manage resources, and perform fault diagnosis. ing language, called the Contingent Rover Language (CRL). A key feature of CRL is that it enables the encoding of contingent plans specifying what to do if a failure occurs, as well as what to do if a serendipitous science opportunity arises. For example, a CRL plan could specify the following contingent rover behavior: wher: a failure occurs, execute a contingency plan to recover from the failure; if none is available, then execute a contingency plan to acquire additional data to support failure diagnosis and recovery by the ground operations team.
Derived from text
Ground Operational Support System; Roving Vehicles; Autonomy; Mars Exploration; Ground Based Control

20040077186 NASA Ames Research Center, Moffett Field, CA, USA
Satellite Estimates of Terrestrial Biomass and the Effects of Deforestation on the Global Carbon Cycle
Potter, Christopher; Klooster, Steven; Genovese, Vanessa Brooks; Torregrosa, Alicia; Bobo, Matthew; Research and Technology 1999; December 2000, pp. 172-173; In English; See also 20040077048; No Copyright; Avail: CASI; A01, Hardcopy

Investigators of the Ecosystem Science and Technology Branch are generating new global model estimates for terrestrial biomass sources of atmospheric carbon dioxide (COz). This ecosystem simulation modeling uses a combination of global satellite observations, predictions of above-ground biomass based on climate and satellite vegetation indexes, and the most current data on country-by- country changes in global forest cover (1 990 to 1995), which are compiled regularly by the Food and Agricultural Organization (FAO) of the United Nations. The model estimates for carbon fluxes, which include forest area regrowth and expansion of carbon sinks in temperate and boreal forest zones, are based on the most recent global maps for

observed climate, elevation, soils, plant cover, and changes in forest areas from natural and human forces.
Derived from text
Ecosystems; Biomass; Simulation; Carbon Dioxide; Carbon Cycle; Environment Models

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040074450 NASA Goddard Space Flight Center, Greenbelt, MD, USA
DASL-Data and Activities for Solar Learning
Jones, Harrison P.; Henney, Carl; Hill, Frank; Gearen, Michael; Pompca, Stephen; Stagg, Travis; Stefaniak, Linda; Walker, Connie; [2004]; 1 pp.; In English; National Science Teachers Association Convention, 1-4 Apr. 2004, Atlanta, GA, USA; Copyright; Avail: Other Sources; Abstract Only

DASL-Data and Activities for Solar Learning Data and Activities for Solar Learning (DASL) provides a classroom learning environment based on a twenty-five year record of solar magnetograms from the National Solar Observatory (NSO) at Kitt Peak, AZ. The data, together with image processing software for Macs or PCs, can be used to learn basic facts about the Sun and astronomy at the middle school level. At the high school level, students can study properties of the Sun's magnetic cycle with classroom exercises emphasizing data and error analysis and can participate in a new scientific study, Research in Active Solar Longitudes (RASL), in collaboration with classrooms throughout the country and scientists at NSO and NASA. We present a half-day course to train teachers in the scientific content of the project and its classroom use. We will provide a compact disc with the data and software and will demonstrate software installation and use, classroom exercises, and participation in RASL with computer projection.
Author
Image Processing; Magnetic Signatures; Solar Activity; Solar Observatories; Sun

20040074999 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ultraviolet Radiation and Stratospheric Ozone
Stolarski, R.; 2003; 1 pp.; In English; Fall AGU 2003 Meeting: The Sun's Spectrum and Life on Earth, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Ultraviolet radiation from the sun produces ozone in the stratosphere and it participates in the destruction of ozone. Absorption of solar ultraviolet radiation by ozone is the primary heating mechanism leading to the maximum in temperature at the stratopause. Variations of solar ultraviolet radiation on both the 27-day solar rotation period and the 11-year solar cycle affect ozone by several mechanisms. The temperature and ozone in the upper stratosphere respond to solar uv variations as a coupled system. An increase in uv leads to an increase in the production of ozone through the photolysis of molecular oxygen. An increase in uv leads to an increase in temperature through the heating by ozone photolysis. The increase in temperature leads to a partially-offsetting decrease in ozone through temperature-dependent reaction rate coefficients. The ozone variation modulates the heating by ozone photolysis. The increase in ozone at solar maximum enhances the uv heating. The processes are understood and supported by long-term data sets. Variation in the upper stratospheric temperatures will lead to a change in the behavior of waves propagating upward from the troposphere. Changes in the pattern of wave dissipation will lead to acceleration or deceleration of the mean flow and changes in the residual or transport circulation. This mechanism could lead to the propagation of the solar cycle uv variation from the upper stratosphere downward to the lower stratosphere. This process is not well-understood and has been the subject of an increasing number of model studies. I will review the data analyses for solar cycle and their comparison to model results.
Author
Ultraviolet Radiation; Temperature Dependence; Radiation Absorption; Ozone; Atmospheric Temperature; Solar Radiation; Solar Cycles

20040075613 NASA Marshall Space Flight Center, Huntsville, AL, USA, National Space Science and Technology Center, Huntsville, AL, USA
Supergranule Diffusion and Active Region Decay
Hathaway, David H.; Choudhary, Debi Prasad; [2004]; 1 pp.; In English; 204th Meeting of the AAS, 30 May - 3 Jun. 2004, Denver, CO, USA; Copyright; Avail: Other Sources; Abstract Only

Models of the Sun's magnetic dynamo include turbulent diffusion to parameterize the effects of convective motions on

the evolution of the Sun's magnetic field. Supergranules are known to dominate the evolution of the surface magnetic field structure as evidenced by the structure of both the active and quiet magnetic network. However, estimates for the dif hivity attributed to su perymules differ by an order of magnitude from about 100 km sup2/s to more than 1000 km sup2/s. We examine this question of the e i v i t y using three merent approaches. 1) We study the decay of more than 30,000 active regions by determining the rate of change in the sunspot area of each active region from day-to-day. 2) We study the decay of a single isolated active region near the time of solar minimum by examining the magnetic field evolution over five solar rotations fiom SOHOMDI magnetograms obtained at 96-minute intervals. 3) We study the characteristics of supergranules that influence the estimates of their diffusive properties - flow speeds and lifetimes as functions of size - fiom SOHO/MDI Dopplergrams.
Author
Solar Magnetic Field; Diffusivity

20040075684 NASA Marshall Space Flight Center, Huntsville, AL, USA
Status of Solar Sail Material Characterization at NASA's Marshall Space Flight Center
Edwards, David L.; Semmel, Charles; Hovater, Mary; Nehles, Mary; Gray, Perry; Hubbs, Whitney; Wertz, George; [2004]; 1 pp.; In English; The Seventh International Space Conference Protection of Materials and Structures from the Sapce Environment, 10-13 May 2004, Toronto, Canada; No Copyright; Avail: Other Sources; Abstract Only

Near term solar sail propelled science missions are targeting the Lagrange point 1 (Ll) as well as locations sunward of L1 as destinations. These near term missions include the Solar Polar Imager' and the L1 Diamond '. The Environmental Effects Group at NASA's Marshall Space Flight Center (MSFC) continues to actively characterize solar sail material in preparation for these near term solar sail missions. Previous investigations indicated that space environmental effects on sail material thermo-optical properties were minimal and would not significantly affect the propulsion efficiency of the sail. These investigations also indicated that the sail material mechanical stability degrades with increasing radiation exposure. This paper will further quantify the effect of space environmental exposure on the mechanical properties of candidate sail materials. Candidate sail materials for these missions include Aluminum coated Mylar(TradeMark), Teonex(TraeMark), and CP1 (Colorless Polyimide). Experimental data will be presented on sail material response to charged particle radiation and subsequent Hypervelocity Impact (HVI). Data will also be presented indicating mechanical property variations in sail material resulting from electron exposure, proton exposure, and a combined electron and proton exposure. Tabular data consisting of areal density, thickness, thermo-optical, mechanical, and electrical properties, vacuum stability and outgassing will be presented.
Author
Solar Sails; Mechanical Properties; Aerospace Environments; Environment Effects; Stability; Hypervelocity Impact; Optical Properties

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*.

20040074451 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Assessment of Clear Sky Radiative Forcing in the Caribbean Region Using an Aerosol Dispersion Model and Ground Radiometry During Puerto Rico Dust Experiment
Gasso, Santiago; Qi, Qiang; Westpthal, Douglas; Reid, Jeffery; Tsay, Si-Chee; [2004]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

This study investigates the surface and top of the atmosphere solar radiative forcing by long-range transport of Saharan dust. The calculations of radiative forcing are based on measurements collected in the Puerto Rico Dust Experiment (PRIDE) carried out during July, 2000. The purpose of the experiment was the characterization of the Saharan dust plume, which frequently reaches the Caribbean region during the summer. The experiment involved the use of three approaches to study the plume: space and ground based remote sensing, airborne and ground based in-situ measurements and aerosol dispersion modeling. The diversity of measuring platforms provides an excellent opportunity for determination of the direct effect of dust on the clear sky radiative forcing. Specifically, comparisons of heating rates, surface and TOA fluxes derived from the Navy global aerosol dispersion model NAAPS (NRL Aerosol Analysis and Prediction System) and actual measurements of fluxes from ground and space based platforms are shown. In addition, the direct effect of dust on the clear sky radiative forcing is modeled. The extent and time of evolution of the radiative properties of the plume are computed with the aerosol

concentrations modeled by NAAPS. Standard aerosol parameterizations, as well as in-situ composition and size distributions measured during PRIDE, are utilized to compute the aerosol optical depth, single scattering albedo and asymmetry factor. Radiative transfer computations are done with an in-house modified spectral radiative transfer code (Fu-Liou). The code includes gas absorption and cloud particles (ice and liquid phase) and it allows the input of meteorological data. The code was modified to include modules for the aerosols contribution to the calculated fluxes. This comparison study helps to narrow the current uncertainty in the dust direct radiative forcing, as recently reported in the 2001 IPCC assessment.
Author
Radiative Transfer; Caribbean Region; Aerosols; Atmospheric Models; Scattering; Size Distribution

20040074994 NASA Goddard Space Flight Center, Greenbelt, MD, USA
TOMS and SBUV Data: Comparison to 3D Chemical-Transport Model Results
Stolarski, Richard S.; Douglass, Anne R.; Steenrod, Steve; Frith, Stacey; 2003; 1 pp.; In English; Fall AGU 2003 Meeting: A Quarter Century of Satelite Measurements by TOMS, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We have updated our merged ozone data (MOD) set using the TOMS data from the new version 8 algorithm. We then analyzed these data for contributions from solar cycle, volcanoes, QBO, and halogens using a standard statistical time series model. We have recently completed a hindcast run of our 3D chemical-transport model for the same years. This model uses off-line winds from the finite-volume GCM, a full stratospheric photochemistry package, and time-varying forcing due to halogens, solar uv, and volcanic aerosols. We will report on a parallel analysis of these model results using the same statistical time series technique as used for the MOD data.
Author
Ozone; Solar Cycles; Time Series Analysis; Algorithms; Photochemical Reactions; Aerosols

20040075015 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Use of MODIS-Derived Fire Radiative Energy to Estimate Smoke Aerosol Emissions over Different Ecosystems
Ichoku, Charles; Kaufman, Yoram J.; 2003; 1 pp.; In English; AGU Fall 2003 Meeting: Effects of Biomass Burning Plumes on the Troposphere and Stratosphere, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Biomass burning is the main source of smoke aerosols and certain trace gases in the atmosphere. However, estimates of the rates of biomass consumption and emission of aerosols and trace gases from fires have not attained adequate reliability thus far. Traditional methods for deriving emission rates employ the use of emission factors e(sub x), (in g of species x per kg of biomass burned), which are difficult to measure from satellites. In this era of environmental monitoring from space, fire characterization was not a major consideration in the design of the early satellite-borne remote sensing instruments, such as AVHRR. Therefore, although they are able to provide fire location information, they were not adequately sensitive to variations in fire strength or size, because their thermal bands used for fire detection saturated at the lower end of fire radiative temperature range. As such, hitherto, satellite-based emission estimates employ proxy techniques using satellite derived fire pixel counts (which do not express the fire strength or rate of biomass consumption) or burned areas (which can only be obtained after the fire is over). The MODIS sensor, recently launched into orbit aboard EOS Terra (1999) and Aqua (2002) satellites, have a much higher saturation level and can, not only detect the fire locations 4 times daily, but also measures the at-satellite fire radiative energy (which is a measure of the fire strength) based on its 4 micron channel temperature. Also, MODIS measures the optical thickness of smoke and other aerosols. Preliminary analysis shows appreciable correlation between the MODIS-derived rates of emission of fire radiative energy and smoke over different regions across the globe. These relationships hold great promise for deriving emission coefficients, which can be used for estimating smoke aerosol emissions from MODIS active fire products. This procedure has the potential to provide more accurate emission estimates in near real-time, providing opportunities for various disaster management applications such as alerts, evacuation and, smoke dispersion forecasting.
Author
Biomass Burning; Advanced Very High Resolution Radiometer; MODIS (Radiometry); Aerosols; Smoke; Satellite-Borne Instruments; Atmospheric Composition

20040075714 NASA Ames Research Center, Moffett Field, CA, USA
Photochemistry of Interstellar and Cometary Ice Analogs
Sandford, Scott; Bernstein, Max; Allamandola, Louis; Walker, Robert; Research and Technology 1997; September 1998, pp. 117-118; In English; See also 20040075705; No Copyright; Avail: CASI; A01, Hardcopy

The mid-infrared spectrometer (MIRS) that flew on the joint NASA/Japanese Space Agency Infrared Telescope in Space (IRTS) mission in 1995 yielded a wealth of data that are presently being analyzed and reported on. Here we present the results of MIRS studies of the Galactic Bulge region. The MlRS operated over wavelengths ranging from 4.6 to 11.7 microns with a spectral resolution of about 0.23 to 0.36 microns. This is an ideal spectral region and resolution for investigations of infrared emissions from solid material, since it covers many of the diagnostic stretching and bending modes of candidate interstellar material. The IRTS/MIRS telescope/instrument combination achieved sensitivities that were orders of magnitude better than those of any other instrumentation previously used for diffuse mid-infrared emission studies.
Derived from text
Ice; Photochemical Reactions; Infrared Radiation; Spaceborne Telescopes; Spectral Resolution

20040076917 NASA Marshall Space Flight Center, Huntsville, AL, USA
Conductance Effects on Inner Magnetospheric Plasma Morphology: Model Comparisons with IMAGE EUV, MENA, and HENA Data
Liemohn, M.; Ridley, A. J.; Kozyra, J. U.; Gallagher, D. L.; Brandt, P. C.; Henderson, M. G.; Denton, M. H.; Jahn, J. M.; Roelof, E. C.; DeMajistre, R. M., et al.; 2004; 1 pp.; In English; Spring AGU 2004 Meeting: 2004 Joint Assembly AGU, CGU, and Society of Exploration Geophysicists, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

Modeling results of the inner magnetosphere showing the influence of the ionospheric conductance on the inner magnetospheric electric fields during the April 17, 2002 magnetic storm are presented. Kinetic plasma transport code results are analyzed in combination with observations of the inner magnetospheric plasma populations, in particular those from the IMAGE satellite. Qualitative and quantitative comparisons are made with the observations from EW, MENA, and HENA, covering the entire energy range simulated by the model (0 to 300 keV). The electric field description, and in particular the ionospheric conductance, is the only variable between the simulations. Results from the data-model comparisons are discussed, detailing the strengths and weaknesses of each conductance choice for each energy channel.
Author
Magnetic Storms; Magnetospheres; Electric Fields; Plasmas (Physics); Extreme Ultraviolet Radiation

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20040075705 NASA Ames Research Center, Moffett Field, CA, USA
Research and Technology 1997
September 1998; 188 pp.; In English; See also 20040075706 - 20040075828
Report No.(s): NASA/TM-1998-112240; A-9810764; No Copyright; Avail: CASI; A09, Hardcopy

This report highlights the challenging work accomplished during fiscal year 1997 by Ames research scientists and engineers. The work is divided into accomplishments that support the goals of NASA s four Strategic Enterprises: Aeronautics and Space Transportation Technology, Space Science, Human Exploration and Development of Space (HEDS), and Earth Science. NASA Ames Research Center s research effort in the Space, Earth, and HEDS Enterprises is focused i n large part to support Ames lead role for Astrobiology, which broadly defined is the scientific study of the origin, distribution, and future of life in the universe. This NASA initiative in Astrobiology is a broad science effort embracing basic research, technology development, and flight missions. Ames contributions to the Space Science Enterprise are focused in the areas of exobiology, planetary systems, astrophysics, and space technology. Ames supports the Earth Science Enterprise by conducting research and by developing technology with the objective of expanding our knowledge of the Earth s atmosphere and ecosystems. Finallv, Ames supports the HEDS Enterprise by conducting research, managing spaceflight projects, and developing technologies. A key objective is to understand the phenomena surrounding the effects of gravity on living things. Ames has also heen designated the Agency s Center of Evcellence for Information Technnlogv. The three cornerstones of Information Technology research at Ames are automated reasoning, human-centered computing, and high performance computing and networking.
Author
NASA Programs; Information Systems; Aeronautical Engineering; Aerospace Engineering; Gravitational Physiology

20040076875 Pofcher, Schlussel and Katcher, New York, NY, USA

Legal Radiation-Safety Responsibilities of Accelerator Projects

Pofcher, M. F.; Conference on Shielding of High-Energy Accelerators; December 06, 1957, pp. 81-85; In English; See also 20040076842; No Copyright; Avail: CASI; A01, Hardcopy

It might be helpful to state several concepts which are not too familiar and to point out some of the problems actually present in this field right now. It is important for those working in the accelerator field to realize, as a generalization, that state law rather than federal law governs their operation. The Atomic Energy Act of 1954, by its terms, does not cover high-energy accelerators or sources of radiation other than uranium, radioisotopes, etc. Federal jurisdiction exists, if it does, only under contract provisions. An AEC contract will usually provide that the health and safety regulations of the AEC must be complied with; these have been issued and published in the Federal Register. These regulations apply only to the work done under contract with the AEC or possibly to work done in connection with machines financed in whole or in part by the AEC. In addition to the regulations of the AEC and other agencies of the federal government (of which there are many and the number is increasing every day), there are a great many state and local regulations governing activities in this field, ranging from detailed radiation codes, such as those issued in New York, California, Texas, and Pennsylvania, to rather informal but nevertheless effective enforcement of regulations or inspections by local authorities. Probably there are three general areas of legal or semi-legal problems. The first is liability for injuries and fatalities. The second consists of the laws and regulations with which the accelerator project must comply. The third encompasses what I term administrative and corporate types of legal problems such as the ones Dr. Haworth indicated. These include labor problems, building problems, insurance rates and coverage, and the like. In all three of these areas it is predominantly state and local laws, and rules and regulations promulgated by state and local agencies, that are important.

Derived from text

Radiation Protection; Accelerators; Laws

20040077048 NASA Ames Research Center, Moffett Field, CA, USA

Research and Technology 1999

December 2000; 207 pp.; In English; See also 20040077049 - 20040077191

Contract(s)/Grant(s): 992-23-10

Report No.(s): NASA/TM-2000-209618; Rept-0003831; No Copyright; Avail: CASI; A10, Hardcopy

This report highlights the research accomplished during fiscal year 7 999 by Ames Research Center scientists and engineers. The work is divided into accomplishments that support four of NASA s Strategic Enterprises: Aero-Space Technology, Space Science, Earth Science, and Human Exploration and Development of Space (HEDS). The key purpose of this report is to communicate information to our stakeholders about the scope and diversity of Ames mission and the nature of Ames research and technology activities.

Author

Earth Sciences; Life Support Systems; Aerospace Engineering; Measuring Instruments; Atmospheric Chemistry

Subject Term Index

A STARS
The Nearby Stars (NStars) Project – 198

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