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Langley Research Center

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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The U.S. Patent and Trademark Office (USPTO)

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

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Subject Term Index

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20040082079

A Revised Approach to the ULDB Design

Smith, Michael; Cathey, H. M., Jr.; 2004; 2 pp.; In English; 35th COSPAR Scientific Assembly (Session PSB1), Jul. 2004, Paris, France

Contract(s)/Grant(s): NAS5-03003; No Copyright; Avail: CASI; A01, Hardcopy

The National Aeronautics and Space Administration Balloon Program has experienced problems in the scaling up of the proposed Ultra Long Duration Balloon. Full deployment of the balloon envelope has been the issue for the larger balloons. There are a number of factors that contribute to this phenomenon. Analytical treatments of the deployment issue are currently underway. It has also been acknowledged that the current fabrication approach using foreshortening is costly, labor intensive, and requires significant handling during production thereby increasing the chances of inducing damage to the envelope. Raven Industries has proposed a new design and fabrication approach that should increase the probability of balloon deployment, does not require foreshortening, will reduce the handling, production labor, and reduce the final balloon cost. This paper will present a description of the logic and approach used to develop this innovation. This development consists of a serial set of steps with decision points that build upon the results of the previous steps. The first steps include limited material development and testing. This will be followed by load testing of bi-axial reinforced cylinders to determine the effect of eliminating the foreshortening. This series of tests have the goal of measuring the strain in the material as it is bi-axially loaded in a condition that closely replicated the application in the full-scale balloon. Constant lobe radius pumpkin shaped test structures will be designed and analyzed. This matrix of model tests, in conjunction with the deployment analyses, will help develop a curve that should clearly present the deployment relationship for this kind of design. This will allow the ″design space″ for this type of balloon to be initially determined. The materials used, analyses, and ground testing results of both cylinders and small pumpkin structures will be presented. Following ground testing, a series of test flights, staged in increments of increasing suspended load and balloon volume, will be conducted. The first small scale test flight has been proposed for early Spring 2004. Results of this test flight of this new design and approach will presented. Two additional domestic test flights from Ft. Sumner, New Mexico, and Palestine, Texas, and one circumglobal test flight from Australia are planned as part of this development. Future plans for both ground testing and test flights will also be presented.

Author

Balloons; Flight Tests; NASA Programs; Load Tests; Ground Tests; Deployment

20040082239 San Jose State Univ., CA, USA

CATS-based Agents That Err

Callantine, Todd J.; November 2002; 35 pp.; In English

Contract(s)/Grant(s): RTOP 728-20-10

Report No.(s): NASA/CR-2002-211858; IH-032; No Copyright; Avail: CASI; A03, Hardcopy

This report describes preliminary research on intelligent agents that make errors. Such agents are crucial to the development of novel agent-based techniques for assessing system safety. The agents extend an agent architecture derived from the Crew Activity Tracking System that has been used as the basis for air traffic controller agents. The report first reviews several error taxonomies. Next, it presents an overview of the air traffic controller agents, then details several mechanisms for causing the agents to err in realistic ways. The report presents a performance assessment of the error-generating agents, and

identifies directions for further research. The research was supported by the System-Wide Accident Prevention element of the FAA/NASA Aviation Safety Program.
Author
Complex Systems; Pilot Error; Artificial Intelligence; Civil Aviation; Spacecrews; Tracking (Position)

20040082308 NASA Marshall Space Flight Center, Huntsville, AL, USA
Deflection Measurements of a Thermally Simulated Nuclear Core Using a High-Resolution CCD-Camera
Stanojev, B. J.; Houts, M.; [2004]; 8 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICAPP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Space fission systems under consideration for near-term missions all use compact. fast-spectrum reactor cores. Reactor dimensional change with increasing temperature, which affects neutron leakage. is the dominant source of reactivity feedback in these systems. Accurately measuring core dimensional changes during realistic non-nuclear testing is therefore necessary in predicting the system nuclear equivalent behavior. This paper discusses one key technique being evaluated for measuring such changes. The proposed technique is to use a Charged Couple Device (CCD) sensor to obtain deformation readings of electrically heated prototypic reactor core geometry. This paper introduces a technique by which a single high spatial resolution CCD camera is used to measure core deformation in Real-Time (RT). Initial system checkout results are presented along with a discussion on how additional cameras could be used to achieve a three- dimensional deformation profile of the core during test.
Derived from text
Deflection; CCD Cameras; Reactor Cores; Spectra; Charge Coupled Devices; Deformation; Fast Nuclear Reactors

20040082396 QSS Group, Inc., Cleveland, OH, USA
Computed Linear/Nonlinear Acoustic Response of a Cascade for Single/Multi Frequency Excitation
Nallasamy, M.; Hixon, R.; Sawyer, S.; June 2004; 26 pp.; In English; Tenth Aeroacoustics Conference, 10-12 May 2004, Manchester, UK; Original contains color illustrations
Contract(s)/Grant(s): NAS3-00145; WBS 781-30-09
Report No.(s): NASA/CR-2004-213110; AIAA Paper 2004-2998; E-14584; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines mode generation and propagation characteristics of a 2-D cascade due to incident vortical disturbances using a time domain approach. Full nonlinear Euler equations are solved employing high order accurate spatial differencing and time marching techniques. The solutions show the generation and propagation of mode orders that are expected from theory. Single frequency excitations show linear response over a wide range of amplitudes. The response for multi-frequency excitations tend to become nonlinear due to interaction between frequencies and self interaction.
Derived from text
Acoustics; Frequencies; Excitation; Propagation Modes

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*.

20040081415 NASA Goddard Space Flight Center, Greenbelt, MD, USA
STK/Lifetime as a Replacement for Heritage Orbital Lifetime Software
Dove, Edwin; 2004; 1 pp.; In English; STK User's Conference, 7-10 Jun. 2004, Chantilly, VA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Flight Dynamics Analysis Branch (FDAB) of NASNGSFC is tasked with determining the orbital lifetime of several developmental and operational satellites, which include the Hubble Space Telescope. A DOS based program developed by the FDAB many years ago, called PC Lifetime, is used to determine a satellite s lifetime and could soon be in need of a replacement. STK s Lifetime Object Tool is a possible candidate. Due to the reduced support of the PC Lifetime program, and the growing incompatibility of older programs with new operating systems, a comparative analysis was done to determine if STWLifetime could meet the stringent requirements that were laid before it. The use of highly accurate numerical propagators such as STK s High Precision Orbit Propagator (OP) and the Goddard Trajectory Determination System (GTDS) provided

a basis on which to compare STWLifetime s results. Several test cases were run, but the main four test cases would determine whether or not STWLifetime could be PC- Lifetime s replacement. These four cases include a geotransfer orbit, two circular LEOS, and a Poiar LEO. Following rigorous testmg procedures, a conclusion will be determined. STK has proved to be a versatile program on many satellite missions and the FDAB has high hopes that it can pass FDAB s requirements for orbital lifetime prediction.
Derived from text
Goddard Trajectory Determination System; Aerodynamics; Low Earth Orbits; Orbital Lifetime

20040082215 NASA Langley Research Center, Hampton, VA, USA
DSMC Simulations of Hypersonic Flows With Shock Interactions and Validation With Experiments
Moss, James N.; Bird, Graeme A.; [2004]; 14 pp.; In English; 37th AIAA Thermophysics Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Report No.(s): AIAA Paper 2004-2585; Copyright; Avail: CASI; A03, Hardcopy

The capabilities of a relatively new direct simulation Monte Carlo (DSMC) code are examined for the problem of hypersonic laminar shock/shock and shock/boundary layer interactions, where boundary layer separation is an important feature of the flow. Flow about two model configurations is considered, where both configurations (a biconic and a hollow cylinder-flare) have recent published experimental measurements. The computations are made by using the DS2V code of Bird, a general two-dimensional/axisymmetric time accurate code that incorporates many of the advances in DSMC over the past decade. The current focus is on flows produced in ground-based facilities at Mach 12 and 16 test conditions with nitrogen as the test gas and the test models at zero incidence. Results presented highlight the sensitivity of the calculations to grid resolution, sensitivity to physical modeling parameters, and comparison with experimental measurements. Information is provided concerning the flow structure and surface results for the extent of separation, heating, pressure, and skin friction.
Author
Shock Wave Interaction; Hypersonic Flow; Boundary Layer Separation; Monte Carlo Method; Computerized Simulation; Hypersonic Shock

20040082216 NASA Langley Research Center, Hampton, VA, USA
Application of Excitation from Multiple Locations on a Simplified High-Lift System
Melton, LaTunia Pack; Yao, Chung-Sheng; Seifert, Avi; [2004]; 14 pp.; In English; 2nd Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Report No.(s): AIAA Paper 2004-2324; Copyright; Avail: CASI; A03, Hardcopy

A series of active flow control experiments were recently conducted on a simplified high-lift system. The purpose of the experiments was to explore the prospects of eliminating all but simply hinged leading and trailing edge flaps, while controlling separation on the supercritical airfoil using multiple periodic excitation slots. Excitation was provided by three. independently controlled, self-contained, piezoelectric actuators. Low frequency excitation was generated through amplitude modulation of the high frequency carrier wave, the actuators' resonant frequencies. It was demonstrated, for the first time, that pulsed modulated signal from two neighboring slots interact favorably to increase lift. Phase sensitivity at the low frequency was measured, even though the excitation was synthesized from the high-frequency carrier wave. The measurements were performed at low Reynolds numbers and included mean and unsteady surface pressures, surface hot-films, wake pressures and particle image velocimetry. A modest (6%) increase in maximum lift (compared to the optimal baseline) was obtained due t o the activation of two of the three actuators.
Author
Active Control; Flow Distribution; Airfoils; Leading Edge Flaps; Trailing Edge Flaps; Piezoelectric Actuators

20040082218 NASA Langley Research Center, Hampton, VA, USA
LASTRAC.3d: Transition Prediction in 3D Boundary Layers
Chang, Chau-Lyan; [2004]; 21 pp.; In English; 34th AIAA Fluid Dynamics Conference
Report No.(s): AIAA Paper 2004-2542; No Copyright; Avail: CASI; A03, Hardcopy

Langley Stability and Transition Analysis Code (LASTRAC) is a general-purpose, physics-based transition prediction code released by NASA for laminar flow control studies and transition research. This paper describes the LASTRAC extension to general three-dimensional (3D) boundary layers such as finite swept wings, cones, or bodies at an angle of attack. The stability problem is formulated by using a body-fitted nonorthogonal curvilinear coordinate system constructed on the body surface. The nonorthogonal coordinate system offers a variety of marching paths and spanwise waveforms. In the extreme case

of an infinite swept wing boundary layer, marching with a nonorthogonal coordinate produces identical solutions to those obtained with an orthogonal coordinate system using the earlier release of LASTRAC. Several methods to formulate the 3D parabolized stability equations (PSE) are discussed. A surface-marching procedure akin to that for 3D boundary layer equations may be used to solve the 3D parabolized disturbance equations. On the other hand, the local line-marching PSE method, formulated as an easy extension from its 2D counterpart and capable of handling the spanwise mean flow and disturbance variation, offers an alternative. A linear stability theory or parabolized stability equations based N-factor analysis carried out along the streamline direction with a fixed wavelength and downstream-varying spanwise direction constitutes an efficient engineering approach to study instability wave evolution in a 3D boundary layer. The surface-marching PSE method enables a consistent treatment of the disturbance evolution along both streamwise and spanwise directions but requires more stringent initial conditions. Both PSE methods and the traditional LST approach are implemented in the LASTRAC.3d code. Several test cases for tapered or finite swept wings and cones at an angle of attack are discussed.
Author
Laminar Boundary Layer; Three Dimensional Boundary Layer; Boundary Layer Control

20040082220 NASA Langley Research Center, Hampton, VA, USA
DSMC Simulations of Hypersonic Flows With Shock Interactions and Validation With Experiments
Moss, James N.; Bird, Graeme A.; June 25, 2004; 14 pp.; In English; 37th AIAA Thermophysics Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 900-90-50
Report No.(s): AIAA Paper 2004-2585; No Copyright; Avail: CASI; A03, Hardcopy

The capabilities of a relatively new direct simulation Monte Carlo (DSMC) code are examined for the problem of hypersonic laminar shock/shock and shock/boundary layer interactions, where boundary layer separation is an important feature of the flow. Flow about two model configurations is considered, where both configurations (a biconic and a hollow cylinder-flare) have recent published experimental measurements. The computations are made by using the DS2V code of Bird, a general two-dimensional/axisymmetric time accurate code that incorporates many of the advances in DSMC over the past decade. The current focus is on flows produced in ground-based facilities at Mach 12 and 16 test conditions with nitrogen as the test gas and the test models at zero incidence. Results presented highlight the sensitivity of the calculations to grid resolutions, sensitivity to physical modeling parameters, and comparison with experimental measurements. Information is provided concerning the flow structure and surface results for the extent of separation, heating, pressure, and skin friction.
Derived from text
Hypersonic Flow; Monte Carlo Method; Shock Wave Interaction; Simulation; Nitrogen

20040082230 NASA Langley Research Center, Hampton, VA, USA
Wall Interference Study of the NTF Slotted Tunnel Using Bodies of Revolution Wall Signature Data
Iyer, Venkit; Kuhl, David D.; Walker, Eric L.; 2004; 18 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): NAS1-00135
Report No.(s): AIAA Paper 2004-2306; Copyright; Avail: CASI; A03, Hardcopy

This paper is a description of the analysis of blockage corrections for bodies of revolution for the slotted-wall configuration of the National Transonic Facility (NTF) at the NASA Langley Research Center (LaRC). A wall correction method based on the measured wall signature is used. Test data from three different-sized blockage bodies and four wall ventilation settings were analyzed at various Mach numbers and unit Reynolds numbers. The results indicate that with the proper selection of the boundary condition parameters, the wall correction method can predict blockage corrections consistent with the wall measurements for Mach numbers as high as 0.95.
Author
Wall Flow; Boundary Conditions; Bodies of Revolution; Aerodynamic Interference; Blocking; Signatures

20040082234 NASA Langley Research Center, Hampton, VA, USA
Optical Measurement Technique for Space Column Characterization
Barrows, Danny A.; Watson, Judith J.; Burner, Alpheus W.; Phelps, James E.; [2004]; 14 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 2004-2185; Copyright; Avail: CASI; A03, Hardcopy

A simple optical technique for the structural characterization of lightweight space columns is presented. The technique

is useful for determining the coefficient of thermal expansion during cool down as well as the induced strain during tension and compression testing. The technique is based upon object-to-image plane scaling and does not require any photogrammetric calibrations or computations. Examples of the measurement of the coefficient of thermal expansion are presented for several lightweight space columns. Examples of strain measured during tension and compression testing are presented along with comparisons to results obtained with Linear Variable Differential Transformer (LVDT) position transducers.
Author
Thermal Expansion; Calibrating; Optical Measurement; Photogrammetry

20040082235 NASA Ames Research Center, Moffett Field, CA, USA
Vortex Core Size in the Rotor Near-Wake
Young, Larry A.; June 2003; 33 pp.; In English
Contract(s)/Grant(s): 727-01-21
Report No.(s): NASA/TM-2003-212275; A-03010293; No Copyright; Avail: CASI; A03, Hardcopy

Using a kinetic energy conservation approach, a number of simple analytic expressions are derived for estimating the core size of tip vortices in the near-wake of rotors in hover and axial-flow flight. The influence of thrust, induced power losses, advance ratio, and vortex structure on rotor vortex core size is assessed. Experimental data from the literature is compared to the analytical results derived in this paper. In general, three conclusions can be drawn from the work in this paper. First, the greater the rotor thrust, t h e larger the vortex core size in the rotor near-wake. Second, the more efficient a rotor is with respect to induced power losses, the smaller the resulting vortex core size. Third, and lastly, vortex core size initially decreases for low axial-flow advance ratios, but for large advance ratios core size asymptotically increases to a nominal upper limit. Insights gained from this work should enable improved modeling of rotary-wing aerodynamics, as well as provide a framework for improved experimental investigations of rotor a n d advanced propeller wakes.
Derived from text
Vortices; Rotors; Aerodynamics; Axial Flow; Boundary Layers

20040082242 NASA Langley Research Center, Hampton, VA, USA
Aeroheating Design Issues for Reusable Launch Vehicles: A Perspective
Zoby, E. Vincent; Thompson, Richard A.; Wurster, Kathryn E.; June 22, 2004; 23 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 794-40-3A
Report No.(s): AIAA Paper 2004-2535; No Copyright; Avail: CASI; A03, Hardcopy

An overview of basic aeroheating design issues for Reusable Launch Vehicles (RLV), which addresses the application of hypersonic ground-based testing, and computational fluid dynamic (CFD) and engineering codes, is presented. Challenges inherent to the prediction of aeroheating environments required for the successful design of the RLV Thermal Protection System (TPS) are discussed in conjunction with the importance of employing appropriate experimental/computational tools. The impact of the information garnered by using these tools in the resulting analyses, ultimately enhancing the RLV TPS design is illustrated. A wide range of topics is presented in this overview; e.g. the impact of flow physics issues such as boundary-layer transition, including effects of distributed and discrete roughness, shockshock interactions, and flow separation/reattachment. Also, the benefit of integrating experimental and computational studies to gain an improved understanding of flow phenomena is illustrated. From computational studies, the effect of low-density conditions and of uncertainties in material surface properties on the computed heating rates are highlighted as well as the significant role of CFD in improving the Outer Mold Line (OML) definition to reduce aeroheating while maintaining aerodynamic performance. Appropriate selection of the TPS design trajectories and trajectory shaping to mitigate aeroheating levels and loads are discussed. Lastly, an illustration of an aeroheating design process is presented whereby data from hypersonic wind-tunnel tests are integrated with predictions from CFD codes and engineering methods to provide heating environments along an entry trajectory as required for TPS design.
Derived from text
Aerodynamic Characteristics; Computational Fluid Dynamics; Reusable Launch Vehicles; Aerodynamic Heating; Surface Properties; Boundary Layer Transition

20040082245 NASA Langley Research Center, Hampton, VA, USA

Assessment of LAURA for Laminar Supersonic Shallow Cavities

Wood, William A.; Pulsonetti, Maria V.; Everhart, Joel L.; Bey, Kim S.; July 07, 2004; 9 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Contract(s)/Grant(s): 794-40-3A

Report No.(s): AIAA Paper 2004-2639; No Copyright; Avail: CASI; A02, Hardcopy

The ability of the Laura flow solver to predict local heating augmentation factors for shallow cavities is assessed. This assessment is part of a larger e ort within the Space Shuttle return-to-flight program to develop technologies to support on-orbit tile repair decisions. The comparison is made against global phosphor thermography images taken in the Langley Aerothermodynamic Laboratory 20-Inch Mach 6 Air Tunnel. The cavities are rectangular in shape, with lengths L/H of 14 20 and depths H/ of 1.1 5.2. The fully laminar results, for Re = 300, show good agreement between the data sets. For Re = 503, the wind tunnel data indicates boundary layer transition with turbulent flow both within and downstream of the cavity. The turbulent flow structures are significantly di erent from the laminar predictions, with order of magnitude increases in the heating augmentations. Because of the di erent flow structures, no simple bump factor can be used to correct the laminar calculations to account for the turbulent heating levels. A fine gradation in wind tunnel cases will be required to clearly delineate the laminar-to-turbulent transition point, and hence the limits of applicability of the laminar numerical approach.

Derived from text

Cavities; Aerothermodynamics; Hypersonic Speed; Space Shuttles; Boundary Layer Transition; Turbulence

20040082297 NASA Langley Research Center, Hampton, VA, USA

Numerical Simulation of Roughness-Induced Transient Growth in a Laminar Boundary Layer

Fischer, Paul; Choudhari, Meelan; [2004]; 15 pp.; In English; 34th AIAA Fluid Dynamics Conference

Contract(s)/Grant(s): EPSRC-GR/S59635

Report No.(s): AIAA Paper 2004-2539; No Copyright; Avail: CASI; A03, Hardcopy

Numerical simulations are used to examine the roughness-induced transient growth in a laminar boundary-layer flow. Based on the spectral element method, these simulations model the stationary disturbance field associated with a nonsmooth roughness geometry, such as the spanwise periodic array of circular disks used by White and co-workers during a series of wind tunnel experiments at Case Western Reserve University. Besides capturing the major trends from the recent measurements by White and Ergin, the simulations provide additional information concerning the relative accuracy of the experimental findings derived from two separate wall-finding procedures. The paper also explores the dependence of transient growth on geometric characteristics of the roughness distribution, including the height and planform shape of the roughness element and the ratio of roughness due to spacing between an adjacent pair of elements. Results are used for a preliminary assessment of the differences between recently reported theoretical results of Tumin and Reshotko and the measurements by White and Ergin.

Author

Laminar Boundary Layer; Boundary Layer Flow; Surface Roughness; Simulation

20040082334 NASA Glenn Research Center, Cleveland, OH, USA

Comparison of Theoretical and Experimental Unsteady Aerodynamics of Linear Oscillating Cascade With Supersonic Leading-Edge Locus

Ramsey, John K.; Erwin, Dan; June 2004; 64 pp.; In English

Contract(s)/Grant(s): WBS 22-297-10-06; RTOP 297-10-00

Report No.(s): NASA/TM-2004-211820; E-13512; No Copyright; Avail: CASI; A04, Hardcopy

An experimental influence coefficient technique was used to obtain unsteady aerodynamic influence coefficients and, consequently, unsteady pressures for a cascade of symmetric airfoils oscillating in pitch about mid-chord. Stagger angles of 0 deg and 10 deg were investigated for a cascade with a gap-to-chord ratio of 0.417 operating at an axial Mach number of 1.9, resulting in a supersonic leading-edge locus. Reduced frequencies ranged from 0.056 to 0.2. The influence coefficients obtained determine the unsteady pressures for any interblade phase angle. The unsteady pressures were compared with those predicted by several algorithms for interblade phase angles of 0 deg and 180 deg.

Derived from text

Unsteady Aerodynamics; Influence Coefficient; Pressure Measurement; Pressure Oscillations; Wind Tunnel Tests

20040082550 NASA Langley Research Center, Hampton, VA, USA
Langley Stability and Transition Analysis Code (LASTRAC) Version 1.2 User Manual
Chang, Chau-Lyan; June 2004; 105 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WU 23-762-45-ME
Report No.(s): NASA/TM-2004-213233; L-19022; No Copyright; Avail: CASI; A06, Hardcopy

LASTRAC is a general-purposed, physics-based transition prediction code released by NASA for Laminar Flow Control studies and transition research. The design and development of the LASTRAC code is aimed at providing an engineering tool that is easy to use and yet capable of dealing with a broad range of transition related issues. It was written from scratch based on the state-of-the-art numerical methods for stability analysis and modern software technologies. At low fidelity, it allows users to perform linear stability analysis and N-factor transition correlation for a broad range of flow regimes and configurations by using either the linear stability theory or linear parabolized stability equations method. At high fidelity, users may use nonlinear PSE to track finite-amplitude disturbances until the skin friction rise. This document describes the governing equations, numerical methods, code development, detailed description of input/output parameters, and case studies for the current release of LASTRAC.
Author
Stability; Numerical Analysis; Boundary Layer Control; Laminar Boundary Layer

20040082844 Texas A&M Univ., College Station, TX
Synthetic Jet Actuation - Modeling, Actuator Development and Application to Separation Control
Rediniotis, Othon K.; Jun. 2004; 141 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0012
Report No.(s): AD-A424008; AFRL-SR-AR-TR-04-0312; No Copyright; Avail: CASI; A07, Hardcopy

This work presents an investigation of synthetic jet actuation for separation control over wings/airfoils, in steady and unsteady flows, the development of high-power, compact synthetic jet actuators (SJA) for flow separation control, the modeling and control of such actuators and the modeling and control of the resulting SJA-controlled aerodynamics and wing/airfoil, respectively. The developed actuator is compact enough to fit in the interior of a NACAOOl5 profiled wing with a chord of 0.375 m. Test bench experiments showed that the multi-piston actuator array was capable of producing exit velocities of up to 90 rn/s for an actuator frequency of 130 Hz. The actuator was placed in a NACA 0015 wing and tested in a wind tunnel. An experimental investigation into the effects of a synthetic jet actuator on the performance of the wing, in steady flow, is described. Emphasis is placed on the capabilities of the actuator to control the separation of the flow over the wing at high angles of attack. The investigation included the use of force balance measurements, on -surface flow visualization with oil and tufts, off-surface flow visualizations with smoke, surface pressure distribution measurements and wake surveys.
DTIC
Actuators

20040084195 Pittsburgh Univ., Pittsburgh, PA, USA
Study of the von-Karman Vortex Street Close to Onset of Shedding
Roushan, Pedram; Wu, Xiao-Lun; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 147; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Bernard-von Karman vortex street is studied in a flowing soap film channel. The two-dimensional fluid flow in the film allows stable vortex streets to be generated and investigated over a broad range of Reynolds numbers, 10\hRe\h2000. Unlike previous studies, which concentrated on the temporal velocity oscillations at a single point in the wake region, the current study focuses on the entire near-wake region using image analysis techniques. The envelope of the von-Karman vortex street is analyzed for different rod diameters, which span more than two orders of magnitude in their diameters. The parameters that characterize the envelope of the vortex street, such as the growth rate and the saturation amplitude, are measured for different Reynolds numbers. It is found that all of the curves representing the envelope can be collapsed onto a single master curve, suggesting that the shape of the von-Karman vortex street is universal, independent of Re. We construct a simple model that takes into account the energy transfer into vortices by periodic oscillations of transverse velocity fluctuations beneath the rod. This simple model not only explains the near wake shape of the von-Karman vortex street, but also allows extraction of useful information about the wake, such as the kinetic energy injected into the fluid and the drag coefficient (C(sub D)).
Author
Fluid Flow; Karman Vortex Street; Reynolds Number; Two Dimensional Flow; Kinetic Energy

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*.

20040081326 General Accounting Office, Washington, DC
Aviation Security: Further Steps Needed to Strengthen the Security of Commercial Airport Perimeters and Access Controls
Jun. 2004; 64 pp.; In English
Report No.(s): PB2004-105548; GAO-04-728; No Copyright; Avail: CASI; A04, Hardcopy

In the 2 years since passage of the Aviation and Transportation Security Act (ATSA), the Transportation Security Administration (TSA) has primarily focused its efforts on improving aviation security through enhanced passenger and baggage screening. The act also contained provisions directing TSA to take actions to improve the security of airport perimeters, access controls, and airport workers. GAO was asked to assess TSA's efforts to: (1) evaluate the security of airport perimeters and the controls that limit access into secured airport areas, (2) help airports implement and enhance perimeter security and access controls by providing them funding and technical guidance, and (3) implement measures to reduce the potential security risks posed by airport workers.
NTIS
Airport Security; Civil Aviation

20040081382 Nebraska Univ., Omaha, NE, USA
The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4
Bowen, Brent, Editor; Gudmundsson, Sveinn, Editor; Oum, Tae, Editor; July 2003; 325 pp.; In English; 2003 Air Transport Research Society World Conference, 10-12 Jul. 2003, Toulouse, France; See also 20040081383 - 20040081395
Report No.(s): UNOAI-03-8-Vol-4; Copyright; Avail: CASI; A14, Hardcopy

The following reports of the 2003 Air Transport Research Society (ATRS) World Conference were included for processing in the NA&SD database:Air Travel Security and Facility Fees and Their Impact on Air Travel and Transportation Safety. (the Case of Canada.); Evaluation of Commercial Airline Safety: Assessment of Major, National, and Regional Airlines Safety; The Impact of the Air Carrier's Top Management Functions on Flight Safety in a Globalised Environment; The Influence of Operational Uncertainties on Airline Schedule Planning and Punctuality Control Techniques; A Brazilian Case Study for the Air Traffic Flow Management Problem; A Simultaneous Equation Model for Air Traffic in the New York Area; Low Fare Airlines In Asia: An Analysis of Cost Competition Dynamics; Introducing a Low Cost, Low Fare Concept in Brazil: GOL Airlines; An Analysis of Competing No-Frills and Network Carrier Fares: A Study of London-Amsterdam; Japanese Airport Benchmarking with the Endogenous-Weight TPF Model; Application of the Date Envelopment Analysis Techniques in the Study of the Operational Efficiency of the Main Venezuelan Airports and the Behavior with the Presence of Military Air Bases; Comparison of Passenger Selection Criteria: A Study of London-Amsterdam Passengers; and Air Transport Policy and the Measurement of Tourism Benefits.
Derived from text
Air Transportation; Airline Operations

20040081383 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA
An Evaluation of Commercial Airline Safety: Assessment of Major, National, and Regional Airlines Safety
Vasigh, Bijan; Erfani, G. Rod; Halldorsson, Freyr; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 17 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The risk associated with flying commercial airlines is influenced by many factors. The risk is largely depending on a number of elements such as age and the condition of the aircraft, the age and the experience of the pilot, airport equipments and facilities, and air traffic condition. The purpose of this study is to review the current literature regarding airline safety with the intent of offering explanations to various aspects of accidents. In this study we evaluate the commercial airline safety in the form of accidents, incidents and near- midair collusion by using data collected by the Federal Aviation Administration (FAA). The research focuses on major, national and regional airlines. The empirical examination will assess the risk of an airline incurring an accident, incident or near midair collision based on the presence or absence of certain attributes. Airline

safety and financial data for the period of 1985-2001 are used. The remainder of the paper is divided as follows: Section 11provides a review of the previous work. The Data and Methodology are presented in section M. A model for assessing risk and safety is developed in Section IV. Finally, Section V concludes the paper.
Author
Commercial Aircraft; Flight Safety; Aircraft Safety

20040081398 Massachusetts Inst. of Tech., Cambridge, MA, USA
Development of Improved Models, Stochasticity, and Frameworks for the MIT Extensible Air Network Simulation
Clarke, John-Paul; May 07, 2004; 79 pp.; In English
Contract(s)/Grant(s): NAG2-1548; No Copyright; Avail: CASI; A05, Hardcopy

MEANS, the MIT Extensible Air Network Simulation, was created in February of 2001, and has been developed with support from NASA Ames since August of 2001. MEANS is a simulation tool which is designed to maximize fidelity without requiring data of such a low level as to preclude easy examination of alternative scenarios. To this end, MEANS is structured in a modular fashion to allow more detailed components to be brought in when desired, and left out when they would only be an impediment. Traditionally, one of the difficulties with high-fidelity models is that they require a level of detail in their data that is difficult to obtain. For analysis of past scenarios, the required data may not have been collected, or may be considered proprietary and thus difficult for independent researchers to obtain. For hypothetical scenarios, generation of the data is sufficiently difficult to be a task in and of itself. Often, simulations designed by a researcher will model exactly one element of the problem well and in detail, while assuming away other parts of the problem which are not of interest or for which data is not available. While these models are useful for working with the task at hand, they are very often not applicable to future problems. The MEAN Simulation attempts to address these problems by using a modular design which provides components of varying fidelity for each aspect of the simulation. This allows for the most accurate model for which data is available to be used. It also provides for easy analysis of sensitivity to data accuracy. This can be particularly useful in the case where accurate data is available for some subset of the situations that are to be considered. Furthermore, the ability to use the same model while examining effects on different parts of a system reduces the time spent learning the simulation, and provides for easier comparisons between changes to different parts of the system.
Author
Air Traffic Control; Computerized Simulation; Stochastic Processes

20040082244 NASA Ames Research Center, Moffett Field, CA, USA
Human Factors Report: TMA Operational Evaluations 1996 and 1998
Lee, Katharine K.; Quinn, Cheryl M.; Hoang, Ty; Sanford, Beverly D.; February 2000; 53 pp.; In English
Contract(s)/Grant(s): RTOP 576-01-24
Report No.(s): NASA/TM-2000-209587; A-00V0008; No Copyright; Avail: CASI; A04, Hardcopy

The Traffic Management Advisor (TMA) is a component of the Center-TRACON Automation System (CTAS), a suite of decision-support tools for the air traffic control (ATC) environment which is being developed at NASA Ames Research Center. TMA has been operational at the ATC facilities in Dallas/Fort Worth, Texas, since an operational field evaluation in 1996. The Operational Evaluation demonstrated significant benefits, including an approximately 5 percent increase in airport capacity. This report describes the human factors results from the 1996 Operational Evaluation and an investigation of TMA usage performed two years later, during the 1998 TMA Daily Use Field Survey. The results described are instructive for CTAS focused development, and provide valuable lessons for future research in ATC decision-support tools where it is critical to merge a well-defined, complex work environment with advanced automation.
Derived from text
Air Traffic Control; Human Factors Engineering; Simulation; Evaluation

20040082509 NASA Langley Research Center, Hampton, VA, USA, AeroTech Research, Inc., Hampton, VA, USA
Development of an Aircraft Approach and Departure Atmospheric Profile Generation Algorithm
Buck, Bill K.; Velotas, Steven G.; Rutishauser, David K., Technical Monitor; June 2004; 68 pp.; In English
Contract(s)/Grant(s): NAS1-02056; 23-727-04
Report No.(s): NASA/CR-2004-213236; No Copyright; Avail: CASI; A04, Hardcopy

In support of NASA Virtual Airspace Modeling and Simulation (VAMS) project, an effort was initiated to develop and test techniques for extracting meteorological data from landing and departing aircraft, and for building altitude based profiles for key meteorological parameters from these data. The generated atmospheric profiles will be used as inputs to NASA s

Aircraft Vortex Spacing System (AVOLSS) Prediction Algorithm (APA) for benefits and trade analysis. A Wake Vortex Advisory System (WakeVAS) is being developed to apply weather and wake prediction and sensing technologies with procedures to reduce current wake separation criteria when safe and appropriate to increase airport operational efficiency. The purpose of this report is to document the initial theory and design of the Aircraft Approach Departure Atmospheric Profile Generation Algorithm.
Author
Aircraft Design; Vortices; Wakes; Airspace

20040082632 Defense Science Board, Washington, DC
Defense Science Board Task Force Report on Aerial Refueling Requirements
May 2004; 68 pp.; In English
Report No.(s): AD-A423583; No Copyright; Avail: CASI; A04, Hardcopy

Aerial refueling capabilities are an essential enabler of U.S. power projection and other critic at national missions. OPERATIONS ENDURING and IRAQI FREEDOM (OEF and OIF) could not have happened without these aerial refueling capabilities. Aerial refueling makes possible rapid deployment of forces to contingencies and the elective employment of those forces in the contingencies. In OIF there were over 8500 aerial refueling sorties flown and about 450 million pounds of fuel off loaded. In addition, aerial refueling remains a critical element in supporting the bomber leg of U.S. nuclear forces and other special national security missions. The task force was charged to evaluate current aerial refueling capability and to identify and evaluate alternative means of meeting future aerial refueling requirements.
DTIC
Air to Air Refueling; Refueling

20040082637 Civil Aeromedical Inst., Oklahoma City, OK
Usability and Effectiveness of Advanced General Aviation Cockpit Displays for Instrument Flight Procedures
Williams, Kevin W.; Ball, Jerry D.; Nov. 2003; 23 pp.; In English
Report No.(s): AD-A423591; DOT/FAA/AM-03-17; No Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to asses the impact of advanced navigation displays on instrument flight procedures for general aviation, single-pilot operations. The study was designed to identify human factors that should be considered during the deployment of this technology to the entire general aviation community and in the development of future displays. The study focuses on single-pilot operations during normal to high workload conditions, including a failure of the vacuum- driven cockpit displays. Sixteen IFR-rated pilots were asked to plan and fly two separate flights in instrument condition, once using conventional instrumentation, and once using a moving-map/GPS display combination. Results show advantages for the advanced displays in flight performance under high- workload conditions. However, training requirements for these displays are likely to be increased relative to conventional navigational instrument.
DTIC
Cockpits; Display Devices; General Aviation Aircraft

20040082642 Army Aeromedical Research Lab., Fort Rucker, AL
A Proof of Concept of an Airborne Visibility Indicator
Estrada, Arthur; LeDuc, Patricia A.; Persson, James L.; Greig, Joanna L.; Crowley, John S.; Apr. 2004; 46 pp.; In English
Report No.(s): AD-A423600; USAARL-2004-15; No Copyright; Avail: CASI; A03, Hardcopy

Every year U.S. Army and civil aviation loses lives and aircraft due to spatial disorientation experienced during periods of minimal visibility or inadvertent entry into instrument meteorological conditions. Flights sometime end catastrophically when an aircraft flies into terrain or water. It is the duty of the pilot-in-command of a single-aircraft mission, or of the air mission commander in a multi-aircraft operation, to determine the prevailing visibility through which they will be traveling. U. S. Army rotary-wing pilots have always had to use their judgment and experience to subjectively assess the enroute visibility. As weather deteriorates, pilots must rely on their subjective analysis to formulate a course of action: to proceed, alter, or abort the mission. Advances in state-of-the-art technologies may be able to provide military and civil pilots with objective visibility data presented via a cockpit instrument (an Airborne Visibility Indicator (AVI)) which could provide the necessary objective real-time information from which an informed decision to proceed with or abort a mission can be made. Prior to the actual expense of developing such an instrument, this proof of concept project was conducted to determine if such a concept was practical, would enhance situational awareness, and serve as a countermeasure to inadvertent entry into visual conditions conducive to spatial disorientation (SD). In general, data from this proof of concept investigation indicated that an AVI would

be a useful tool, was favorably received by aircrews, and was a countermeasure to SD. Based on the findings and conclusions of this proof of concept project, it is recommended that the development of an AVI be continued and a USAARL Small Business Innovative Research (SBIR) proposal topic be submitted for consideration.
DTIC
Civil Aviation; Optical Equipment; Visibility

20040082656 Army War Coll., Carlisle Barracks, PA
Impact of Insufficient Inter-Theater Airlift Assets on National Strategic Decision-Makers
Barr, James A.; May 3, 2004; 31 pp.; In English
Report No.(s): AD-A423640; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this paper is to examine the limitations placed on national decision-makers due to limited inter-theater airlift resources. The paper will begin with national policy as it relates to air mobility looking further at requirements as defined in the Mobility Requirements Study 2005. The paper will look at recent operations to determine lessons which can be learned from those experiences and applied to future requirements. The paper will discuss efforts to address mobility requirements to include pre-positioned forces contracting with the Civil Reserve Air Fleet procurement of C-17 aircraft and modernization of the C-5 fleet. The paper will analyze alternatives to address the inter-theater airlift capacity issue and will recommend a strategy to meet airlift requirements.
DTIC
Tanker Aircraft

20040082695 Civil Aeromedical Inst., Oklahoma City, OK
Access-to-Egress II: Subject Management and Injuries in a Study of Emergency Evacuation through the Type- III Exit
Corbett, Cynthia L.; McLean, Garnet A.; Whinnery, James E.; Oct. 2003; 28 pp.; In English
Report No.(s): AD-A423728; DOT/FAA/AM-03/15; No Copyright; Avail: CASI; A03, Hardcopy

The ethical treatment of human research subjects is a requirement of federal regulations. Accomplishing this goal requires that important bilateral information-sharing between research staff and subjects occurs at all phases of the research process, and that significant safeguards are provided to minimize the potential for injury. This report presents an overview of subject- and injury-management procedures utilized during an aeromedical research project designed to assess the effects of changes in airplane cabin configuration and operation on emergency evacuation through a Type-III overwing exit, as well as an analysis of the injuries sustained by subjects during the study. Subject management procedures included medical screening to assure a basic level of subject health and fitness, briefings applicable to important safety issues in the research process, alteration of the research method to eliminate identified sources of injury, and informed subject consent. All 2,544 subjects completed 4 evacuation trials for a total of 10,176 crossings through the Type-III exit. Fifty- eight (2.3%) of the subjects sustained some type of injury during the evacuations, for a rate of 0. 0057 injuries per exit-crossing. Eleven of those injuries (18. 6%) were deemed serious. Forty injuries (69.0%) were sustained during high-motivation trials. Differential subject management by flight attendants affected the occurrence of injury, necessitating procedural changes halfway through the study to reduce the injury rate. Injuries are an undesirable corollary to research involving humans. There is a significant potential for injuries in studies simulating emergency evacuation from airplanes in which subjects must navigate a chaotic aircraft cabin, compete for the available egress route, and maneuver through the exit to the outside. Experimental evacuations provide valuable information on injury patterns and prevention that can help airlines increase passenger safety. (4 tables, 21 figures)7
DTIC
Egress; Emergencies; Injuries; Medical Science; Passengers; Research Management; Transport Aircraft

20040082725 Army War Coll., Carlisle Barracks, PA
Is the Current Army Aviation Maintenance Strategy Efficient or Effective in the Post Cold War, Non-Linear Battlefield Era of Expeditionary Force Projection?
Russell, Marvin N.; Mar. 19, 2004; 43 pp.; In English
Report No.(s): AD-A423799; No Copyright; Avail: CASI; A03, Hardcopy

Army Aviation Maintenance performance has slowly declined over the past 20 years and is currently lacking a comprehensive 21st Century strategy to prepare it to support the Transformation of Army Aviation as an Expeditionary Force. The key questions aviation planners must answer are as follows: What is Army Aviation's Expeditionary Strategy?; Is the current Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Table of Organization and Equipment (TO&E) the right organizational structure for Army Aircraft maintenance in the 21st Century?; Should Army

Aviation keep the current three levels of maintenance and/or combine AVUM companies and AVIM companies under one maintenance battalion command?; and Is the current Army Aviation Maintenance strategy efficient or effective in the Post Cold War non-linear battlefield in an era of Expeditionary Force Projection, and what added capabilities or interoperability does it bring to the fight? Over the past 35 years the Army Aviation Maintenance philosophy and strategy have not significantly changed. During 1969, in a search for a maintenance strategy to meet the needs of the high helicopter operational tempo (OPTEMPO) of the Vietnam War, the Army reorganized aviation maintenance into a semi-decentralized design consisting of three levels of maintenance. From 1969 to 1985 this system was managed for the commanders under one maintenance officer. After Army Aviation became a branch in 1983, Army Aviation Organizations changed from the H Series TO&E to the L Series TO&E. This change further decentralized maintenance and removed the Aviation Maintenance Officer from full responsibility for aircraft maintenance. For the aviation maintenance portion of the force to meet transformation goals, the author advocates a maintenance strategy of centralized multifunctional maintenance organizations focused on effective and efficient operations. (6 figures, 55 refs.)
DTIC
Aircraft Maintenance; International Relations; Nonlinearity; Politics

20040082743 Air Force Research Lab., Brooks AFB, TX
Pressure Breathing During G Without a Counter- Pressure Vest
O'Connor, Robert; Isdahl, Wayne; Werchan, Paul; Balldin, Ulf; May 2004; 35 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A423833; AFRL-HE-BR-TR-2004-0047; No Copyright; Avail: CASI; A03, Hardcopy

This report was delivered to Air Combat Command (ACC/DRS) in response to their request for a study of use of the COMBAT EDGE positive pressure breathing (PPB) system without its chest counter-pressure vest. The vest is worn to balance intra-thoracic pressure during PPB, but some aircrew have reported that the vest causes increased heat stress and decreased mobility. Eleven subjects, including five F-15 aircrew, completed centrifuge exposures up to +9 Gz using PPB at 60 mm Hg pressure with and without the counter-pressure vest. Additional G-exposures using pressures of 0, 30, and 45 mm Hg were performed without the vest. Elimination of the counter-pressure vest did not significantly reduce G-tolerance. The use of PPB, with or without the vest, was preferred by all test subjects. PPB at 60 mm Hg produced the highest G- protection and was preferred by the test subjects over lesser pressures. Subjects reported no adverse effects from the use of PPB without chest counter-pressure. Whether PPB without counter-pressure will increase fatigue during multiple sorties was not determined. (15 tables, 3 figures, 21refs.)
DTIC
Centrifugal Force; Physiological Effects; Pressure; Pressure Breathing; Pressure Suits; Vests

20040082814 Secretary of the Air Force, Washington, DC
Guide To Mobile Aircraft Arresting System Installation - Air Force Handbook 10-222, Volume 8
Mar. 2000; 184 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423975; No Copyright; Avail: CASI; A09, Hardcopy

This handbook addresses the actions necessary to install a Mobile Aircraft Arresting System (MAAS), including installations of the MAAS with the Lightweight and Standard Fairlead beams. A MAAS may be installed to meet a wide range of uses, such as an airfield survivability arresting system (for use on a bomb damaged runway), as a bare base asset for overseas deployment or for emergeney or contingency use at an established base Users of this booklet include power production personnel and personnel on the installation teams. In addition information is provided which is relevant for heavy equipment and engineering personnel assigned to assist with the installation and for advance team and control center personnel involved in the planning and beddown at an installation or bare base. Installation team members are assumed to have a knowledge of the system and its operation and maintenance requirements.
DTIC
Aircraft Brakes; Arresting Gear; Handbooks; Installing

20040084086 National Commission on Terrorist Attacks Upon the USA, Washington, DC, USA
The 9/11 Commission Report: Final Report of the Nationl Commission on Terrorist Attacks Upon the USA Executive Summary
Kean, Thomas H.; Ben-Veniste, Richard; Fielding, Fred F.; Gorelick, Jamie S.; Gorton, Slade; Hamilton, Lee H.; Kerrey, Bob; Lehman, John F.; Roemer, Timothy J.; Thompson, James R., et al.; July 22, 2004; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We present the narrative of this report and the recommendations that flow from it to the President of the USA, the USA Congress, and the American people for their consideration. Ten Commissioners, five Republicans and five Democrats chosen by elected leaders from our nation s capital at a time of great partisan division have come together to present this report without dissent. We have come together with a unity of purpose because our nation demands it. September 11, 2001, was a day of unprecedented shock and suffering in the history of the USA.The nation was unprepared.At 8:46 on the morning of September 11, 2001, the USA became a nation transformed. An airliner traveling at hundreds of miles per hour and carrying some 10,000 gallons of jet fuel plowed into the North Tower of the World Trade Center in Lower Manhattan. At 9:03, a second airliner hit the South Tower. At 9:37 that same morning, a third airliner slammed into the western face of the Pentagon. At 10:03, a fourth airliner crashed in a field in southern Pennsylvania. It had been aimed at the USA Capitol or the White House, and was forced down by heroic passengers armed with the knowledge that America was under attack. More than 2,600 people died at the World Trade Center; 125 died at the Pentagon; 256 died on the four planes. The death toll surpassed that at Pearl Harbor in December 1941. This immeasurable pain was inflicted by 19 young Arabs acting at the behest of Islamist extremists headquartered in distant Afghanistan. Some had been in the USA for more than a year, mixing with the rest of the population. Though four had training as pilots, most were not well-educated. Most spoke English poorly, some hardly at all. In groups of four or five, carrying with them only small knives, box cutters, and cans of Mace or pepper spray, they had hijacked the four planes and turned them into deadly guided missiles. Why did they do this? How was the attack planned and conceived? How did the U.S. government fail to anticipate and prevent it? What can we do in the future to prevent similar acts of terrorism? This report investigates these questions.
Author
Terrorism; United States; Investigation

20040084087 National Commission on Terrorist Attacks Upon the USA, Washington, DC, USA
The 9/11 Commission Report: Final Report of the Commission on Terrorist Attacks Upon the USA
Kean, Thomas H.; Benveniste, Richard; Fielding, Fred F.; Gorelick, Jamie S.; Gorton, Slade; Hamilton, Lee H.; Kerrey, Bob; Lehman, John F.; Roemer, Timothy J.; Thompson, James R., et al.; July 22, 2004; 585 pp.; In English; No Copyright; Avail: CASI; A25, Hardcopy

We present the narrative of this report and the recommendations that flow from it to the President of the USA, the USA Congress, and the American people for their consideration. Ten Commissioners - five Republicans and five Democrats chosen by elected leaders from our nation's capital at a time of great partisan division - have come together to present this report without dissent. We have come together with a unity of purpose because our nation demands it. September 11, 2001, was a day of unprecedented shock and suffering in the history of the USA.The nation was unprepared. How did this happen, and how can we avoid such tragedy again? To answer these questions, the Congress and the President created the National Commission on Terrorist Attacks Upon the USA (Public Law 107-306, November 27, 2002). Our mandate was sweeping. The law directed us to investigate 'facts and circumstances relating to the terrorist attacks of September 11, 2001,' including those relating to intelligence agencies, law enforcement agencies, diplomacy, immigration issues and border control, the flow of assets to terrorist organizations, commercial aviation, the role of congressional oversight and resource allocation, and other areas determined relevant by the Commission. In pursuing our mandate, we have reviewed more than 2.5 million pages of documents and interviewed more than 1,200 individuals in ten countries. This included nearly every senior official from the current and previous administrations who had responsibility for topics covered in our mandate. We have sought to be independent, impartial, thorough, and nonpartisan. From the outset, we have been committed to share as much of our investigation as we can with the American people.To that end, we held 19 days of hearings and took public testimony from 160 witnesses.
Author
Terrorism; Airport Security; Air Piracy; United States; Investigation

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*.

20040081080 NASA Ames Research Center, Moffett Field, CA, USA
Access from Space: A New Perspective on NASA's Space Transportation Technology Requirements and Opportunities
Rasky, Daniel J., et al.; [2004]; 1 pp.; In English; AIAA Space 2004 Conference and Exposition, 28-30 Sep. 2004, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The need for robust and reliable access from space is clearly demonstrated by the recent loss of the Space Shuttle Columbia; as well as the NASA s goals to get the Shuttle re-flying and extend its life, build new vehicles for space access, produce successful robotic landers and s a q k ret~rr? ~llisrions, and maximize the science content of ambitious outer planets missions that contain nuclear reactors which must be safe for re-entry after possible launch aborts. The technology lynch pin of access from space is hypersonic entry systems such the thermal protection system, along with navigation, guidance and control (NG&C). But it also extends to descent and landing systems such as parachutes, airbags and their control systems. Current space access technology maturation programs such as NASA s Next Generation Launch Technology (NGLT) program or the In-Space Propulsion (ISP) program focus on maturing laboratory demonstrated technologies for potential adoption by specific mission applications. A key requirement for these programs success is a suitable queue of innovative technologies and advanced concepts to mature, including mission concepts enabled by innovative, cross cutting technology advancements. When considering space access, propulsion often dominates the capability requirements, as well as the attention and resources. From the perspective of access from space some new cross cutting technology drivers come into view, along with some new capability opportunities. These include new miniature vehicles (micro, nano, and picosats), advanced automated systems (providing autonomous on-orbit inspection or landing site selection), and transformable aeroshells (to maximize capabilities and minimize weight). This paper provides an assessment of the technology drivers needed to meet future access from space mission requirements, along with the mission capabilities that can be envisioned from innovative, cross cutting access from space technology developments.
Author
Aerospace Engineering; Air Bag Restraint Devices; Automatic Control; Reentry; Technology Assessment

20040081353 General Accounting Office, Washington, DC
Defense Logistics: GAO's Observations on Maintenance Aspects of the Navy's Fleet Response Plan
Jun. 18, 2004; 28 pp.; In English
Report No.(s): PB2004-106141; GAO-04-724R; No Copyright; Avail: CASI; A03, Hardcopy

This prompted the Navy, in March 2003, to develop a concept to enhance its deployment readiness strategy. The Navys Fleet Response Plan, implemented in May 2003, evolved from a concept to institutionalize an enhanced surge capability. The Fleet Response Plan modifies the Navys pre-2001 rotational deployment policy, replacing 6-month routine deployments with more flexible deployment options that provide the capability to deploy as many as eight carrier strike groups when and where needed. Although we focused our review of the maintenance impacts of the Fleet Response Plan on aircraft carriers, the plan applies to all ship classes except submarines. The plan changes the manner in which the Navy maintains, trains, staffs, and deploys its ships to allow a greater availability of the fleet to meet Homeland Defense and Defense Guidance requirements. As it relates to maintenance, the plan relies on increased continuous maintenance during pier dockings.
NTIS
Navy; Maintenance; Aircraft Carriers

20040081374 Technische Univ., Munich, Germany
Future Requirments and Concepts for Cabins of Blended Wing Body Configurations: A Scenario Based Approach
Eelman, Stephan; Schmitt, Dieter; Becker, Axel; Granzeier, Werner; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 9 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A02, Hardcopy

The strong influence of unpredictable factors on the development of future concepts for BWB cabins implies the methodology of scenario techniques. The scenario process performed at TU Miinchen together with Airbus Deutschland GmbH, DaimlerChrysler Society and Technology Research Group (REM) and iDS, industrial Design Studio, comprises the development of three different scenarios, the implication of specific requirements and the realization of preliminary cabin concepts. To cover a broad range of potential evolutions, the three scenarios chosen evolved in a generous, innovative and a conservative development of future BWB cabins. On the basis of current cabin standards of the A380, new standards for the BWB cabin designs were quantitatively derived for each scenario as well as this was done qualitatively for a portfolio of essential new technologies, which are formulated as technology recommendations for the aircraft. According to these inputs, 2D cabin layouts and specific system solutions have been developed and sketched to visualize the concepts. In a final step, specific requirements have been evaluated in all scenarios to identi@ their compatibility in the respective future environments.
Author
Blended-Wing-Body Configurations; Aircraft Design

20040081401 Georgia Tech Research Inst., Atlanta, GA, USA

Synergistic Powered-Lift and Control Technologies-Development of Pneumatic Channel Wing Powered-Lift Aircraft Technology

Englar, Robert J.; Campbell, Bryan A.; June 29, 2004; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG-1-02075; GTRI Proj. A-6842; No Copyright; Avail: CASI; A03, Hardcopy

The powered-lift Channel Wing concept has been combined with pneumatic Circulation Control aerodynamic ana propuisive tecnnoiogy to generate a Pneumatic Channel Wing (PCW) configuration intended to have Super-STOL or VSTOL capability while eliminating many of the operational problem areas of the original Channel Wing vehicle. Wind-tunnel development and evaluations of a PCW powered model conducted at Georgia Tech Research Institute (GTRI) have shown substantial lift capabilities for the blown configuration (C, values of 10 to 11). Variation in blowing of the channel was shown to be more efficient than variation in propeller thrust in terms of lift generation. Also revealed was the ability to operate unstalled at very high angles of attack of 40 degrees-45 degrees, or to achieve very high lift at much lower angle of attack to increase visibility and controllability. In order to provide greater flexibility during Super-STOL takeoffs and landings, the blown model also displayed the ability to interchange thrust and drag forces by varying blowing without any moving parts. A preliminary design study of this pneumatic vehicle based on the two technologies integrated into a simple Pneumatic Channel Wing configuration showed very strong Super-STOL potential. This report presents experimental results, discusses variations in the configuration geometry under development, and addresses additional considerations to extend this integrated technology to advanced design studies of PCW-type vehicles.

Author

Pneumatic Control; Powered Lift Aircraft; Aerodynamic Configurations; V/Stol Aircraft; Channel Wings; Technology Utilization; Powered Models

20040082016 New Mexico State Univ., NM, USA

Advances in Scientific Balloon Thermal Modeling

Bohaboj, T.; Cathey, H. M., Jr.; [2004]; 2 pp.; In English

Contract(s)/Grant(s): NAS5-03003; No Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration's Balloon Program office has long acknowledged that the accurate modeling of balloon performance and flight prediction is dependant on how well the balloon is thermally modeled. This ongoing effort is focused on developing accurate balloon thermal models that can be used to quickly predict balloon temperatures and balloon performance. The ability to model parametric changes is also a driver for this effort. This paper will present the most recent advances made in this area. This research effort continues to utilize the ″Thrmal Desktop″ addition to AUTO CAD for the modeling. Recent advances have been made by using this analytical tool. A number of analyses have been completed to test the applicability of this tool to the problem with very positive results. Progressively detailed models have been developed to explore the capabilities of the tool as well as to provide guidance in model formulation. A number of parametric studies have been completed. These studies have varied the shape of the structure, material properties, environmental inputs, and model geometry. These studies have concentrated on spherical ″proxy models″ for the initial development stages and then to transition to the natural shaped zero pressure and super pressure balloons. An assessment of required model resolution has also been determined. Model solutions have been cross checked with known solutions via hand calculations. The comparison of these cases will also be presented. One goal is to develop analysis guidelines and an approach for modeling balloons for both simple first order estimates and detailed full models. This papa presents the step by step advances made as part of this effort, capabilities, limitations, and the lessons learned. Also presented are the plans for further thermal modeling work.

Author

Balloon Flight; Models; Performance Prediction

20040082311 Sikorsky Aircraft, Stratford, CT, USA

Crash Testing of Helicopter Airframe Fittings

Clarke, Charles W.; Townsend, William; Boitnott, Richard; [2004]; 8 pp.; In English; AHS International 60th Annual Forum and Technology Display, 7-10 Jun. 2004, Baltimore, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): DAAH10-98-2-0001; 23-728-01-06; No Copyright; Avail: CASI; A02, Hardcopy

As part of the Rotary Wing Structures Technology Demonstration (RWSTD) program, a surrogate RAH-66 seat attachment fitting was dynamically tested to assess its response to transient, crash impact loads. The dynamic response of this composite material fitting was compared to the performance of an identical fitting subjected to quasi-static loads of similar magnitude. Static and dynamic tests were conducted of both smaller bench level and larger full-scale test articles. At the bench

level, the seat fitting was supported in a steel fixture, and in the full-scale tests, the fitting was integrated into a surrogate RAH-66 forward fuselage. Based upon the lessons learned, an improved method to design, analyze, and test similar composite material fittings is proposed.
Author
Airframes; Crashes; Fittings; Structural Engineering; Rotary Wing Aircraft; Seats; Dynamic Tests

20040082616 Civil Aeromedical Inst., Oklahoma City, OK
Access-To-Egress III: Repeated Measurement of Factors that Control the Emergency Evacuation of Passengers Through the Transport Airplane Type-III overwing Exit
McLean, Garnet A.; Corbett, Cynthia L.; Jan. 2004; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423562; DOT-FAA-AM-04-2; No Copyright; Avail: CASI; A03, Hardcopy

Simulated emergency evacuations were conducted from a narrow-body transport airplane simulator through a Type- III overwing exit. The independent variables were passageway configuration, hatch disposal location, subject group size (density), and subject motivation level. Additional variables of interest included individual subject characteristics, i.e., gender, age, waist size, and height, shown in previous studies to significantly affect emergency egress. Subjects were restricted to those who had no previous emergency evacuation (research) history.
DTIC
Egress; Emergencies; Passengers; Transport Aircraft

20040082633 Defense Science Board, Washington, DC
Defense Science Board Study on Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles
Israel, Kenneth; Nesbit, Robert; Feb. 2004; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423585; No Copyright; Avail: CASI; A05, Hardcopy

Lessons from recent combat experiences in Kosovo, Afghanistan and Iraq have shown that UAVs can provide vastly improved acquisition and more rapid dissemination of Intelligence, Surveillance and Reconnaissance (ISR) data. They are one of the principal contributors to successful outcomes for the USA in these campaigns. The benefits and promise offered by UAVs in surveillance, targeting and attack have captured the attention of senior military and civilian officials in the Defense Department (DoD), members of Congress, and the public alike. Indeed, these recent combat operations appear to indicate that unmanned air systems have at last come of age.
DTIC
Combat; Drone Vehicles; Intelligence; Military Operations; Pilotless Aircraft

20040082641 Army Aeromedical Research Lab., Fort Rucker, AL
Speech Intelligibility with Helicopter Noise: Tests of Three Helmet-Mounted Communication Systems
Ribera, John E.; Mozo, Ben T.; Murphy, Barbara A.; Feb. 2004; 9 pp.; In English
Contract(s)/Grant(s): Proj-878
Report No.(s): AD-A423599; USAARL-2004-16; No Copyright; Avail: CASI; A02, Hardcopy

Military aviator helmet communications systems are designed to enhance speech intelligibility (SI) in background noise and reduce exposure to harmful levels of noise. Some aviators, over the course of their aviation career, develop noise-induced hearing loss that may affect their ability to perform required tasks. New technology can improve SI in noise for aviators with normal hearing as well as those with hearing loss. SI in noise scores were obtained from 40 rotary-wing aviators (20 with normal hearing and 20 with hearing-loss waivers). There were three communications systems evaluated: a standard SPH-4B, an SPH-4B aviator helmet modified with communications earplug (CEP), and an SPH-4B modified with active noise reduction (ANR). Subjects' SI was better in noise with newer technologies than with the standard issue aviator helmet. A significant number of aviators on waivers for hearing loss performed within the range of their normal hearing counterparts when wearing the newer technology. The rank order of perceived speech clarity was 1) CEP, 2) ANR, and 3) unmodified SPH-4B. To insure optimum SI in noise for rotary- wing aviators, consideration should be given to retrofitting existing aviator helmets with new technology, and incorporating such advances in communication systems of the future. Review of standards for determining fitness to fly is needed.
DTIC
Helicopters; Helmet Mounted Displays; Helmets; Intelligibility; Rotary Wing Aircraft; Telecommunication

20040082648 Civil Aeromedical Inst., Oklahoma City, OK

Distribution and Optical Purity of Methamphetamine Found in Toxic Concentration in a Civil Aviation Accident Pilot Fatality

Chaturvedi, Arvind K.; Cardona, Patrick S.; Soper, John W.; Canfield, Dennis V.; Dec. 2003; 10 pp.; In English

Report No.(s): AD-A423609; DOT/FAA/AM-03/22; No Copyright; Avail: CASI; A02, Hardcopy

The Federal Aviation Administration's Civil Aerospace Medical Institute conducts toxicological evaluation of postmortem biological samples collected from pilots involved in fatal civil aircraft accidents. The submitted samples are primarily analyzed for the presence of primary combustion gases, alcohol/ volatiles, and drugs. The findings of a unique aircraft accident are described in this report. Upon crashing in weather conditions of poor visibility, a 1- occupant airplane was substantially damaged, with no evidence of fire. Remains of the pilot were found outside the crashed aircraft. Pathological examination revealed multiple blunt force injuries and vascular congestion, including subdural hemorrhage of the cerebral cortex. Autopsied samples -- blood, brain, gastric contents, heart, liver, muscle, spleen, urine, and vitreous fluid --were submitted for toxicological analysis. The fluorescence polarization immunoassay showed 8.0 micrograms/ml amphetamines in urine. Subsequent gas chromatographic/mass spectrometric confirmatory analysis determined the presence of methamphetamine and amphetamine in blood and urine. The amount of methamphetamine found in gastric contents was 575-fold higher than that of amphetamine. Stereochemical analyses of gastric contents, blood, and urine using a chiral probe indicated that methamphetamine detected in the sample types was not optically pure. In gastric contents and urine, this secondary amine's optical isomers were present in equal proportions. The enantiomeric excess of (+) methamphetamine over its (-) form was about 32% in blood. Both optical forms of amphetamine were present in the ratio of 1.2-1.5:1.0 in the 3 sample types. The blood methamphetamine concentration found was in the range sufficient to produce toxic effects. Findings support the conclusion of the NTSB that, in addition to the visibility-associated adverse weather conditions, the use of the controlled substance played a contributory role in this accident.

DTIC

Accident Investigation; Aircraft Accidents; Amphetamines; Civil Aviation; Methamphetamine; Purity; Toxicity; Toxicology

20040082720 Notre Dame Univ., IN

Dynamics of Plasma-Surface Interactions

May 11, 2004; 12 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0412

Report No.(s): AD-A423782; AFRL-SR-AR-TR-04-0293; No Copyright; Avail: CASI; A03, Hardcopy

This project explored specific strategies to augment the plasma density surrounding hypersonic vehicles through a novel solid-state device that provides cold-cathode electron ejection. Successive deposition of metallic, insulating, and metallic nanolayers on a glass support formed a metal-insulator-metal(MIM) device. When a voltage bias was applied, the MIM device delivered hot electrons to the metal/vacuum interface from within the solid. These hot electrons have the potential to stimulate nonthermal chemical reactions at the gas/surface interface or supplement the charge density of a plasma above the device. The emitted electrons had a relatively narrow distribution of kinetic energies that could be tuned by altering the bias potential. Design and electronic performance characteristics are reported for operational MIM devices.

DTIC

Hypersonic Vehicles; Kinetic Energy; Plasma Interactions; Plasmas (Physics); Surface Reactions

20040082735 Alphatech, Inc., Burlington, MA

Low Observability Path Planning for an Unmanned Air Vehicle Using Mixed Integer Linear Programming

Chaudhry, Atif; Misovec, Kathy; D'Andrea, Raffaello; Apr. 2004; 10 pp.; In English

Contract(s)/Grant(s): F33615-01-C-3149; Proj-ARPF

Report No.(s): AD-A423815; AFRL-VA-WP-TP-2004-312; No Copyright; Avail: CASI; A02, Hardcopy

Detection of an Unmanned Air Vehicle by radar is dependent on many variables including range, altitude, and relative orientation. Given a radar location and appropriate model for the likelihood of detection, a path plan can be created for an Unmanned Air Vehicle which constrains the probability of detection. In this paper such an approach is taken using a linearized detection model. The detection model and the Unmanned Air Vehicle's dynamics are represented as a linear program subject to mixed integer constraints. This mixed integer linear program (MILP) is then solved with commercial software which has been traditionally used by the Operations Research community. This approach searches for all feasible solutions and produces the best path plan based on the user specified parameters.

DTIC

Drone Vehicles; Integers; Linear Programming; Trajectory Planning

20040082758 Army War Coll., Carlisle Barracks, PA
The UAV: A Strategic Asset in the Transformed Reserve Component
Herchenroeder, Gary; Feb. 17, 2004; 25 pp.; In English
Report No.(s): AD-A423858; No Copyright; Avail: CASI; A03, Hardcopy

As the U.S. military transforms its reserve component needs to maintain relevance through modernized equipment and strategic utilization. Shifting the Unmanned Aerial Vehicle (UAV) application into the Army's reserve component would effectively serve both purposes. This paper addresses some aspects of the currently fielded UAV program and it contends that this resource should be brought into the reserve component. It further proposes an idea that the AH-64 Apache Helicopter has no place in the reserve component and should be replaced by the UAV. There will also be an indication that the discussed UAV employment ideas could benefit both active and reserve Army components and that they should be reviewed by the key players within each element and by the combatant commands. The author recommends UAV utilization as a strategic resource within the Army's reserve component.
DTIC
Drone Vehicles; Reserves

20040082761 Civil Aeromedical Inst., Oklahoma City, OK
Automatic Dependent Surveillance - Broadcast/Cockpit Display of Traffic Information: Pilot Use of the Approach Spacing Application
Prinzo, O. V.; Hendrix, Alfred M.; Oct. 2003; 20 pp.; In English
Report No.(s): AD-A423864; DOT/FAA/AM-03/13; No Copyright; Avail: CASI; A03, Hardcopy

Pilots may benefit from surveillance technology that enhances their ability to maintain pre-determined distances from other aircraft during initial and final approach. Avionics that provide a cockpit display of traffic information (CDTI) enable pilots to acquire, verify, establish, and maintain pre-defined spacing intervals from other aircraft. It is of interest to the Federal Aviation Administration to determine how the use of these displays influences safety, capacity, and efficiency. The second operational evaluation of ADS-B/CDTI provided an opportunity to evaluate procedural modifications needed to support operational approval for Approach Spacing and Visual Acquisition/Traffic Awareness applications. Ten flight crews flew 86 approaches during 3 day and 2 night operations. Subject-matter experts read transcripts and listened to 9 hrs of audiotapes for the presence of problems and operational concerns stemming from pilot use of the CDTI. Controllers issued 169 traffic calls that resulted in 70% positive visual acquisitions (83% displayed on CDTI, 17% not displayed), which resulted in a 48% increase in visual approach clearances (up from 23 to 34). Eighty-three percent of the approach clearances that included an instruction for the pilot to follow that traffic were transmitted 2 s or less after the pilot reported that the traffic was visually acquired. Approximately 55% of these visual approaches involved one or more problems. Problems included uncertainty (33%), speed overtakes (28%), lost visual contact (11%), confusion (8%), clearance copied by traffic (8%), follow traffic not sighted (6%), and aircraft call sign (6%). The use of a CDTI created some problems for the participants, including several from the call sign procedure that distinguished between the aircraft being talked to versus talked about.
DTIC
Air Traffic; Air Traffic Control; Broadcasting; Cockpits; Display Devices; Spacing; Surveillance

20040082780 Nangia Aero Research Associates, Bristol
Configuration Studies Supporting Design/Assessment of Sensor Craft
Nangia, Rajendar K.; Nov. 21, 2003; 70 pp.; In English
Contract(s)/Grant(s): F61775-01-WE087
Report No.(s): AD-A423911; SPC-01-4087; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking Nangia Aero Research Associates as follows: The objective of the proposed work is to support on-going research at the Configuration Aerodynamics Branch (AFRL/VA) for design/assessment of a Sensor Craft configuration. The sensor aircraft is subject to challenging flight envelope (mission profile). The design at present is relatively ″fluid″. Box wings of different layouts arise. It has to cruise and loiter (very high LID) for substantial periods and needs to carry a large percentage of its all-up-weight in fuel. The high aspect- ratio wings therefore need to be fairly thick. This implies emphasis on efficient aerodynamic and structural loading. A particularly critical aspect is the design of juncture and LE/TE design. Obviously there are many geometry parameters that arise implying substantial computation. It is proposed to commence work on this configuration. Suitable geometry parameters have been discussed with VA scientists. In the first phase with seed funding from EOARD, it is proposed to: 1. Set up the methodology of the design problem including flight envelope (Mach #. altitude & scale effects). Indicate important/critical design regimes. 2. Set up appropriate geometry with thick aerofoil sections including junctions. 3. Solve for design (under appropriate constraints) of the wings with mutual

interference and allowance for juncture effects. 4. Two typical cases are to be done. showing the effects of main parametric variations. 5. Results will show the forces, moments and pressure distributions. Longitudinal behavior is the first interest. A restricted effort will be directed toward laterals also. 6. Compiling a report on the techniques used and results obtained with conclusions and suggestions for further work. 7. Draft report is to be sent for comments before issuing the final version, which is the main deliverable.
DTIC
Aircraft Design

20040082803 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Optimization of Heterogeneous UAV Communications Using the Multiobjective Quadratic Assignment Problem
Kleeman, Mark P.; Mar. 2004; 192 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423960; AFIT/GCE/ENG/04-04; No Copyright; Avail: CASI; A09, Hardcopy

The Air Force has placed a high priority on developing new and innovative ways to use Unmanned Aerial Vehicles (UAVs). The Defense Advanced Research Projects Agency (DARPA) currently funds many projects that deal with the advancement of UAV research. The ultimate goal of the Air Force is to use UAVs in operations that are highly dangerous to pilots, mainly the suppression of enemy air defenses (SEAD). With this goal in mind, formation structuring of autonomous or semi-autonomous UAVs is of future importance. This particular research investigates the optimization of heterogeneous UAV multi-channel communications in formation. The problem maps to the multiobjective Quadratic Assignment Problem (mQAP). Optimization of this problem is done through the use of a Multiobjective Evolutionary Algorithm (MOEA) called the Multiobjective Messy Genetic Algorithm - II (MOMGA- II). Experimentation validates the attainment of an acceptable Pareto Front for a variety of mQAP benchmarks. It was observed that building block size can affect the location vectors along the current Pareto Front. The competitive templates used during testing perform best when they are randomized before each building block size evaluation. This tuning of the MOMGA- II parameters creates a more effective algorithm for the variety of mQAP benchmarks, when compared to the initial experiments. Thus this algorithmic approach would be useful for Air Force decision makers in determining the placement of UAVs in formations.
DTIC
Drone Vehicles; Heterogeneity; Telecommunication

20040082807 National Defense Univ., Washington, DC
The DoD C-17 Versus the Boeing 777. A Comparison of Acquisition and Development
Battershell, A. L.; Oct. 1999; 109 pp.; In English
Report No.(s): AD-A423964; No Copyright; Avail: CASI; A06, Hardcopy

In 1995, two significant aircraft made aviation history as they lifted off runways in different parts of the country. One, the Boeing 777, a wide-bodied, two-engine passenger plane created by private enterprise, made its first commercial transoceanic flight in June 1995. The other, the C- 17, a military cargo plane created by the Department of Defense (DOD), received initial operating certification in January 1995. Each aircraft exhibited innovative design and high-tech features, but neither boasted an unprecedented level of untried technology. They were similar in many ways-both intended to ferry passengers or cargo with appropriate ease from one point to another. Yet each of these aircraft had a unique story of development-one a straightforward narrative of almost 9 years, the other a complex, convoluted yarn spanning 24 years. Even after Congress approved funding, the C-17 time table was greater than the Boeing 777. This study compares and contrasts the histories of these two aircraft to determine why a private-sector company was able to develop and produce the 777 in significantly less time than the government took to develop and produce the C-17. The 777 originated in the late 1980s during market research by the Seattle-based Boeing Company. To determine what the market would bear, Boeing solicited input from commercial airlines, asking them what they wanted in a new aircraft. Once Boeing determined the type of aircraft to build, the company set a timeline, initiated innovative development procedures, and then followed a set of guidelines to produce the aircraft.
DTIC
Aircraft Design; Boeing 777 Aircraft; Transport Aircraft

20040082824 Cincinnati Univ., OH
Cooperative Control for UAV's Searching Risky Environments For Targets
Flint, Matthew; Fernandez-Gaucherand, Emmanuel; Polycarpou, Marios; Mar. 2003; 13 pp.; In English
Contract(s)/Grant(s): F33615-01-C-3150; Proj-ARPF
Report No.(s): AD-A423988; AFRL-VA-WP-TP-2003-304; ASC-03-0575; No Copyright; Avail: CASI; A03, Hardcopy

A software architecture is presented, which introduces several agents which focus on different aspects of path planning for multiple autonomous unmanned aerial vehicles (UAV's) that are searching an uncertain and threatening environment for targets. One agent models threats in the environment. Another develops a model of the environment that allows targets to be defined by individual probability distribution. Lastly, an agent is presented that utilizes the information from the other agents to generate a near optimal path plan using a Dynamic Programming algorithm.
DTIC
Aerial Reconnaissance; Architecture (Computers); Drone Vehicles; Targets

20040082835 Civil Aeromedical Inst., Oklahoma City, OK
CFD Validation for Contaminant Transport in Aircraft Cabin Ventilation Flow Fields
Garner, Robert P.; Wong, Kwai L.; Ericson, Shawn C.; Baker, A. J.; Orzechowski, Joseph A.; Apr. 2004; 9 pp.; In English Report No.(s): AD-A423999; DOT/FAA/AM-04/7; No Copyright; Avail: CASI; A02, Hardcopy

Civil transport aircraft have clearly been demonstrated as a preferred target of terrorist organizations through the years. The threat of the release of a noxious chemical or biological agent into the passenger cabin is real. Protection of occupants is critical for maintaining public confidence in air travel. Therefore, the Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI) is directing a project for quantitative evaluation of the distribution of contaminants released during mid-flight in commercial airliner passenger cabins. The effort uses the CAMI 747 Aircraft Environmental Research Facility (AERF) to collect airflow data to be used to validate computational fluid dynamics (CFD) algorithms that can predict the potential distribution of a variety of particles in the aircraft. The cabin velocity vector field is measured at a number of points within the cabin using 3-dimensional sonic and conventional hot-wire anemometers. These data serve as a comparison basis to simulation via CFD that predicts the 3-dimensional ventilation flow field. This paper presents the first results of validation of CFD prediction of the cabin flow field in a segment of a 747 AERF. Agreement between the data and the simulation is good, hence represents the first steps towards development of a CFD system to quantitatively study contaminant distribution and assist in testing optimal responses to an attack on various airframes. The release of a chemical weapon has been the focus of work to date, but CFD is ultimately applicable to predicting the distribution of other entities through the aircraft environmental control system (ECS) such as biological, nuclear, or other toxic agents. Concurrently, the approach is applicable to generic cabin air quality issues where an understanding of flow fields is of critical importance in terms of the role that fresh air and
DTIC
Aircraft Compartments; Computational Fluid Dynamics; Contaminants; Flow Distribution; Transport Aircraft; Ventilation

20040084122 Raytheon Aircraft Co., Wichita, KS, USA
Perspective: Raytheon Aircraft Company
Pfeiffer, Neal J.; Herring, Dana C.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 144-180; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

Raytheon manufactures a range of business aircraft. These are sold under the Beechcraft and Hawker badges. At the bottom end there are the piston-powered Bonanza and Baron. They are followed by the King Air products; C90A, 200, & 350 with 4, 6, & 8-passenger cabins respectively. In the jet market, the base product is the Beech Premier 1 followed by the Hawker 400XP (previously the Beechjet), the Hawker 800XP, and finally the Hawker Horizon which is in flight test now.
Derived from text
Manufacturing; Flight Tests; Aircraft Production

20040084123 Naval Air Systems Command, Patuxent River, MD, USA
A Greybeard's View of the State of Aerodynamic Prediction
Lawrence, Tom; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 181-214; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

An overview of over 100 years of producing wind tunnel data used in the building of various aircraft configurations is presented. Limitations of wind tunnel data are addressed as well as their strengths. Understanding these strengths and weakness has enabled designers to make allowances for their shortcomings thus enabling the design and development of successful aircraft. The role of computers and computational fluid dynamics in aircraft design is addressed with some discussion on the synergy between wind tunnel data and CFD.
CASI
Computational Fluid Dynamics; Aircraft Design; Wind Tunnel Tests

20040084126

Northrop Grumman Perspectives on COMSAC

COMSAC: Computational Methods for Stability and Control; April 2004, pp. 98-117; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

Northrop Grumman perspectives/experiences are: Impact of inaccurate aerodynamic S&C predictions. Potential benefits of complementary use of CFD and wind tunnels. Northrop Grumman experiences/perspectives lesson learned and flight testing. Summary and recommendations.

Derived from text

Stability; Active Control; Aerodynamic Stability; Flight Tests

20040084127 NASA Langley Research Center, Hampton, VA, USA

Stability and Control Challenges for COMSAC: A NASA Langley Perspective

Fremaux, Charles Michael; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 28-47; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

This presentation is designed as a limited-scope ″tutorial″ and is aimed primarily at the CFDer who has not been exposed to stability and control problems. Examples of some classic S&C problems are used for illustration. S&C is a fundamental technology for enabling flight, but significant problems with the prediction of S&C characteristics persists, especially where separated flow is involved. Even after 100 years of flight, experimental methods still have significant limitations. Experimental and computational tools can and must be complementary. NASA Flight Prediction Workshop (Williamsburg, Virginia, November 2002) brought together experts from government, industry, and academia to discuss problems associated with state-of-the-art flight prediction. Among the concerns highlighted were deficiencies in S&C prediction lack of calibrated CFD tools for aerodynamic prediction in general.

Derived from text

Computational Fluid Dynamics; Stability; Active Control

20040084129 Boeing Co., Saint Louis, MO, USA

Boeing Integrated Defense Systems Perspective on COMSAC

Evans, Dave; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 118-123; In English; See also 20040084120; No Copyright; Avail: CASI; A02, Hardcopy

This presentation will discuss Computational Fluid Dynamics as it is used for tactical aircraft and weapons development. Primary emphasis will be products designed, developed and built in St. Louis reflecting the presenter s background and experience, though it is believed that similar issues will be found wherever tactical vehicles are developed.

Author

Aircraft Design; Systems Integration; Weapons Development

20040084133 Lockheed Martin Aeronautics Co., Fort Worth, TX, USA

An S and C Perspective on CFD

Killingsworth, Russ D.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 248-272; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

I will review the trends for wind tunnel testing since the Wright Brothers. Review data requirements for S&C. Show a few examples of CFD in challenging flow fields. Compare capabilities and time requirements for CFD and WT. And recommend the biggest payoff areas for applying CFD to S&C.

Author

Computational Fluid Dynamics; Wind Tunnel Tests; Time Functions; Payloads

20040084134 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Computational Methods in Stability and Control: WPAFB Perspective

Blake, William; Thomas, Will; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 124-143; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

Getting the vertical tail size correct on the first try has been a challenge for over 50 years. Most of the Century Series fighters suffered from roll coupling brought on by a combination of high rates of roll and insufficient stability to counter the resultant buildup in alpha and beta. Enlarging the vertical tails was the most common and successful solution. Early tests of the ″Have Blue″ stealth prototype with its inward canted vertical tails proved unsatisfactory, so outward canted tails were

selected for the F-117A. Even so, on the first flight of the F-117A (6/18/81), directional stability and control were both found to be far less than predicted, so the tails were increased in size by 50%. Dick Abrams, head of flight test at Lockheed, stated that ″the same mistake wasn't made on the YF-22″. On the YF-22, several methods were used to predict the required vertical tail size and the largest value was used with an additional safety factor included. No problems were encountered during flight test and the tail size for the proposed production configuration was actually decreased in size from the prototype.
Derived from text
Directional Stability; Active Control; Computation; Tail Assemblies; Flight Tests

20040084135 Boeing Commercial Airplane Co., Renton, WA, USA
The Role for Computational Fluid Dynamics for Stability and Control: Is it Time?
Ball, Douglas N.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 69-97; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

Over the past 25 years the field of Computational Fluid Dynamics has made tremendous strides. Wings can be designed and tested with complete confidence that the results will be as expected. Their reliability and range of applicability has grown. Now is the time to explore what can be done with CFD at the corners of the flight envelope. The presentation is broken down into three areas: 1. A description of the kinds of ″surprises″ that Boeing Commercial Airplanes has experienced in the last 25 years. 2. A sampling of the kinds of CFD modeling that we are doing in support of stability & control and loads issues. 3. A brief discussion as to how we, as an government/industry/academia team might operate.
Derived from text
Computational Fluid Dynamics; Stability; Computation; Active Control

20040084136 NASA Langley Research Center, Hampton, VA, USA
Introductory Remarks
Tenney, Darrel R.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 1-5; In English; See also 20040084120; No Copyright; Avail: CASI; A01, Hardcopy

Future vehicle designs will see a paradigm shift from: 1) Steady to the unsteady world (e.g. flow control, adaptive morphing); 2) Passive to active; 3) Rigid designs to exploitation of flexibility and adaptability; 4) Few discrete to numerous distributed (e.g. sensors, control surfaces); 5) To obtain a vehicle that is always at optimum performance. Therefore, future designs will be inherently multidisciplinary, and the greatest technical challenges and opportunities occur at the intersection of disciplines COMSAC appears to be a step towards enabling the future vision.
CASI
Aircraft Design; Conferences

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*.

20040081328 Oak Ridge National Lab., TN, Crawford (R. W.) Energy Systems, Tucson, AZ, USA, AccaMath Services, Carrollton, IL, USA
Estimating Impacts of Diesel Fuel Reformulation with Vector-Based Blending
Hadder, G. R.; Crawford, R. W.; McAdams, H. T.; McNutt, B. D.; Dec. 2002; In English
Report No.(s): DE2003-814286; ORNL/TM-2002/225; No Copyright; Avail: National Technical Information Service (NTIS)

The Oak Ridge National Laboratory Refinery Yield Model has been used to study the refining cost, investment, and operating impacts of specifications for reformulated diesel fuel (RFD) produced in refineries of the U.S. Midwest in summer of year 2010. The study evaluates different diesel fuel reformulation investment pathways. The study also determines whether there are refinery economic benefits for producing an emissions reduction RFD (with flexibility for individual property values) compared to a vehicle performance RFD (with inflexible recipe values for individual properties). Results show that refining costs are lower with early notice of requirements for RFD. While advanced desulfurization technologies (with low hydrogen consumption and little effect on cetane quality and aromatics content) reduce the cost of ultra low sulfur diesel fuel, these technologies contribute to the increased costs of a delayed notice investment pathway compared to an early notice investment pathway for diesel fuel reformulation. With challenging RFD specifications, there is little refining benefit from producing

emissions reduction RFD compared to vehicle performance RFD. As specifications become tighter, processing becomes more difficult, blendstock choices become more limited, and refinery benefits vanish for emissions reduction relative to vehicle performance specifications. Conversely, the emissions reduction specifications show increasing refinery benefits over vehicle performance specifications as specifications are relaxed, and alternative processing routes and blendstocks become available.
NTIS
Diesel Fuels; Refining; Mixtures; Cost Reduction

20040082327 NASA Glenn Research Center, Cleveland, OH, USA
Procedure for Determining One-Dimensional Flow Distributions in Arbitrarily Connected Passages Without the Influence of Pumping
Meitner, Peter L.; June 2004; 12 pp.; In English; Turbo Expo 2003, 16-19 Jun. 2003, Atlanta, GA, USA
Contract(s)/Grant(s): WBS 22-722-90-C1; DA Proj. 1L1-61102-AF-20
Report No.(s): NASA/TM-2004-211885; E-13567; ARL-TR-3213; GT2003-38061; No Copyright; Avail: CASI; A03, Hardcopy

A calculation procedure is presented which allows the one-dimensional determination of flow distributions in arbitrarily connected (branching) flow passages having multiple inlets and exits. The procedure uses an adaptation of the finite element technique, iteratively coupled with an accurate one-dimensional flow solver. The procedure eliminates the usual restrictions inherent with finite element flow calculations. Unlike existing one-dimensional methods, which require simplifications to the flow equations (uncoupling the momentum and energy equations), to allow for arbitrary branching and multiple inlets and exits, the only limitation of the described methodology is that, at present, it can only accommodate non-rotating configurations (no pumping effects). The calculation procedure is robust, and will always converge for physically possible flow. The procedure is described, and its use is illustrated by an example.
Derived from text
Fluid Flow; Heat Transfer; Flow Distribution; Turbines; Finite Element Method

20040082333 NASA Glenn Research Center, Cleveland, OH, USA
NASA Glenn Wind Tunnel Model Systems Criteria
Soeder, Ronald H.; Roeder, James W.; Stark, David E.; Linne, Alan A.; May 2004; 36 pp.; In English
Contract(s)/Grant(s): WBS 22-708-90-63
Report No.(s): NASA/TM-2004-212706/REV1; E-14216-1-REV1; No Copyright; Avail: CASI; A03, Hardcopy

This report describes criteria for the design, analysis, quality assurance, and documentation of models that are to be tested in the wind tunnel facilities at the NASA Glenn Research Center. This report presents two methods for computing model allowable stresses on the basis of the yield stress or ultimate stress, and it defines project procedures to test models in the NASA Glenn aeropropulsion facilities. Both customer-furnished and in-house model systems are discussed. The functions of the facility personnel and customers are defined. The format for the pretest meetings, safety permit process, and model reviews are outlined. The format for the model systems report (a requirement for each model that is to be tested at NASA Glenn) is described, the engineers responsible for developing the model systems report are listed, and the timetable for its delivery to the project engineer is given.
Author
Wind Tunnel Tests; Supersonic Wind Tunnels; Aircraft Engines; Design Analysis; Wind Tunnel Models

20040082393 NASA Glenn Research Center, Cleveland, OH, USA
An Experimental Investigation Into the Temperature Profile of a Compliant Foil Air Bearing
Radil, Kevin; Zeszotek, Michelle; May 2004; 22 pp.; In English; 2004 Annual Meeting and Exhibition, 17-20 May 2004, Tornot, Canada; Original contains color illustrations
Contract(s)/Grant(s): WBS 714-09-17; DA Proj. 1L1-62211-A4-7A
Report No.(s): NASA/TM-2004-213100; ARL-TR-3200; E-14575; No Copyright; Avail: CASI; A03, Hardcopy

A series of tests was performed to determine the internal temperature profile in a compliant bump-type foil journal air bearing operating at room temperature under various speeds and load conditions. The temperature profile was collected by instrumenting a foil bearing with nine, type K thermocouples arranged in the center and along the bearing s edges in order to measure local temperatures and estimate thermal gradients in the axial and circumferential directions. To facilitate the measurement of maximum temperatures from viscous shearing in the air film, the thermocouples were tack welded to the backside of the bumps that were in direct contact with the top foil. The mating journal was coated with a high temperature

solid lubricant that, together with the bearing, underwent high temperature start-stop cycles to produce a smooth, steady-state run-in surface. Tests were conducted at speeds from 20 to 50 krpm and loads ranging from 9 to 222 N. The results indicate that, over the conditions tested, both journal rotational speed and radial load are responsible for heat generation with speed playing a more significant role in the magnitude of the temperatures. The temperature distribution was nearly symmetric about the bearing center at 20 and 30 krpm but became slightly skewed toward one side at 40 and 50 krpm. Surprisingly, the maximum temperatures did not occur at the bearing edge where the minimum film thickness is expected but rather in the middle of the bearing where analytical investigations have predicted the air film to be much thicker. Thermal gradients were common during testing and were strongest in the axial direction from the middle of the bearing to its edges, reaching 3.78 8C/mm. The temperature profile indicated the circumferential thermal gradients were negligible.
Derived from text
Foil Bearings; Gas Bearings; Temperature Profiles; Steady State; Heat Generation; High Temperature Lubricants

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*.

20040082240 NASA Ames Research Center, Moffett Field, CA, USA
A Closed-Loop Optimal Neural-Network Controller to Optimize Rotorcraft Aeromechanical Behaviour, Volume 2, Output from Two Sample Cases
Leyland, Jane Anne; March 2001; 293 pp.; In English
Contract(s)/Grant(s): 712-10-12
Report No.(s): NASA/TM-2001-209623/VOL2; A-00V0033/VOL2; No Copyright; Avail: CASI; A13, Hardcopy

A closed-loop optimal neural-network controller technique was developed to optimize rotorcraft aeromechanical behaviour. This technique utilities a neural-network scheme to provide a general non-linear model of the rotorcraft. A modem constrained optimisation method is used to determine and update the constants in the neural-network plant model as well as to determine the optimal control vector. Current data is read, weighted, and added to a sliding data window. When the specified maximum number of data sets allowed in the data window is exceeded, the oldest data set is and the remaining data sets are re-weighted. This procedure provides at least four additional degrees-of-freedom in addition to the size and geometry of the neural-network itself with which to optimize the overall operation of the controller. These additional degrees-of-freedom are: 1. the maximum length of the sliding data window, 2. the frequency of neural-network updates, 3. the weighting of the individual data sets within the sliding window, and 4. the maximum number of optimisation iterations used for the neural-network updates.
Derived from text
Optimal Control; Neural Nets; Rotary Wing Aircraft; Aerodynamics; Degrees of Freedom

20040082243 NASA Langley Research Center, Hampton, VA, USA
Characterization of Piezoelectric Actuators for Flow Control Over a Wing
Mossi, Karla M.; Bryant, Robert G.; April 20, 2004; 4 pp.; In English; 9th International Conference on New Actuators, 14-16 Jun. 2004, Breman, Germany
Contract(s)/Grant(s): NAG1-03002; 762-55-MI; No Copyright; Avail: CASI; A01, Hardcopy

During the past decade, piezoelectric actuators as the active element in synthetic jets demonstrated that they could significantly enhance the overall lift on an airfoil. However, durability, system weight, size, and power have limited their use outside a laboratory. These problems are not trivial, since piezoelectric actuators are physically brittle and display limited displacement. The objective of this study is to characterize the relevant properties for the design of a synthetic jet utilizing three types of piezoelectric actuators as mechanical diaphragms, Radial Field Diaphragms, Thunders, and Bimorphs so that the shape cavity volume does not exceed 147.5 cubic centimeters on a 7centimeter x 7centimeter aerial coverage. These piezoelectric elements were selected because of their geometry, and overall free-displacement. Each actuator was affixed about its perimeter in a cavity, and relevant parameters such as clamped displacement variations with voltage and frequency, air velocities produced through an aperture, and sound pressure levels produced by the piezoelectric diaphragms were measured.
Author
Piezoelectric Actuators; Wings; Flow Regulators; Characterization; Air Jets

20040082310 Florida Univ., Gainesville, FL, USA

Subsurface Stress Fields In Single Crystal (Anisotropic) Contacts

Arakere, Nagaraj K.; Knudsen, Erik C.; Duke, Greg; Battista, Gilda; Swanson, Greg; [2004]; 1 pp.; In English; ASME Turbo Expo, 14-17 Jun. 2004, Vienna, Austria

Contract(s)/Grant(s): 376-20-20; No Copyright; Avail: Other Sources; Abstract Only

Single crystal superalloy turbine blades used in high pressure turbomachinery are subject to conditions of high temperature, triaxial steady and alternating stresses, fretting stresses in the blade attachment and damper contact locations, and exposure to high-pressure hydrogen. The blades are also subjected to extreme variations in temperature during start-up and shutdown transients. The most prevalent HCF failure modes observed in these blades during operation include crystallographic crack initiation/propagation on octahedral planes, and noncrystallographic initiation with crystallographic growth. Numerous cases of crack initiation and crack propagation at the blade leading edge tip, blade attachment regions, and damper contact locations have been documented. Understanding crack initiation/propagation under mixed-mode loading conditions is critical for establishing a systematic procedure for evaluating HCF life of single crystal turbine blades. This paper presents analytical and numerical techniques for evaluating two and three dimensional subsurface stress fields in anisotropic contacts. The subsurface stress results are required for evaluating contact fatigue life at damper contacts and dovetail attachment regions in single crystal nickel-base superalloy turbine blades. An analytical procedure is , presented, for evaluating the subsurface stresses in the elastic half-space, using a complex potential method outlined by Lekhnitskii. Numerical results are presented for cylindrical and spherical anisotropic contacts, using finite element analysis. Effects of crystal orientation on stress response and fatigue life are examined.

Author

Single Crystals; Crystallography; Turbine Blades; Triaxial Stresses; Nickel Alloys; Stress Distribution

20040084068 NASA Langley Research Center, Hampton, VA, USA

A Sensitivity Study of the Aircraft Vortex Spacing System (AVOSS) Wake Predictor Algorithm to the Resolution of Input Meteorological Profiles

Rutishauser, David K.; Butler, Patrick; Riggins, Jamie; June 2004; 19 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WU 23-727-04-00

Report No.(s): NASA/TM-2004-213239; L-18383; No Copyright; Avail: CASI; A03, Hardcopy

The AVOSS project demonstrated the feasibility of applying aircraft wake vortex sensing and prediction technologies to safe aircraft spacing for single runway arrivals. On average, AVOSS provided spacing recommendations that were less than the current FAA prescribed spacing rules, resulting in a potential airport efficiency gain. Subsequent efforts have included quantifying the operational specifications for future Wake Vortex Advisory Systems (WakeVAS). In support of these efforts, each of the candidate subsystems for a WakeVAS must be specified. The specifications represent a consensus between the high-level requirements and the capabilities of the candidate technologies. This report documents the beginnings of an effort to quantify the capabilities of the AVOSS Prediction Algorithm (APA). Specifically, the APA horizontal position and circulation strength output sensitivity to the resolution of its wind and turbulence inputs is examined. The results of this analysis have implications for the requirements of the meteorological sensing and prediction systems comprising a WakeVAS implementation.

Author

Vortex Advisory System; Aircraft Wakes; Algorithms; Meteorological Parameters

20040084120 NASA Langley Research Center, Hampton, VA, USA

COMSAC: Computational Methods for Stability and Control, Part 1

Fremaux, C. Michael, Compiler; Hall, Robert M., Compiler; April 2004; 385 pp.; In English; COMSAC: Computational Methods for Stability and Control, 23-25 Sep. 2003, Hampton, VA, USA; See also 20040084121 - 20040084136; Original contains color illustrations

Contract(s)/Grant(s): WU 23-762-45-AF

Report No.(s): NASA/CP-2004-213028/PT1; L-18378A/PT1; No Copyright; Avail: CASI; A17, Hardcopy

Work on stability and control included the following reports:Introductory Remarks; Introduction to Computational Methods for Stability and Control (COMSAC); Stability & Control Challenges for COMSAC: a NASA Langley Perspective; Emerging CFD Capabilities and Outlook A NASA Langley Perspective; The Role for Computational Fluid Dynamics for Stability and Control:Is it Time?; Northrop Grumman Perspective on COMSAC; Boeing Integrated Defense Systems Perspective on COMSAC; Computational Methods in Stability and Control:WPAFB Perspective; Perspective: Raytheon

Aircraft Company; A Greybeard's View of the State of Aerodynamic Prediction; Computational Methods for Stability and Control: A Perspective; Boeing TacAir Stability and Control Issues for Computational Fluid Dynamics; NAVAIR S&C Issues for CFD; An S&C Perspective on CFD; Issues, Challenges & Payoffs: A Boeing User s Perspective on CFD for S&C; and Stability and Control in Computational Simulations for Conceptual and Preliminary Design: the Past, Today, and Future?
Derived from text
Computational Fluid Dynamics; Control Stability

20040084124 Boeing Commercial Airplane Co., Seattle, WA, USA
Issues, Challenges and Payoffs: A Boeing User's Perspective on CFD for S and C
Bogue, David R.; Lines, T. R.; Doll, R. D.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 273-308; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents viewgraphs on the issues and challenges and payoffs of Computational fluid dynamics CFD) for (S&C) stability and control.
CASI
Computational Fluid Dynamics; Stability; Aircraft Control; Technology Utilization

20040084130 Boeing Co., Saint Louis, MO, USA
Boeing TacAir Stability and Control Issues for Computational Fluid Dynamics
Hollingsworth, William B.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 227-238; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

Experience in aero-predictions has flagged 5 key areas for needed improvememt:basic forces and moments at high angle of attack, external store effects, uncommanded lateral motion (abrupt wing stall), aerodynamic damping, and airframe flexibility corrections. Data from wind tunnel tests, flight tests and predictions from computational fluid dynamics are compared in terms of accuracy, consistency, and usage as predictors of flight characteristics. Recommendations for CFD development for stability and control applications are given.
CASI
Computational Fluid Dynamics; Flight Characteristics; Control Stability; Airframes; Boeing Aircraft

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)*.

20040081502 Defence Science Technology Lab., Thurleigh, Kingdom
Distributed Mission Training: How Distributed Should It Be?
Smith, Ebb; McIntyre, Heather; Advanced Technologies for Military Training; April 2004; 13 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The UK's MoD has funded a programme of applied research to explore the benefits to be gained from using networks of simulator, or Synthetic Training Environments (STEs), for multi-role air mission training (i.e collective training). Within the UK the use of networked simulation in this context has become known as Mission Training through Distributed Simulation (MTDS). Within the US it is known as Distributed Mission training (DMT). The Defence and Science Technology Laboratory (Dstl) and QinetiQ have undertaken the MoD sponsored research via a series of trials. The trials have been conducted under the banner heading of RAPTORS. To date four trials have taken place; Ebb and Flow, SyCOE, VirtEgo and SyCLONE. All have been conducted using the synthetic Composite Air Operation (COMAO) test-bed created specifically to assess the potential of MTDS. Combat-ready, front-line aircrew and an expert White Force from the UK's Air Warfare Centre (AWC) Tactical Wing and Training have participated in all four trials. The research has indicated that there is, potentially, much to be gained from the use of networked simulation for MTDS. The question remains as to the extent that participants should or could be distributed during MTDS exercises. This is particularly pertinent if the aspiration is to use networked simulation for coalition training, because, of necessity this would require some training participants to be geographically dispersed. The last two trials therefore included a Wide Area Network (WAN) to link together research facilities in Canada, the UK and US. This

paper will discuss the outcome of these trials with particular reference to SyCLONE.
Author
Wide Area Networks; Training Simulators; Test Stands

20040081508 Air Force Research Lab., Brooks AFB, TX, USA
Validation of Visual Threat Recognition and Avoidance Training through Analogical Transfer
Goettl, Barry P.; McCormick, Ed; Ashworth, Alan; Anthony, Michael; Advanced Technologies for Military Training; April 2004; 9 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Visual Threat Recognition and Avoidance Trainer (VTRAT) system addresses the need for realistic training that enables forces to respond quickly and operate effectively during threat engagements. This initiative combines state-of-the-art visual, interactive simulations with intelligent tutoring methodologies to train the visual scanners. VTRAT is an automated virtual intelligent instructional training aid, designed to introduce or refresh scanners on visual recognition of threats and on their duties during a threat engagement. This paper describes two studies that employ a backward transfer procedure for validating the training effectiveness of VTRAT. In experiment 1, 34 Air Force aircrew personnel were tested at Air Force Special Operations Command on their identification of surface-to-air missiles (SAMs). Several types of SAMs were simulated and presented to participants. Participants identified the model of SAM, and the accuracy of trajectory (whether or not the SAM would hit their simulated aircraft). Participants were assigned to either a novice group (no combat experience) or expert group (combat experience in either the Kosovo or Iraqi air campaigns). The experts outperformed the novices on all performance measures. In experiment 2, 39 aircraft scanners with the 19th Special Operations Squadron at Hurlbert Field, FL completed VTRAT training upon return from deployment in Afghanistan. There was a significant positive correlation between number of antiaircraft artillery (AAA) threats observed in theater and AAA threat recognition in VTRAT. Together these two studies provide evidence supporting the validity of VTRAT training for recognizing and avoiding visual threats. Additionally, survey results indicated that scanners rated the VTRAT visuals to be highly realistic and VTRAT training to be valuable compared to previous training methods.
Author
Surface to Air Missiles; Missile Detection; Missile Signatures; Flight Crews

20040081512 Air Force Research Lab., Mesa, AZ, USA
Technology Insertion Process: Determining Task Deficiencies and Matching to Effective Technologies
Sidor, Gregory J.; Greschke, David R.; Andre, Terence S.; Schurig, Ira A.; Cain, Jonathan M.; Good, Justine N.; Bennett, Winston, Jr.; Advanced Technologies for Military Training; April 2004; 12 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

No other time in history have we seen as much readily available technology for training warfighters as we see today. There is an abundance of training technology in almost every warfighter domain. However, the challenge still remains as to how best to use this technology, and in particular, what tasks can benefit the most from insertion of technology into the training environment. The Air Force Research Laboratory (AFRL) in Mesa, Arizona recently made substantial progress toward this challenge by identifying how simulation technologies could be used to enhance flying within the U.S. Air Force, Air Education and Training Command (AETC). Researchers from AFRL developed a technology insertion process that included instructor pilot workshops, visits to flying training bases, training task definitions, assessment of current simulators, surveys to assess critical training tasks, and a Quality Function Deployment (QFD) to prioritize training technologies. The workshops were a critical component of the technology insertion process as they helped us identify the training requirements and tasks for several aircraft training courses including the T-6, T-38, T-1A, AT-38B, T-38C, F-15, and F-16. After the instructor pilots validated the task requirements, AFRL launched an internet-based survey to over 700 instructor pilots across the U.S. Air Force. The survey was designed to collect ratings on task difficulty, syllabus time allocation, how often tasks contribute to busted check rides, proficiency of graduates, and the adequacy of current simulation devices. This data identified the more critical training needs and formed the basis of an index for weighting the criteria in the subsequent QFD. QFD workshop participants included former and current instructor pilots, researchers, and engineers who have had exposure to updated training technologies. Participants in the QFD workshop assessed how useful 27 different advanced simulation technologies would be for training each task. The priority weights from the survey were then used as multipliers for each technology score to yield total weighted scores for each technology and a prioritized rank ordering of those technologies. This analytic process yielded valuable information to aid leaders in making decisions about technology investment. In this paper, we focus on the technology

insertion process and how this process can be used to prioritize advanced simulation technology in a flying training environment.
Author
Training Evaluation; Pilot Ratings; Military Personnel; Training Simulators

20040081518 QinetiQ Ltd., Thurleigh, UK
Aircrew Mission Training via Distributed Simulation: Progress in NATO
Tomlinson, Barry; vanGeest, Jan; Advanced Technologies for Military Training; April 2004; 14 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Mission Training via Distributed Simulation (MTDS) exploits modern simulation technology to provide a new concept in aircrew collective training for air operations. MTDS has been the subject of NATO RTO activities since 1998. The MTDS Task Group is working to create a prototype NATO synthetic MTDS environment, conduct a multi-national COMAO exercise and assess its potential to support training to enhance NATO's operational effectiveness in multi-national air operations. This activity is known as ″Exercise First WAVE″ (Warfighter Alliance in a Virtual Environment), the first ever multi-national wide area networked real-time simulation of Combined Air Operations conducted in NATO. This paper reviews the work of the NATO MTDS Task Group, examines the nature and potential of Aircrew Mission Training via Distributed Simulation and reports progress with ″Exercise First WAVE″. It summarises lessons learned so far about defining and creating a distributed training environment and about the technical and training issues which need to be addressed in order to implement and exploit MTDS in NATO and the nations.
Author
Computerized Simulation; Physical Exercise; Systems Simulation; System Effectiveness; Training Simulators

20040081523 Simulation Technologies, Inc., Mesa, AZ, USA
Aircrew Mission Training via Distributed Simulation (MTDS): Development of the Multi-Country Complex Synthetic Environment
Greschke, David A.; Cerutti, Stefano; Advanced Technologies for Military Training; April 2004; 18 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent military conflicts have been predominantly multinational in their execution. It has also been environment involving the use of high technology systems against relatively rudimentary and widely dispersed enemy forces. The lack of well-defined enemy lines and infrastructures has mandated aerospace operations an increasingly dynamic nature. In addition, due to the ″CNN effect″ the world is demanding minimal collateral damage. Because these missions involve a complex system of systems, numerous individuals teams must interact with one another in order to plan and execute each mission. The training of the aerospace forces in this time-compressed, highly dynamic battlespace thus presents a major training challenge. While teams may have developed high levels of expertise in team tasks within their particular specialties, cultures and nationalities, they may not have similar levels of expertise involving the inter-team tasks needed to effectively operate as part of a larger dynamic aerospace force. Furthermore, all teams at a national level have limited opportunities to train together in realistic, collective training environments. One potential cost-effective solution to this training challenge is the use of Distributed Mission Training technologies to create a distributed virtual training environment in which the various teams and nations collectively train together from home station in a common virtual environment. This paper describes the technological aspects of Exercise First WAVE, a coalition force, Composite Operations (COMAO) mission training exercise using distributed simulation technologies being sponsored the NATO SAS Panel Task Group 034. During this exercise, British, Canadian, Dutch, French, German, Italian and US aircrews, together with command and control personnel will plan, brief, execute, replay, and debrief composite force air missions using real-time simulators located in their home countries interconnected via secure data links. The objectives of the project are to expand distributed simulation intercontinental distances; develop systems to mitigate difficulties caused by extreme long distance links; establish processes for creating scenarios to fulfill specified training objectives; implement systems distributed mission planning, briefing, and debriefing; and assess the effectiveness of distributed simulation for enhancing Warfighter skills in conducting coalition force operations.
Author
Command and Control; Complex Systems; Simulators; Networks; Training Simulators

20040081524 QinetiQ Ltd., Farnborough, UK

Using Integrated Synthetic Environments to Train the Command and Control of Military Assistance to Civil Emergencies

Kelly, M.; Smith, N.; Advanced Technologies for Military Training; April 2004; 10 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A research programme has been initiated to develop an integrated SE for training the Command and Control of civil emergencies. The focus for this work is on the UK Military Assistance to the Civil Authority (MACA) activities. Events such as the fuel crisis, strikes by fire and ambulance services, and the increasing demands generated following the World Trade Centre attack, have all required the deployment of MoD assets. The SE research community in the UK has long wished to see its applications migrate from military use to the civil domain. Therefore this study seeks to identify where existing SE tools and techniques can be used to support military aid to civil authorities. This paper discusses the research programme, sponsored by the UK MoD Corporate Research Programme (SSS Domain) and describes the work carried out to date. Research conducted so far includes a stakeholder analysis of recent national crises. This analysis led to a generic model of crisis development, which identifies five phases ranging from prevention through containment to a review phase at the end. The application of SEs to support these phases is then described. In parallel to the stakeholder analysis, a survey of simulation tools that have the potential to support crisis management was performed and is described here. Finally some prototype architectures are illustrated and an overview of future work in this programme is discussed.

Author

Computerized Simulation; Emergencies; Education; Management Methods

20040082223 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

CCSDS Spacecraft Monitor and Control Service Framework

Merri, Mario; Schmidt, Michael; Ercolani, Alessandro; Dankiewicz, Ivan; Cooper, Sam; Thompson, Roger; Symonds, Martin; Oyake, Amalaye; Vaughs, Ashton; Shames, Peter, et al.; May 2004; 31 pp.; In English; SpaceOps 2004 Conference, 17-21 May 2004, Montreal, Canada; Copyright; Avail: CASI; A03, Hardcopy

This CCSDS paper presents a reference architecture and service framework for spacecraft monitoring and control. It has been prepared by the Spacecraft Monitoring and Control working group of the CCSDS Mission Operations and Information Management Systems (MOIMS) area. In this context, Spacecraft Monitoring and Control (SM&C) refers to end-to-end services between on- board or remote applications and ground-based functions responsible for mission operations. The scope of SM&C includes: 1) Operational Concept: definition of an operational concept that covers a set of standard operations activities related to the monitoring and control of both ground and space segments. 2) Core Set of Services: definition of an extensible set of services to support the operational concept together with its information model and behaviours. This includes (non exhaustively) ground systems such as Automatic Command and Control, Data Archiving and Retrieval, Flight Dynamics, Mission Planning and Performance Evaluation. 3) Application-layer information: definition of the standard information set to be exchanged for SM&C purposes.

Author

Automatic Control; Command and Control; Evaluation; Information Management; Management Systems

20040082338 NASA Glenn Research Center, Cleveland, OH, USA

Comparison of Theoretical and Experimental Unsteady Aerodynamics of Linear Oscillating Cascade With Supersonic Leading-Edge Locus

Ramsey, John K.; Erwin, Dan; June 2004; In English; Original contains color illustrations

Report No.(s): NASA/TM-2004-211280/SUPPL; No Copyright; Avail: CASI; C01, DVD

The movie file contained in the DVD contains footage of the NASA/Ohio State Supersonic Oscillating Cascade Facility wind tunnel run with an oscillating mechanism. Links to view the movie can also be found in figures 4 and 8 in the online PDF version that this record references, Doc ID 20040082334.

CASI

Cascade Wind Tunnels; Supersonic Wind Tunnels; Unsteady Aerodynamics; Wind Tunnel Tests

20040082812 Secretary of the Air Force, Washington, DC

Emergency Airfield Lighting System (EALS) - Air Force Handbook 10-222, Volume 7

Sep. 1999; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423973; No Copyright; Avail: CASI; A06, Hardcopy

This handbook summarizes the key steps for installing, troubleshooting and repacking the Emergency Airfield Lighting System (EALS). It contains checklists that serve as memory joggers for civil engineer electrical and power production technicians. It augments but does not replace TO 35F5-3-17-1, Lighting System, Airfield, Emergency A/E82U-2. Anyone using this handbook should have hands-on experience with the EALS and have read the applicable technical orders.
DTIC
Airports; Emergencies; Handbooks; Illuminating; Landing Sites; Lighting Equipment

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*.

20040082188 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Development of a Crosslink Channel Simulator
Hunt, Chris; Smith, Carl; Burns, Rich; January 2004; 7 pp.; In English; IEEE Aerospace Conference, Mar. 2004, Big Sky, MT, USA
Contract(s)/Grant(s): GS-35F-0060N
Report No.(s): IEEEAC Paper 1376; Copyright; Avail: CASI; A02, Hardcopy

Distributed Spacecraft missions are an integral part of current and future plans for NASA and other space agencies. Many of these multi-vehicle missions involve utilizing the array of spacecraft as a single, instrument requiring communication via crosslinks to achieve mission goals. NASA s Goddard Space Flight Center (GSFC) is developing the Formation Flying Test Bed (FFTB) to provide a hardware-in-the-loop simulation environment to support mission concept development and system trades with a primary focus on Guidance, Navigation, and Control (GN&C) challenges associated with spacecraft flying. The goal of the FFTB is to reduce mission risk by assisting in mission planning and analysis, provide a technology development platform that allows algorithms to be developed for mission functions such as precision formation navigation and control and time synchronization. The FFTB will provide a medium in which the various crosslink transponders being used in multi-vehicle missions can be integrated for development and test; an integral part of the FFTB is the Crosslink Channel Simulator (CCS). The CCS is placed into the communications channel between the crosslinks under test, and is used to simulate on-mission effects to the communications channel such as vehicle maneuvers, relative vehicle motion, or antenna misalignment. The CCS is based on the Starlight software programmable platform developed at General Dynamics Decision Systems and provides the CCS with the ability to be modified on the fly to adapt to new crosslink formats or mission parameters. This paper briefly describes the Formation Flying Test Bed and its potential uses. It then provides details on the current and future development of the Crosslink Channel Simulator and its capabilities.
Derived from text
Hardware-In-the-Loop Simulation; Crosslinking; Time Synchronization; Simulators

20040082302 NASA Marshall Space Flight Center, Huntsville, AL, USA
The New National Vision for Space Exploration
Sackheim, Robert L.; Geveden, Rex; King, David A.; May 07, 2004; 24 pp.; In English; 16th International Federation on Automatic Control Symposium on Automatic Control in Aerospace, 14-18 Jun. 2004, Saint Petersburg, Russia; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

From the Apollo landings on the Moon, to robotic surveys of the Sun and the planets, to the compelling images captured by advanced space telescopes, U.S. achievements in space have revolutionized humanity s view of the universe and have inspired Americans and people around the world. These achievements also have led to the development of technologies that have widespread applications to address problems on Earth. As the world enters the second century of powered flight, it is appropriate to articulate a new vision that will define and guide U.S. space exploration activities for the next several decades. Today, humanity has the potential to seek answers to the most fundamental questions posed about the existence of life beyond Earth. Telescopes have found planets around other stars. Robotic probes have identified potential resources on the Moon, and evidence of water - a key ingredient for life - has been found on Mars and the moons of Jupiter. Direct human experience in space has fundamentally altered our perspective of humanity and our place in the universe. Humans have the ability to respond to the unexpected developments inherent in space travel and possess unique skills that enhance discoveries. Just as Mercury,

Gemini, and Apollo challenged a generation of Americans, a renewed U.S. space exploration program with a significant human component can inspire us - and our youth - to greater achievements on Earth and in space. The loss of Space Shuttles Challenger and Columbia and their crews are a stark reminder of the inherent risks of space flight and the severity of the challenges posed by space exploration. In preparation for future human exploration, we must advance our ability to live and work safely in space and, at the same time, develop the technologies to extend humanity s reach to the Moon, Mars, and beyond. The new technologies required for further space exploration also will improve the Nation s other space activities and may provide applications that could be used to address problems on Earth. Like the explorers of the past and the pioneers of flight in the last century, we cannot today identify all that we will gain from space exploration; we are confident, nonetheless, that the eventual return will be great. Like their efforts, the success of future U.S. space exploration will unfold over generations. The fundamental goal of this new national vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program. In support of this goal, the USA will: 1) Implement a sustained and affordable human and robotic program to explore the solar system and beyond; 2) Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of IMars and other destinations; 3) Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and 4) Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.
Derived from text
Space Exploration; Spaceborne Telescopes; Robotics; Solar System; Apollo Spacecraft; Space Shuttles

20040082418 Institute of Space Medico-Engineering, Beijing, China
Hangtian Yixue Yu Yixue Gongscheng, Volume 16, No. 6
Wei, J. H.; Dec. 2003; 108 pp.; In Chinese
Report No.(s): PB2004-105308; No Copyright; Avail: CASI; A06, Hardcopy
;Partial Contents: Effects of Field-dependent Cognitive Style on Optokinetic Illusion (In English); Analysis on Skin Heat Transfer and Prediction of Skin Burn Subjected to a Hot Water Film (In English); Effects of Hind limb Unloading on Bone Histomorphometry and Bone Mass in Rats; Real Time ECG Data Compression Using TMS320C31; Measurement of Low Wind Velocity under Low Pressure by An Improved Hot-bulb Probe; Early Scale Effects of the Visual Spatial Attention.
NTIS
Aerospace Medicine; Heat Transfer; Electrocardiography

20040082419 Institute of Space Medico-Engineering, Beijing, China
Hangtian Yixue Yu Yixue Gongscheng) Volume 17, Number 1, Febuary 2004
Su, H. Y.; 2004; 88 pp.; In Chinese
Report No.(s): PB2004-105309; No Copyright; Avail: CASI; A05, Hardcopy
;Partial Contents: Effects of Tail Suspension on Electrophysiological Characteristics of Muscle Spindles in Isolated Rat Soleus Muscles (In English); Preliminary Studies on the Structure-activity and Time-effect Relations of the Central Stimulating Effects of Modafinil in Mice (In English); Effects of Combined Stress of High + Gz and Noise on Learning and Memory in Rats; Experimental Study on Human Reaction of Determination and Performance in Virtual Environment; Method to Solve Inverse Problem of EEG Based on Laplacian Equation; Detecting Characteristic Point of ECG Signals with Binomial Wavelet; Object-oriented Bioinformatics Secondary Database on Selenoprotein.
NTIS
Aerospace Medicine; Electroencephalography; Electrophysiology

20040084137 NASA Glenn Research Center, Cleveland, OH, USA
Strategic Research to Enable NASA's Exploration Missions Conference
Nahra, Henry, Compiler; June 2004; 203 pp.; In English; Strategic Research to Enable NASA's Exploration Missions Conference, 22-23 Jun. 2004, Cleveland, OH, USA; See also 20040084138 - 20040084228; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-101-58-09
Report No.(s): NASA/TM-2004-213114; E-14590; No Copyright; Avail: CASI; A10, Hardcopy
Abstracts are presented from a conference sponsored by the NASA Office of Biological and Physical Research and hosted by NASA Glenn Research Center and the National Center for Microgravity Research on Fluids and Combustion, held in

Cleveland, Ohio, June 22-23, 2004. Topics pertained to the behavior of processes and materials in microgravity as well as physiological-biological studies and microgravity effects.
Derived from text
Microgravity; Mars Exploration

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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*.

20040081354 General Accounting Office, Washington, DC
Defense Space Activities: Continuation of Evolved Expendable Launch Vehicle Program's Progress to Date Subject to Some Uncertainty
Jun. 24, 2004; 44 pp.; In English
Report No.(s): PB2004-106142; GAO-04-778R; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. space policy states that access to and use of space is critical to preserving peace and protecting U. S. national security and also benefits the countrys civil and commercial interests. Air Force guidance explains further that access to space requires the ability to launch critical space assets, when needed, by a mix of space launch systems from standard launch pads at major support facilities. This is to ensure that a launch failure or other catastrophic event does not prevent mission success. The current EELV acquisition strategy addresses and reinforces the programs objective and system capabilities by encouraging contractor investment in launch vehicle development and promoting competition over the life of the program in an expected robust commercial marketplace. However, this commercial market never materialized. This letter responds to your February 25, 2004, request. As agreed with your offices, our objective was to determine the extent to which the implementation of the Department of Defenses (DOD) EELV program has achieved assured access to space and projected program cost savings. On April 6, 2004, we provided your offices with a briefing on our observations regarding the EELV programs achievements.
NTIS
Launch Vehicles; Spacecraft Launching

20040081416 NASA Goddard Space Flight Center, Greenbelt, MD, USA
JWST ISIM Primary Structure and Kinematic Mount Configuration
Bartoszyk, Andrew; Carnahan, Tim; Hendricks, Steve; Kaprielian, Charles; Kuhn, Jonathan; Kunt, Cengiz; [2004]; 8 pp.; In English; NASA/GSFC FEMCI Workshop, 5-6 May 2004, Greenbelt, MD, USA; No Copyright; Avail: CASI; A02, Hardcopy

In this presentation we will review the evolution of the ISIM primary structure tube topology and kinematic mount configuration to the current baseline concept. We will also show optimization procedures used and challenges resulting from complex joints under launch loads. Two additional key ISIM structure challenges of meeting thermal distortion and stability requirements and metal-composite bonded joint survivability at cryogenic temperatures are covered in other presentations.
Author
Kinematics; Supports; Thermal Stability; Cryogenic Temperature; Launching; Loads (Forces)

20040082309 Boeing Phantom Works, Huntsville, AL, USA
Cargo Assured Access to International Space Station
Smith, David A.; June 06, 2004; 7 pp.; In English; 24th International Symposium on Space Technology and Science, 30 May - 6 Jun. 2004, Miyazaki, Japan; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS8-02093; Copyright; Avail: CASI; A02, Hardcopy

Boeing's Cargo Assured Access logistics delivery system will provide a means to transport cargo to/from the International Space Station, Low Earth Orbit and the moon using Expendable Launch Vehicles. For Space Station, this capability will reduce cargo resupply backlog during nominal operations (e.g., supplement Shuttle, Progress, ATV and HTV) and augment cargo resupply capability during contingency operations (e.g., Shuttle delay and/or unavailability of International Partner launch or transfer vehicles). This capability can also provide an autonomous means to deliver cargo to lunar orbit, a lunar orbit refueling and work platform, and a contingency crew safe haven in support of NASA's new Exploration Initiative.
Author
Cargo; International Space Station; Logistics; Launch Vehicles

20040082785 Surrey Satellite Technology Ltd., Guildford
Catalytic Decomposition of Nitrous Oxide
Baker, Adam; Gibbon, David M.; Jun. 27, 2003; 22 pp.; In English
Contract(s)/Grant(s): F61775-01-WE017
Report No.(s): AD-A423918; No Copyright; Avail: CASI; A03, Hardcopy

This report details the work undertaken by Surrey Satellite Technology Limited for EOARD under contract number F61775-Ol-WEOl7. Additional data and analysis covering additional tests carried out between the original submission in July 2002 and June 2003 has been incorporated. This report summarises the efforts to develop a prototype nitrous oxide monopropellant thruster for small satellite applications.
DTIC
Artificial Satellites; Catalysis; Decomposition; Nitrous Oxides

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*.

20040082219 NASA Langley Research Center, Hampton, VA, USA
Development of a Flexible Framework for Hypersonic Navier-Stoke Space Shuttle Orbiter Meshes
Alter, Stephen J.; Reuthler, James J.; McDaniel, Ryan D.; April 27, 2004; 18 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 376-70-30-08
Report No.(s): AIAA Paper 2004-2635; No Copyright; Avail: CASI; A03, Hardcopy

A flexible framework constructing block structured volume grids for hypersonic Navier-Strokes flow simulations was developed for the analysis of the Shuttle Orbiter Columbia. The development of the framework, which was partially basedon the requirements of the primary flow solvers used resulted in an ability to directly correlate solutions contributed by participating groups on a common surface mesh. A foundation was built through the assessment of differences between differnt solvers, which provided confidence for independent assessment of other damage scenarios by team members. The framework draws on the experience of NASA Langley and NASA Ames Research Centers in structured grid generation, and consists of a grid generation, and consist of a grid generation process implemented through a division of responsibilities. The nominal division of labor consisted of NASA Johnson Space Center coordinating the damage scenarios to be analyzed by the Aerothermodynamics Columbia Accident Investigation (ACAI) team, Ames developing the surface grids that described the computational volume about the Orbiter, and Langley improving grid quality of Ames generated data and constructing the final computational volume grids. Distributing the work among the participant in th ACAI team resulted in significantl less time required to construct complete meshes than possible by any individual participant. The approach demonstrated that the One-NASA grid generation team could sustain the demand of for five new meshes to explore new damage scenarios within an aggressive time-line.
Derived from text
Aerothermodynamics; Hypersonics; Navier-Stokes Equation; Columbia (Orbiter); Accident Investigation; Space Shuttle Orbiters

20040082376 NASA Marshall Space Flight Center, Huntsville, AL, USA
Application of Probabilistic Risk Assessment (PRA) During Conceptual Design for the NASA Orbital Space Plane (OSP)
Rogers, James H.; Safie, Fayssal M.; Stott, James E.; Lo, Yunnhon; [2004]; 8 pp.; In English; International Conference on Probabilistic Safety Assessment and Management (PSAM7), 14-18 Jun. 2004, Berlin, Germany; No Copyright; Avail: CASI; A02, Hardcopy

In order to meet the space transportation needs for a new century, America's National Aeronautics and Space Administration (NASA) has implemented an Integrated Space Transportation Plan to produce safe, economical, and reliable access to space. One near term objective of this initiative is the design and development of a next-generation vehicle and launch system that will transport crew and cargo to and from the International Space Station (ISS), the Orbital Space Plane (OSP). The OSP system is composed of a manned launch vehicle by an existing Evolved Expendable Launch Vehicle (EELV).

The OSP will provide emergency crew rescue from the ISS by 2008, and provide crew and limited cargo transfer to and from the ISS by 2012. A key requirement is for the OSP to be safer and more reliable than the Soyuz and Space Shuttle, which currently provide these capabilities.
Author
Aerospace Planes; Risk; Space Transportation; Spacecrews; Launch Vehicles

20040084054 Tokai Univ., Hiratsuka, Japan
Development of Lightweight Material using High Strength Fibers Against Space Debris Impacts
Tanaka, Makoto; Akahoshi, Yasuhiro; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Space debris larger than 10 cm in diameter have been tracked by ground-based radio frequency radars and optical observations. These orbital data obtained by radar measurement are available to avoid hypervelocity impacts of space debris. However, there are no data on debris of diameter between 1 cm and 10 cm. These medium size debris could give catastrophic damages to large-scale space structures such as the International Space Station (ISS). As a spacecraft becomes larger, the potential hazard of debris impacts becomes an ever more serious concern. In order to protect spacecraft against hypervelocity impacts of debris and meteoroids, several researchers have studied shielding systems. Many space researchers have been pointing out that the protection capability of multi-shock bumper shields is not enough against hypervelocity impacts of medium size debris with 1 to 10 cm in diameter. In the future, it will be important to establish key technologies of protection and mitigation against medium size debris, because year-by-year scale and lifetime of spacecraft increase. The purpose of this study is to develop a new lightweight material and shield against hypervelocity impacts of medium size debris.
Derived from text
Space Debris; Spacecraft Structures; High Strength; International Space Station; Hypervelocity; Cross Sections

20040084057 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Management Coating As Thermal Protection System for Space Transportation System
Kaul, Raj; Stuckey, C. Irvin; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 20 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents viewgraphs on the development of a non-ablative thermal management coating used as the thermal protection system material for space shuttle rocket boosters and other launch vehicles. The topics include: 1) Coating Study; 2) Aerothermal Testing; 3) Preconditioning Environments; 4) Test Observations; 5) Lightning Strike Test Panel; 6) Test Panel After Impact Testing; 7) Thermal Testing; and 8) Mechanical Testing.
CASI
Coating; Space Transportation System; Temperature Control; Thermal Protection; Aerothermodynamics

20040084168 NASA Glenn Research Center, Cleveland, OH, USA
Tests of Flammability of Cotton Fabrics and Expected Skin Burns in Microgravity
Cavanagh, Jane M.; Torvi, David A.; Gabriel, Kamiel S.; Ruff, Gary A.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 63; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

During a shuttle launch and other portions of space flight, astronauts wear specialized flame resistant clothing. However during most of their missions on board the Space Shuttle or International Space Station, astronauts wear ordinary clothing, such as cotton shirts and pants. As the behaviour of flames is considerably different in microgravity than under earth's gravity, fabrics are expected to burn in a different fashion in microgravity than when tested on earth. There is interest in determining how this change in burning behaviour may affect times to second and third degree burn of human skin, and how the results of standard fabric flammability tests conducted under earth's gravity correlate with the expected fire behaviour of textiles in microgravity. A new experimental apparatus was developed to fit into the Spacecraft Fire Safety Facility (SFSF), which is used on NASA's KC-135 low gravity aircraft. The new apparatus was designed to be similar to the apparatus used in standard vertical flammability tests of fabrics. However, rather than using a laboratory burner, the apparatus uses a hot wire system to ignite 200 mm high by 80 mm wide fabric specimens. Fabric temperatures are measured using thermocouples and/or an infrared imaging system, while flame spread rates are measured using real time observations or video. Heat flux gauges are placed between 7 and 13 mm away from the fabric specimen, so that heat fluxes from the burning fabric to the skin can be

estimated, along with predicted times required to produce skin burns. In November of 2003, this new apparatus was used on the KC-135 aircraft to test cotton and cotton/polyester blend fabric specimens in microgravity. These materials were also been tested using the same apparatus in 1-g, and using a standard vertical flammability test that utilizes a flame. In this presentation, the design of the test apparatus will be briefly described. Examples of results from the KC-135 tests will be provided, including heat fluxes and skin burn predictions. These results will be compared with results from 1-g tests using the same apparatus and a standard fabric flammability test apparatus. Recommendations for future microgravity fabric flammability tests will also be discussed.
Author
Burns (Injuries); Protective Clothing; Skin (Anatomy); Microgravity; Fabrics

20040084171 Princeton Univ. Observatory, NJ, USA
Isolated Liquid Droplet Combustion: Inhibition and Extinction Studies
Kazakov, A.; Kroenlein, K. G.; Dryer, F. L.; Williams, F. A.; Nayagam, V.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 93-94; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

NASA's new space exploration initiative calls for an expansion of human presence into space, and many of the technologies envisioned for these efforts involve fire risks including oxygen generating systems, power-generation equipment, propellant production systems, and waste-management technology and other essentials for life support. The flammability characteristics of materials and methods of sensing the imminence of fires, as well as mitigating those fires which might occur all require detailed information as to how flammability and extinction processes are affected by reduced gravitational body forces and ambient environments that can be significantly different that those on earth. The effects of these differences have not been fully characterized under conditions that supply sufficient results to determine the best means of optimizing fire safety related issues. Both experiments and modeling results can provide insights to developing optimal approaches and to defining fire safety related materials criteria and sensing/control methodologies. Liquid flammables produce particular fire safety problems when liquids under pressure are released (formation of aerosols) and/or spills occur accidentally into inhabitable environments on earth as well as under reduced gravity conditions. Methodologies involving the inert dilution of the atmosphere to reduce oxygen index beyond what will support combustion (without precluding biological activity), addition of flame and ignition inhibitors to the liquid phase, and/or addition of flame and ignition inhibitors to the gas phase are individually, and in concert, techniques for enhancing fire safety on earth. Investigations in earth s gravitational field have shown that the effectiveness of a particular methodology is at least locally coupled with natural convective effects produced by the ignition and combustion event. The variation of this coupling in reduced gravity conditions can change the relative effectiveness of various approaches, in some cases eliminating their consideration.
Author
Fire Prevention; Fires; Risk; Safety Factors; Waste Management; Drops (Liquids); Extinction; Inhibitors

20040084199 NASA Glenn Research Center, Cleveland, OH, USA
Comparison of Carbon Dioxide and Helium as Fire Extinguishing Agents for Spacecraft
Gokoglu, Suleyman; Son, Youngjin; Ronney, Paul D.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 159; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The effects of radiation heat transfer in microgravity compared to convection heat transfer in earth gravity for opposed-flow (downward) over thermally-thick fuel using low density foam fuel were investigated. Microgravity experiments on flame spread over thermally-thick fuels were conducted using foam fuels to obtain low density and thermal conductivity, and thus large flame spread rate compared to dense fuels such as PMMA. And thereby valid microgravity results were obtained even in 2.2 second drop-tower experiments not to mention for the longer duration tests in Zero Gravity Facility. Contrast to the conventional understanding, it was found that steady flame spread can occur over thick fuels in quiescent microgravity environments, especially when radiatively-active diluent gases such as CO2 were employed. This is proposed to result from radiative heat transfer from the flame to the fuel surface, which could lead to steady spread even when the amount of the heat transfer via conduction from the flame to the fuel bed is negligible. Radiative effects are more significant at microgravity conditions because the flame is thicker and thus the volume of radiating combustion products is larger as well. These results suggested that helium may be a better inert or extinguishment agent on both a mass and a mole bases at microgravity even though CO2 is much better on a mole bases at earth gravity, and these are relevant to studies of fire safety in manned spacecraft, particularly the International Space Station that uses CO2 fire extinguishers. CO2 may not be as effective as an extinguishing agent at g as it is at earth gravity in some conditions because of the differences in spread mechanisms between the two cases. In particular, the difference between conduction-dominated heat transport to the fuel bed at earth gravity and

radiation-dominated heat transport at g indicates that radiatively-inert diluent such as helium could be preferable in g applications. Helium may be a superior fire suppression agent at g on several bases. First, helium is more effective than CO2 on a mole basis (thus pressure times storage volume basis) at g, meaning that the size and weight of storage bottles would be smaller for the same fire-fighting capability. Second; helium is much more effective on a mass basis (by about 11 times) at g. Third; helium has no physiological activity, unlike CO2 that affects human respiration. Fourth, as compared to N2 or CO2, is not very soluble in water and thus has fewer tendencies to cause bloodstream bubble formation following rapid spacecraft cabin depressurization.
Author
Carbon Dioxide; Fire Extinguishers; Helium; Convective Heat Transfer; Radiative Heat Transfer; Thermal Conductivity; Microgravity

20040084202 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Fire Suppression in Low Gravity Using a Cup Burner
Takahashi, Fumiaki; Linteris, Gregory T.; Katta, Viswanath R.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 165; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Longer duration missions to the moon, to Mars, and on the International Space Station increase the likelihood of accidental fires. The goal of the present investigation is to: (1) understand the physical and chemical processes of fire suppression in various gravity and O2 levels simulating spacecraft, Mars, and moon missions; (2) provide rigorous testing of numerical models, which include detailed combustion-suppression chemistry and radiation sub-models; and (3) provide basic research results useful for advances in space fire safety technology, including new fire-extinguishing agents and approaches.The structure and extinguishment of enclosed, laminar, methane-air co-flow diffusion flames formed on a cup burner have been studied experimentally and numerically using various fire-extinguishing agents (CO2, N2, He, Ar, CF3H, and Fe(CO)5). The experiments involve both 1g laboratory testing and low-g testing (in drop towers and the KC-135 aircraft). The computation uses a direct numerical simulation with detailed chemistry and radiative heat-loss models. An agent was introduced into a low-speed coflowing oxidizing stream until extinguishment occurred under a fixed minimal fuel velocity, and thus, the extinguishing agent concentrations were determined. The extinguishment of cup-burner flames, which resemble real fires, occurred via a blowoff process (in which the flame base drifted downstream) rather than the global extinction phenomenon typical of counterflow diffusion flames. The computation revealed that the peak reactivity spot (the reaction kernel) formed in the flame base was responsible for attachment and blowoff of the trailing diffusion flame. Furthermore, the buoyancy-induced flame flickering in 1g and thermal and transport properties of the agents affected the flame extinguishment limits.
Author
Fire Extinguishers; Microgravity; Chemical Reactions; Combustion Chemistry; Gravitation; Fire Prevention; Burners

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*.

20040081407 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GPS Navigation Results from the Low Power Transceiver CANDOS Experiment on STS-107
Haas, Lin; Massey, Chris; Baraban, Dmitri; Kelbel, David; Lee, Taesul; Long, Anne; Carpenter, J. Russell; [2003]; 12 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the Global Positioning System (GPS) navigation results from the Communications and Savigation Demonstration on Shuttle (CANDOS) experiment flown on STS- 107. The CAkDOS experiment consisted of the Low Power Transceiver (LPT) that hosted the GPS Enhanced Orbit Determination Experiment (GEODE) orbit determination software. All CANDOS test data were recovered during the mission using the LPT's Tracking and Data Relay Satellite System (TDRSS) uplinh'downlink communications capabilit! . An overview of the LPT's navigation software and the GPS experiment timeline is presented. In addition. this paper discusses GEODE performance results. including comparisons ibith the Best Estimate of

Trajectory (BET). N.ASA Johnson Space Center (JSC) real-time ground navigation vectors. and post-processed solutions using the Goddard Trajectory Determination System (GTDS).
Author
Global Positioning System; Goddard Trajectory Determination System; Orbit Determination; Space Transportation System; Transmitter Receivers; Space Navigation

20040081420 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Preliminary Results from NASA/GSFC Ka-Band High Rate Demonstration for Near-Earth Communications
Wong, Yen; Gioannini, Bryan; Bundick, Steven N.; Miller, David T.; 2004; 10 pp.; In English; Space Operations 204 Conference, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: CASI; A02, Hardcopy

In early 2000, the National Aeronautics and Space Administration (NASA) commenced the Ka-Band Transition Project (KaTP) as another step towards satisfying wideband communication requirements of the space research and earth exploration-satellite services. The KaTP team upgraded the ground segment portion of NASA's Space Network (SN) in order to enable high data rate space science and earth science services communications. The SN ground segment is located at the White Sands Complex (WSC) in New Mexico. NASA conducted the SN ground segment upgrades in conjunction with space segment upgrades implemented via the Tracking and Data Relay Satellite (TDRS)-HIJ project. The three new geostationary data relay satellites developed under the TDRS-HIJ project support the use of the inter-satellite service (ISS) allocation in the 25.25-27.5 GHz band (the 26 GHz band) to receive high speed data from low earth-orbiting customer spacecraft. The TDRS H spacecraft (designated TDRS-8) is currently operational at a 171 degrees west longitude. TDRS I and J spacecraft on-orbit testing has been completed. These spacecraft support 650 MHz-wide Ka-band telemetry links that are referred to as return links. The 650 MHz-wide Ka-band telemetry links have the capability to support data rates up to at least 1.2 Gbps. Therefore, the TDRS-HIJ spacecraft will significantly enhance the existing data rate elements of the NASA Space Network that operate at S-band and Ku-band.
Author (revised)
Tdr Satellites; Satellite Communication; Extremely High Frequencies

20040082116 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GPS-Based Precision Orbit Determination for a New Era of Altimeter Satellites: Jason-1 and ICESat
Luthcke, Scott B.; Rowlands, David D.; Lemoine, Frank G.; Zelensky, Nikita P.; Williams, Teresa A.; [2003]; 6 pp.; In English; NASA/GSFC Flight Mechanics Symposium, October 2003; No Copyright; Avail: CASI; A02, Hardcopy

Accurate positioning of the satellite center of mass is necessary in meeting an altimeter mission's science goals. The fundamental science observation is an altimetric derived topographic height. Errors in positioning the satellite's center of mass directly impact this fundamental observation. Therefore, orbit error is a critical Component in the error budget of altimeter satellites. With the launch of the Jason-1 radar altimeter (Dec. 2001) and the ICESat laser altimeter (Jan. 2003) a new era of satellite altimetry has begun. Both missions pose several challenges for precision orbit determination (POD). The Jason-1 radial orbit accuracy goal is 1 cm, while ICESat (600 km) at a much lower altitude than Jason-1 (1300 km), has a radial orbit accuracy requirement of less than 5 cm. Fortunately, Jason-1 and ICESat POD can rely on near continuous tracking data from the dual frequency codeless BlackJack GPS receiver and Satellite Laser Ranging. Analysis of current GPS-based solution performance indicates the l-cm radial orbit accuracy goal is being met for Jason-1, while radial orbit accuracy for ICESat is well below the 54x1 mission requirement. A brief overview of the GPS precision orbit determination methodology and results for both Jason-1 and ICESat are presented.
Derived from text
Ice, Cloud and Land Elevation Satellite; Global Positioning System; Satellite Altimetry; Navigation Satellites; Pods (External Stores); Satellite Doppler Positioning

20040084078 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Relative Navigation Algorithms for Phase 1 of the MMS Formation
Kelbel, David; Lee, Taesul; Long, Anne; Carpenter, Russell; Gramling, Cheryl; [2003]; 15 pp.; In English; Flight Mechanics Symposium, 25-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper evaluates several navigation approaches for the first phase of the Magnetospheric Multiscale (MMS) mission, which consists of a tetrahedral formation of four satellites in highly eccentric Earth orbits of approximately 1.2 by 12 Earth radii at an inclination of 10 degrees. The inter-satellite separation is approximately 10 kilometers near apogees. Navigation approaches were studied using ground station m g e =d two-way Doppler measurements, Global Positioning System (GPS)

pseudorange measurements, crosslink range measurements among the members flying in formation, and various combinations of these measurement types. An absolute position accuracy of 10 kilometers or better can be achieved with most of the approaches studied and a relative position accuracy of 100 meters or better can be achieved at apogee in some cases. Among the various approaches studied, the approaches that use a combination of GPS and crosslink measurements were found to be more reliable in terms of absolute and relative navigation accuracies and operational flexibility.
Author
Algorithms; Space Missions; Formation Flying; Satellite Navigation Systems; Magnetospheres

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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*.

20040081400 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Overview of GPM Missions's Ground Validation Program
Smith, Eric A.; Mugnai, Alberto; Nakamura, Kenji; 2004; 2 pp.; In English; EGU 2004 General Assembly: Global Precipitation Measurements and Hydrometeoroogical Extremes, 25-30 Apr. 2004, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

An important element of the internationally structured Global Precipitation Measurement (GPM) mission will be its ground validation research program. Within the last year, the initial architecture of this program has taken shape. This talk will describe that architecture, both in terms of the international program and in terms of the separate regional programs of the principle participating space agencies, i.e., ESA, JAXA, and NASA. There are three overriding goals being addressed in the planning of this program; (1) establishing various new, challenging and important scientific research goals vis-a-vis current ground validation programs supporting satellite retrieval of precipitation; (2) designing the program as an international partnership which operates, out of necessity, heterogeneous sites in terms of their respective observational foci and science thrusts, but anneals itself in terms of achieving a few overarching scientific objectives; and (3) developing a well-designed protocol that allows specific sites or site networks, at their choosing, to operate in a 'supersite' mode - defined as the capability to routinely transmit GV information at low latency to GPM's Precipitation Processing System (PPS). (The PPS is being designed as GPM's data information system, a distributed data system with main centers at the Goddard Space Flight Center (GSFC) within NASA, the Earth Observation Research Center (EORC) within JAXA, and a TBD facility to be identified by the ESA s ESTEC facility in Noordwijk.)
Author (revised)
Meteorological Satellites; Ground Tests; Checkout

20040082062 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Orbit Design for Phase I and II of the Magnetospheric Multiscale Mission
Hughes, Steve P.; 2004; 20 pp.; In English; 27th Annual Guidance and Control Conference, February 2004, Breckenridge, CO, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Magnetospheric Multiscale Mission (MMS) is a NASA mission intended to make fundamental advancements in our understanding of the Earth s magnetosphere. There are three processes that MMS is intended to study including magnetic reconnection, charged particle acceleration, and turbulence. There are four phases of the MMS mission and each phase is designed to study a particular region of the Earth's magnetosphere. The mission is composed of a formation of four spacecraft that are nominally in a regular tetrahedron formation. In this work, we present optimal orbit designs for Phase I and II. This entails designing reference orbits such that the spacecraft dwell-time in the region of interest is a maximum. This is non-trivial because the Earth's magnetosphere is dynamic and its shape and position are not constant in inertial space. Optimal orbit design for MMS also entails designing the formation so that the relative motion of the four spacecraft yields the greatest science return. We develop performance metrics that are directly related to the science return, and use Sequential Quadratic Programming (SQP) to determine optimal relative motion solutions. While designing for optimal science return, we also consider practical constraints such as maximum eclipse time and minimum inter-spacecraft separation distances. Data are presented that illustrates how long we can ensure that the formation remains in the relevant region of the Earth's

magnetosphere. We also draw general conclusions about where in the orbit acceptable tetrahedron configurations can be provided and for how long.
Author
Earth Magnetosphere; Spacecraft Motion; Spacecraft Orbits; Formation Flying; NASA Space Programs

20040082150 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Johns Hopkins Univ., Laurel, MD, USA
Novel Micro ElectroMechanical Systems (MEMS) Packaging for the Skin of the Satellite
Darrin, M. Ann; Osiander, Robert; Lehtonen, John; Farrar, Dawnielle; Douglas, Donya; Swanson, Ted; December 15, 2004; 9 pp.; In English; 2004 IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA
Contract(s)/Grant(s): NAS5-97271
Report No.(s): IEEE Paper 1063; R-1; Copyright; Avail: CASI; A02, Hardcopy

This paper includes a discussion of the novel packaging techniques that are needed to place MEMS based thermal control devices on the skin of various satellites, eliminating the concern associated with potential particulates &om integration and test or the launch environment. Protection of this MEMS based thermal device is achieved using a novel polymer that is both IR transmissive and electrically conductive. This polymer was originally developed and qualified for space flight application by NASA at the Langley Research Center. The polymer material, commercially known as CPI, is coated with a thin layer of ITO and sandwiched between two window-like frames. The packaging of the MEMS based radiator assembly offers the benefits of micro-scale devices in a chip on board fashion, with the level of protection generally found in packaged parts.
Author
Microelectromechanical Systems; Packaging; Satellites; Temperature Control; Launching; Control Equipment

20040082151 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Maneuver and Trajectory Design for the ST5 Constellation
Concha, Marco A.; [2003]; 13 pp.; In English; Flight Mechanics Symposium, 29-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper outlines the trajectory and maneuver design of the Space Technology 5 (ST5) mission constellation. Design challenges for the release and deployment of the three ST5 spacecraft into a highly elliptic orbit include collision avoidance, limited delta-v budget, and coupled attitude and orbit maneuver dynamics. The derived requirements levied on STSs subsystems and the launch vehicle for the successful release and deployment of the constellation are outlined. A maneuver strategy for deployment is given, as well as a delta-v budget showing appropriate margin for contingency.
Author
Launch Vehicles; Trajectories; Collision Avoidance; Attitude (Inclination)

20040082152 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Development of a Strain Energy Deployable Boom for the Space Technology 5 Mission
Meyers, Stew; Sturm, James; [2004]; 14 pp.; In English; 38th Aerospace Mechanism Symposium, 19-21 May 2004, Houston, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Space Technology 5 (ST5) mission is one of a series of technology demonstration missions for the New Millennium Program. This mission will fly three fully functional 25 kilogram micro class spacecraft in formation through the Earth s magnetosphere; the primary science instrument is a very sensitive magnetometer. The constraints of a 25 kg ″Micosat″ resulted in a spin stabilized, octagonal spacecraft that is 30 cm tall by 50 cm diameter and has state of the art solar cells on all eight sides. A non-magnetic boom was needed to place the magnetometer as far from the spacecraft and its residual magnetic fields as possible. The ST-5 spacecraft is designed to be spun up and released from its deployer with the boom and magnetometer stowed for later release. The deployer is the topic of another paper, This paper describes the development efforts and resulting self-deploying magnetometer boom.
Author
Space Missions; Space Programs; Magnetometers; Solar Cells; Aerospace Engineering

20040082214 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Use of SolidEdge as an Engineering Tool to Support NASA Projects
Thornton, Gary; [2004]; 1 pp.; In English; Solid Edge User Summit, 2-4 Jun. 2004, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

This presentation will cover the use of SolidEdge to facilitate creation of components and component assemblies

generated by SOMTC in the support of NASA projects and GSE (e.g., Return To Flight and support components related to a multitude of optical assemblies.) Return To Flight (RTF) Program consist of several projects derived from a Columbia Accident Investigation Board (CAIB) report. One of the recommendations is to increase visual analysis capabilities of the flight vehicle prior to reaching orbit. SolidEdge as the primary 3-D modeler will be utilized by Space Optics Manufacturing Technology Center (SOMTC) at MSFC to generate multiple preliminary design concepts relative to air and ground based viewing platforms with increased fidelity.
Author
Space Manufacturing; Three Dimensional Models; Design Analysis

20040082299 NASA Langley Research Center, Hampton, VA, USA
Aeroheating Design Issues for Reusable Launch Vehicles: A Perspective
Zoby, E. Vincent; Thompson, Richard A.; Wurster, Kathryn E.; [2004]; 23 pp.; In English; 34th AIAA Fluid Dynamics Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Report No.(s): AIAA Paper 2004-2535; No Copyright; Avail: CASI; A03, Hardcopy

An overview of basic aeroheating design issues for Reusable Launch Vehicles (RLV), which addresses the application of hypersonic ground-based testing, and computational fluid dynamic (CFD) and engineering codes, is presented. Challenges inherent to the prediction of aeroheating environments required for the successful design of the RLV Thermal Protection System (TPS) are discussed in conjunction with the importance of employing appropriate experimental/computational tools. The impact of the information garnered by using these tools in the resulting analyses, ultimately enhancing the RLV TPS design is illustrated. A wide range of topics is presented in this overview; e.g. the impact of flow physics issues such as boundary-layer transition, including effects of distributed and discrete roughness, shock-shock interactions, and flow separation/reattachment. Also, the benefit of integrating experimental and computational studies to gain an improved understanding of flow phenomena is illustrated. From computational studies, the effect of low-density conditions and of uncertainties in material surface properties on the computed heating rates a r e highlighted as well as the significant role of CFD in improving the Outer Mold Line (OML) definition to reduce aeroheating while maintaining aerodynamic performance. Appropriate selection of the TPS design trajectories and trajectory shaping to mitigate aeroheating levels and loads are discussed. Lastly, an illustration of an aeroheating design process is presented whereby data from hypersonic wind-tunnel tests are integrated with predictions from CFD codes and engineering methods to provide heating environments along an entry trajectory as required for TPS design.
Author
Aerodynamic Heating; Computational Fluid Dynamics; Reusable Launch Vehicles; General Overviews; Spacecraft Design

20040082367 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Shuttle Program (SSP): Shuttle Environmental Assurance (SEA) Initiative
Meinhold, Anne; [2004]; 16 pp.; In English; 2nd Quarterly In-Process Review Meeting, 2-3 Jun. 2004, Madison, AL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Introduction and approach. Regulatory radar. SEA collaborative studies. Inter-agency collaborative effort. SEA technical issues. Material concerns. SEA contracts.
CASI
Space Shuttles; Environmental Monitoring; Management Planning

20040082379 Sverdrup Technology, Inc., Huntsville, AL, USA
Case Study of Risk Mitigation Based on Hardware/Software Integration (HSI) Testing for the International Space Station (ISS) Node 2 Module
Holt, James Mike; Clanton, Stephen Edward; [2004]; 1 pp.; In English; French Aviation and Space Association Complex and Safe Systems Engineering Conference, 21-22 Jun. 2004, Paris, France
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: Other Sources; Abstract Only

Within the pressurized elements of the International Space Station (ISS), requirements exist to ensure a safe, habitable environment for the crew. In order to provide this environment, thermal control components work in conjunction with software controls to provide heat rejection for subsystem avionics equipment, for the environmental control system and for experiment payloads. It is essential to ISS operations, mission success and crew safety that necessary testing incorporates the extreme conditions to ensure proper performance. This paper provides a general description and methodology applied to thermal related Hardware/Software Integration (HSI) tests for the ISS Node 2 module. A detailed test plan was developed and

implemented with two objectives: the first was for risk mitigation of the thermal control algorithms and software qualification, and the second was for data collection which will substantiate thermalhydraulic models of the Internal Active Thermal Control System (IATCS). Analytical models are utilized to determine on-orbit performance for conditions and scenarios where the simulation of actual on-orbit system performance is limited by test configuration constraints. Node 2 IATCS HSI activities were performed at the Alenia Spazio facility in Torino, Italy with participation from the National Aeronautics and Space Administration (NASA), Alenia Spazio, Jacobs Engineering Sverdrup (JE Sverdrup) and Boeing.
Author
Active Control; Computer Programs; Temperature Control; Simulation; Computers

20040082383 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Deployment Mechanism for the Space Technology 5 Micro Satellite
Rossoni, Peter; Cooperrider, Caner; Durback, Gerard; [2004]; 14 pp.; In English; 38th Aerospace Mechanisms Symposium, 19-21 May 2004, Houston, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy

Space Technology 5 (ST5) is a technology mission that will send three spin-stabilized, 25-kg satellites into a highly elliptical Earth orbit. Each of these satellites must be deployed separately from the same launch vehicle with a spin rate of 3.4 rads (32.4 rpm). Because of the satellite's small size and the requirement to achieve its mission spin rate on deploy, typical spin table, pyrotechnic deployment devices or spin up thrusters could not be used. Instead, this new mechanism design employs a ″Frisbee″ spin up strategy with a shape memory alloy actuated Pinpuller to deploy each satellite. The mechanism has undergone several design and test iterations and has been successfully qualified for flight.
Author
Deployment; Elliptical Orbits; Launch Vehicles

20040082385 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA/BAE Systems SpaceWire Efforts
Rakow, Glenn Parker; Schnurr, Richard G.; Kapcio, Paul; October 2003; 8 pp.; In English; International SpaceWire Seminar, 4-5 Nov. 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A02, Hardcopy

This paper discusses the state of the NASA and BAE SYSTEMS developments using Spacewire. NASA has developed intellectual property that implements Spacewire in Register Transfer Level VHDL for a Spacewire link and router. This design has been extensively verified using directed tests from the Spacewire Standard and design specification, as well as being randomly tested to flush out hard to find bugs in the code. The high level features of the design will be discussed, including the support for multiple time code masters, which will be useful for the James Webb Space Telescope electrical architecture. This design is now ready to be targeted to FPGA's and ASICs. Target utilization and performance information will be presented for some spaceflight qualified FPGA's and a discussion of the ASIC implementations will be addressed. In particular, the BAE SYSTEMS ASIC will be highlighted which will be implemented in their 0.25 micron rad-hard line. The chip will implement a 4-port router with the ability to tie chips together to make larger routers without external glue logic. This part will have integrated LVDS driver/receivers, include a PLL and include skew control logic. It will be targeted to run at greater than 300 MHz and include the implementation for the proposed Spacewire transport layer. The need to provide a reliable transport mechanism for Spacewire has been identified by both NASA and ESA, who are attempting to define a transport layer standard that utilizes a low overhead, low latency connection oriented approach. The Transport layer needs to be implemented in hardware-to prevent bottlenecks.
Author
Product Development; Intellectual Property; Vhsic (Circuits); Control Systems Design

20040084010 Kaiser Compositek, Inc., Brea, CA, USA
Liner-less Tanks for Space Application - Design and Manufacturing Considerations
Jones, Brian H.; Li, Min-Chung; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 9 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Composite pressure vessels, used extensively for gas and fuel containment in space vehicles, are generally constructed with a metallic liner, while the fiber reinforcement carries the major portion of the pressure-induced load. The design is dominated by the liner s low strain at yield since the reinforcing fibers cannot operate at their potential load-bearing capability without resorting to pre-stressing (or autofrettaging). An ultra high-efficiency pressure vessel, which operates at the optimum strain capability of the fibers, can be potentially achieved with a liner-less construction. This paper discusses the design and

manufacturing challenges to be overcome in the development of such a pressure vessel. These include: (1) gas/liquid containment and permeation, (2) design and structural analysis, and (3) manufacturing process development. The paper also presents the development and validation tests on a liner-less pressure vessel developed by Kaiser Compositek Inc. (KCI). It should be noted that KCI s liner-less tank exhibits a highly controlled leak-before-burst mode. This feature results in a structure having the highest level of safety.
Author
Linings; Manufacturing; Propellant Tanks; Mechanical Properties; Aerospace Engineering

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

0 NASA Goddard Space Flight Center, Greenbelt, MD, USA
XML: James Webb Space Telescope Database Issues, Lessons, and Status
Detter, Ryan; Mooney, Michael; Fatig, Curtis C.; 2003; 7 pp.; In English; IEEE Aerospace Conference, 5-14 Mar. 2003, Big Sky, MT, USA
Report No.(s): IEEE Paper-11301; Copyright; Avail: Other Sources

This paper will present the current concept using extensible Markup Language (XML) as the underlying structure for the James Webb Space Telescope (JWST) database. The purpose of using XML is to provide a JWST database, independent of any portion of the ground system, yet still compatible with the various systems using a variety of different structures. The testing of the JWST Flight Software (FSW) started in 2002, yet the launch is scheduled for 2011 with a planned 5-year mission and a 5-year follow on option. The initial database and ground system elements, including the commands, telemetry, and ground system tools will be used for 19 years, plus post mission activities.
Derived from text
James Webb Space Telescope; Applications Programs (Computers); Information Management; Document Markup Languages

20040082158 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Testing of Gyroless Estimation Algorithms for the Fuse Spacecraft
Harman, R.; Thienel, J.; Oshman, Yaakov; 2004; 17 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper documents the testing and development of magnetometer-based gyroless attitude and rate estimation algorithms for the Far Ultraviolet Spectroscopic Explorer (FUSE). The results of two approaches are presented, one relies on a kinematic model for propagation, a method used in aircraft tracking, and the other is a pseudolinear Kalman filter that utilizes Euler's equations in the propagation of the estimated rate. Both algorithms are tested using flight data collected over a few months after the failure of two of the reaction wheels. The question of closed-loop stability is addressed. The ability of the controller to meet the science slew requirements, without the gyros, is analyzed.
Author
Algorithms; Far UV Spectroscopic Explorer; Gyroscopes; Magnetometers; Mathematical Models

20040084069 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Slit Function Measurement of An Imaging Spectrograph Using Fourier Transform Techniques
Park, Hongwoo; Swimyard, Bruce; Jakobsen, Peter; Moseley, Harvey; Greenhouse, Matthew; [2004]; 1 pp.; In English; SPIE Astronomical Telescope and Instrumentations, 21-25 Jun. 2004; Copyright; Avail: Other Sources; Abstract Only

Knowledge of a spectrograph slit function is necessary to interpret the unresolved lines in an observed spectrum. A theoretical slit function can be calculated from the sizes of the entrance slit, the detector aperture when it functions as an exit slit, the dispersion characteristic of the disperser, and the point spread function of the spectrograph. A measured slit function is preferred to the theoretical one for the correct interpretation of the spectral data. In a scanning spectrometer with a single exit slit, the slit function is easily measured. In a fixed grating/or disperser spectrograph, illuminating the entrance slit with a near monochromatic light from a pre-monochrmator or a tunable laser and varying the wavelength of the incident light can measure the slit function. Even though the latter technique had been used successfully for the slit function measurements, it

had been very laborious and it would be prohibitive to an imaging spectrograph or a multi-object spectrograph that has a large field of view. We explore an alternative technique that is manageable for the measurements. In the proposed technique, the imaging spectrograph is used as a detector of a Fourier transform spectrometer. This method can be applied not only to an IR spectrograph but also has a potential to a visible/UV spectrograph including a wedge filter spectrograph. This technique will require a blackbody source of known temperature and a bolometer to characterize the interferometer part of the Fourier Transform spectrometer. This pa?er will describe the alternative slit function measurement technique using a Fourier transform spectrometer.
Author
Slits; Spectrographs; Imaging Techniques; Fourier Transformation; Emission Spectra; Interferometers

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SPACECRAFT PROPULSION AND POWER

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

20040081077 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Development and Implementation of NASA's Lead Center for Rocket Propulsion Testing
Dawson, Michael C.; January 1, 2001; 8 pp.; In English
Contract(s)/Grant(s): NASA-SSC-VA50
Report No.(s): SE-2001-01-00002-SSC; AIAA Paper 2001-0747; No Copyright; Avail: CASI; A02, Hardcopy

With the new millennium, NASA's John C. Stennis Space Center (SSC) continues to develop and refine its role as rocket test service provider for NASA and the Nation. As Lead Center for Rocket Propulsion Testing (LCRPT), significant progress has been made under SSC's leadership to consolidate and streamline NASA's rocket test infrastructure and make this vital capability truly world class. NASA's Rocket Propulsion Test (RPT) capability consists of 32 test positions with a replacement value in excess of $2B. It is dispersed at Marshall Space Flight Center (MSFC), Johnson Space Center (JSC)-White Sands Test Facility (WSTF), Glenn Research Center (GRC)-Plum Brook (PB), and SSC and is sized appropriately to minimize duplication and infrastructure costs. The LCRPT also provides a single integrated point of entry into NASA's rocket test services. The RPT capability is managed through the Rocket Propulsion Test Management Board (RPTMB), chaired by SSC with representatives from each center identified above. The Board is highly active, meeting weekly, and is key to providing responsive test services for ongoing operational and developmental NASA and commercial programs including Shuttle, Evolved Expendable Launch Vehicle, and 2nd and 3rd Generation Reusable Launch Vehicles. The relationship between SSC, the test provider, and the hardware developers, like MSFC, is critical to the implementation of the LCRPT. Much effort has been expended to develop and refine these relationships with SSC customers. These efforts have met with success and will continue to be a high priority to SSC for the future. To data in the exercise of its role, the LCRPT has made 22 test assignments and saved or avoided approximately $51M. The LCRPT directly manages approximately $30M annually in test infrastructure costs including facility maintenance and upgrades, direct test support, and test technology development. This annual budges supports rocket propulsion test programs which have an annual budget in excess of $150M. As the LCRPT continues to develop, customer responsiveness and lower cost test services will be major themes. In that light, SSC is embarking on major test technology development activities ensuring long range goals of safer, more responsive, and more cost effective test services are realized. The LCRPT is also focusing on the testing requirements for advanced propulsion systems. This future planning is key to defining and fielding the ability to test these new technologies in support of the hardware developers.
Author
NASA Space Programs; Test Stands; Propulsion System Performance; Reusable Rocket Engines; Reusable Launch Vehicles

20040082014 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA GSFC MEMS Colloidal Thruster
Cardiff, Eric H.; Jamieson, Brian G.; Norgaard, Peter C.; Chepko, Ariane B.; 2004; 9 pp.; In English; 40th AIAA/ASME/ASEE/SAE Joint Propulsion Conference, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

A number of upcoming missions require different thrust levels on the same spacecraft. A highly scaleable and efficient propulsion system would allow substantial mass savings. One type of thruster that can throttle from high to low thrust while maintaining a high specific impulse is a Micro-Electro-Mechanical System (MEMS) colloidal thruster. The NASA GSFC

MEMS colloidal thruster has solved the problem of electrical breakdown to permit the integration of the electrode on top of the emitter by a novel MEMS fabrication technique. Devices have been successfully fabricated and the insulation properties have been tested to show they can support the required electric field. A computational finite element model was created and used to verify the voltage required to successfully operate the thruster. An experimental setup has been prepared to test the devices with both optical and Time-Of-Flight diagnostics.
Author
Colloids; Microelectromechanical Systems; Thrust; NASA Programs; Fabrication

20040082156 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thruster Placement Issues and Possible Mitigation Methods for the ST-7 Disturbance Reduction System
Hsu, O.; Markley, L.; Houghton, M.; Maghami, P.; 2004; 10 pp.; In English; Flight Dynamics Symposium, 29-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A02, Hardcopy

The Space Technology-7 Disturbance Reduction System is being designed to demonstrate the ability to shield a test mass from non-gravitational forces. In order to meet this goal, two advanced technologies will be employed: a highly sensitive Gravitational Reference Sensor and micro-Newton thrusters. ST-7 is limited to two clusters of four thrusters, which are sufficient to provide control for 6 degrees of freedom, but the overall effectiveness of the baseline configuration is limited by the noise on the measurement signals and the thrust outputs, the disturbance force caused by solar radiation pressure, and the performance of the individual thrusters. This paper presents and discusses these issues in greater detail along with possible mitigation methods.
Author
Aerospace Engineering; Thrust; Space Missions; Spacecraft Configurations; Perturbation Theory

20040082370 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solid Edge's Role and Modeling Techniques for Space Shuttle Flowliner Crack Investigation and Related Components
Goodman, Dwight D.; [2004]; 66 pp.; In English; Solid Edge Summit 2004, 31 May - 4 Jun. 2004, Orlando, FL, USA; No Copyright; Avail: CASI; A04, Hardcopy

In an effort to understand why the cracks were happening, the BTA was designed to measure the actual flow conditions surrounding the flowliners. A procedure was developed to fix the cracks by welding and polishing the affected smooth area.
Author
Cracks; Space Shuttle Main Engine; Fuel Systems

20040082375 NASA Marshall Space Flight Center, Huntsville, AL, USA
Magnetohydrodynamic Instabilities in a Simple Gasdynamic Mirror Propulsion System
Emrich, William J., Jr.; Hawk, Clark W.; [2004]; 30 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The gasdynamic mirror has been proposed as a concept which could form the basis of a highly efficient fusion rocket engine. Gasdynamic mirrors differ from most other mirror type plasma confinement schemes in that they have much larger aspect ratios and operate at somewhat higher plasma densities. To evaluate whether a gasdynamic mirror could indeed confine plasmas in a stable manner for long periods of time, a small scale experimental gasdynamic mirror was built and tested. The objective of this experiment was to determine ranges of mirror ratios and plasma densities over which gasdynamic mirror could maintain stable plasmas. Theoretical analyses indicated that plasma magnetohydrodynamic instabilities were likely to occur during subsonic to supersonic flow transitions in the mirror throat region of the gasdynamic mirror. The experimental evidence based upon data derived from the Langmuir probe measurements seems to confirm this analysis. The assumption that a gasdynamic mirror using a simple mirror geometry could be used as a propulsion system, therefore, appears questionable. Modifications to the simple mirror concept are presented which could mitigate these MHD instabilities.
Author
Magnetohydrodynamic Stability; Plasma Density; Rocket Engines; Transition Flow; Plasma Control; Supersonic Flow

20040082397 NASA Marshall Space Flight Center, Huntsville, AL, USA
Status of the Ablative Laser Propulsion Studies
Herren, Kenneth A.; Lin, Jun; Cohen, Tinothy; Pakhomov, Andrew V.; Thompson, M. Shane; [2004]; 1 pp.; In English; NASA JPL-MSFC 15th Advanced Space Propulsion Workshop, 15-17 Jun. 2004, Pasadena, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We present a short review of our laser-propulsion research as well as some of the current results of the Ablative Laser Propulsion (ALP) studies currently underway at the University of Alabama in Huntsville. It has been shown that direct surface ablation of a solid material produces high specific impulse (Isp) at relatively high energy conversion efficiency (20 - 40%). We detail measurements of specific impulse, thrust and coupling coefficients for elemental target materials both with single and with double pulse laser shots. We also present measurements taken using three independent methods for determination of Isp. The three methods produce consistent values from ion time-of-flight technique, impulse measurements and imaging of the expansion front of plasma plume. We present a demonstration of our ALP lightcraft, a small free-flying micro-vehicle that is propelled by ablation. For ALP lightcraft we use a subscale thin shell of nickel replicated over a diamond turned mandrel that produces a highly polished self-focusing, truncated at the focus parabolic mirror. The mass of the lightcraft is 54 mg and it is driven by 100-ps wide, 35-mJ laser pulses at 532 nm wavelength. This is an ongoing research. We also present the latest work on laserdriven micro-thrusters and detail some the near term goals of our program.
Author
Rocket Thrust; Pulsed Lasers; Laser Propulsion; Thrust

20040082403 Boeing Phantom Works, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Solar Power Technology for Lunar Polar Applications
Henley, Mark W.; Howell, Joe T.; [2004]; 8 pp.; In English; International Workshop on the Laser Energy Transmission for Space Exploration and Ground Applications, 6-7 Jun. 2004, Nara, Japan; Original contains color illustrations
Contract(s)/Grant(s): NAS8-99140; No Copyright; Avail: CASI; A02, Hardcopy

The technology for Laser-Photo-Voltaic Wireless Power Transistor (Laser-PV WPT) is being developed for lunar polar applications by Boeing and NASA Marshall Space Center. A lunar polar mission could demonstrate and validate Laser-PV WPT and other SSP technologies, while enabling access to cold, permanently shadowed craters that are believed to contain ice. Crater may hold frozen water and other volatiles deposited over billion of years, recording prior impact event on the moon (and Earth). A photo-voltaic-powered rover could use sunlight, when available, and laser light, when required, to explore a wide range of lunar terrain. The National Research Council recently found that a mission to the moon's south pole-Aitkir basin has priority for space science
Derived from text
Ice; Laser Outputs; Light Beams; Technology Utilization

20040082540 NASA Marshall Space Flight Center, Huntsville, AL, USA
Non-nuclear Testing of Reactor Systems in the Early Flight Fission Test Facilities (EFF-TF)
VanDyke, Melissa; Martin, James; [2004]; 9 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICAPP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Early Flight Fission-Test Facility (EFF-TF) can assist in the &sign and development of systems through highly effective non-nuclear testing of nuclear systems when technical issues associated with near-term space fission systems are ″non-nuclear″ in nature (e.g. system s nuclear operations are understood). For many systems. thermal simulators can he used to closely mimic fission heat deposition. Axial power profile, radial power profile. and fuel pin thermal conductivity can be matched. In addition to component and subsystem testing, operational and lifetime issues associated with the steady state and transient performance of the integrated reactor module can be investigated. Instrumentation at the EFF-TF allows accurate measurement of temperature, pressure, strain, and bulk core deformation (useful for accurately simulating nuclear behavior). Ongoing research at the EFF-TF is geared towards facilitating research, development, system integration, and system utilization via cooperative efforts with DOE laboratories, industry, universities, and other NASA centers. This paper describes the current efforts for the latter portion of 2003 and beginning of 2004.
Author
Flight Tests; Nuclear Reactors; Aerospace Systems; Thermal Conductivity; Fission

20040083995 Boeing Co., Huntsville, AL, USA
Testing and Qualification of a Non-CFC Cleanliness Verification Agent
Eichinger, Eric; Adam, Steve; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 12 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Orbiter Must Clean Approx. 1000 Critical Components. Some of them are: The Space Shuttle Orbiter Must Precision

Clean & Verify All Fluid Systems Hardware. Detail Parts, Assemblies, & Components. In the Past These Parts Were Cleaned/Verified With Freon 113. The Orbiter Cleaning Facilities (KSC, Palmdale, White Sands, & Vendors) Are Now Transitioning To Freon Replacements. This Presentation Summarizes the Ongoing Effort to Find the Best Cleaning Solvent for Orbiter Hardware.
Derived from text
Space Shuttle Orbiters; Freon; Cleaning

20040084002 NASA Marshall Space Flight Center, Huntsville, AL, USA
Toroidal Tank Development for Upper-stages
DeLay, Tom; Roberts, Keith; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 38 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The advantages, development, and fabrication of toroidal propellant tanks are profiled in this viewgraph presentation. Several images are included of independent research and development (IR&D) of toroidal propellant tanks at Marshall Space Flight Center (MSFC). Other images in the presentation give a brief overview of Thiokol conformal tank technology development. The presentation describes Thiokol's approach to continuous composite toroidal tank fabrication in detail. Images are shown of continuous and segmented toroidal tanks fabricated by Thiokol.
CASI
Propellant Tanks; Toroidal Shells

20040084021 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evaluation of New Repair Methods for Seal Surface Defects on Reusable Solid Rocket Motor (RSRM) Hardware
Stanley, Stephanie; Selvidge, Shawn; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A02, Hardcopy

The focus of the evaluation was to develop a back-up method to cell plating for the improvement or repair of seal surface defects within D6-AC steel and 7075-T73 aluminum used in the RSRM program. Several techniques were investigated including thermal and non-thermal based techniques. Ideally the repair would maintain the inherent properties of the substrate without losing integrity at the repair site. The repaired sites were tested for adhesion, corrosion, hardness, microhardness, surface toughness, thermal stability, ability to withstand bending of the repair site, and the ability to endure a high-pressure water blast without compromising the repaired site. The repaired material could not change the inherent properties of the substrate throughout each of the test in order to remain a possible technique to repair the RSRM substrate materials. One repair method, Electro-Spark Alloying, passed all the testing and is considered a candidate for further evaluation.
Author
Adhesion; Aluminum Alloys; Maintenance; Solid Propellant Rocket Engines; Surface Defects

20040084022 Boeing Co., Huntsville, AL, USA
Hydrogen Torch Braze for SSME Nozzle Tube Repair
Weeks, Jack; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Arizona HydroGen distributes the Henes Browns Gas Generator, which makes its own hydrogen and oxygen from distilled water and burns them in a torch, producing a 6000 F flame. By using the booster unit, the flame temperature can be reduced to 4000 F to 4500 F. This temperature range is ideal for braze repair of SSME nozzle cooling tube repair. The process reduces heat input and thermal loads on adjacent tubes and eliminates several of the potential problems inherent to the arc processes currently used. This presentation will focus on the hot fire test results and the implementation process.
Author
Hydrogen; Torches; Brazing; Maintenance

20040084044 Vought Aircraft Industries, Inc., Stuart, FL, USA
Hazardous Chemical Replacement: Solvent Paint Strippers Replaced by Dry Media Blasting - Case Study
Buckholz, Richard E.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 16 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The paper discusses the following: Finding an Alternate to Solvent Strippers. Dry Media Blasting a Viable Alternative. The Down Side of Wheat Starch Media. Wheat Starch Media use at Vought Aircraft. Wheat Starch Attributes and Limitations.

Corn Hybrid Polymer as a Drop-in for Wheat Starch. The Corn Hybrid Polymer Advantage. Gaining Industry Wide Approval for Corn Hybrid Media. References.
Derived from text
Hazards; Solvents; Replacing

20040084080 NASA, Washington, DC, USA
Taming Liquid Hydrogen: The Centaur Upper Stage Rocket, 1958-2002
Dawson, Virginia P.; Bowles, Mark D.; 2004; 297 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/SP-2004-4230; LC-2004-042092; No Copyright; Avail: CASI; A13, Hardcopy

During its maiden voyage in May 1962, a Centaur upper stage rocket, mated to an Atlas booster, exploded 54 seconds after launch, engulfing the rocket in a huge fireball. Investigation revealed that Centaur's light, stainless-steel tank had split open, spilling its liquid-hydrogen fuel down its sides, where the flame of the rocket exhaust immediately ignited it. Coming less than a year after President Kennedy had made landing human beings on the Moon a national priority, the loss of Centaur was regarded as a serious setback for the National Aeronautics and Space Administration (NASA). During the failure investigation, Homer Newell, Director of Space Sciences, ruefully declared: ″Taming liquid hydrogen to the point where expensive operational space missions can be committed to it has turned out to be more difficult than anyone supposed at the outset.″ After this failure, Centaur critics, led by Wernher von Braun, mounted a campaign to cancel the program. In addition to the unknowns associated with liquid hydrogen, he objected to the unusual design of Centaur. Like the Atlas rocket, Centaur depended on pressure to keep its paper-thin, stainless-steel shell from collapsing. It was literally inflated with its propellants like a football or balloon and needed no internal structure to give it added strength and stability. The so-called ″pressure-stabilized structure″ of Centaur, coupled with the light weight of its high- energy cryogenic propellants, made Centaur lighter and more powerful than upper stages that used conventional fuel. But, the critics argued, it would never become the reliable rocket that the USA needed.
Derived from text
Liquid Hydrogen; Centaur Launch Vehicle; Cryogenic Rocket Propellants

20040084167 Rockwell Scientific Co., LLC, Thousand Oaks, CA, USA
Liquid Micro-jet Impingement Cooling of a Power Conversion Module
Bhunia, Avijit; Chandrasekaran, Sriram; Chen, Chung-Lung; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 59-60; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The Power Management and Distribution (PMAD) system for NASA s long duration HEDS program is envisioned to distribute up to megawatt levels of electric power. The future military directed energy, surveillance and communication missions also demand electric power of similar magnitude with sophisticated power conditioning systems. As a result the power dissipation is projected to grow multifold in coming years, e.g., ~200W/cm2 for silicon devices and \g1000W/cm2 for wide bandgap semiconductor (silicon carbide, gallium nitride) devices. With traditional heat spreading and air-cooling techniques, the thermal management system will be bulky, if not insufficient. In this article we demonstrate that liquid impingement and subsequent phase change, has the potential to make thermal management compact, and thus reduce weight and launch costs. We present liquid (DI water) micro-jet array impingement cooling of a commercial power module (Figure 1a). The silicon devices (six IGBTs and Diodes) are placed on a packaging and isolation layer (DBC), which in turn is mounted on a base plate.
Author
Spacecraft Power Supplies; Cooling

20040084233 NASA Marshall Space Flight Center, Huntsville, AL, USA
In-Space Propulsion for Science and Exploration
Bishop-Behel, Karen; Johnson, Les; [2004]; 18 pp.; In English; National Space and Missile Materials Symposium, 21-25 Jun. 2004, Seattle, WA, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents viewgraphs on the development of In-Space Propulsion Technologies for Science and Exploration. The topics include: 1) In-Space Propulsion Technology Program Overview; 2) In-Space Propulsion Technology Project Status; 3) Solar Electric Propulsion; 4) Next Generation Electric Propulsion; 5) Aerocapture Technology Alternatives; 6) Aerocapture; 7) Advanced Thermal Protection Systems Developed and Being Tested; 8) Solar Sails; 9) Advanced Chemical Propulsion; 10)

Momentum Exchange Tethers; and 11) Momentum-exchange/electrodynamic reboost (MXER) Tether Basic Operation.
CASI
Spacecraft Propulsion; Technology Utilization; Space Exploration; General Overviews; Aerospace Sciences

23
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*.

20040081324 Oak Ridge National Lab., TN
Fossil Energy Program Annual Progress Report for April 2000 Through March 2001
Judkins, R. R.; Carlson, P. T.; Jul. 2001; In English
Report No.(s): DE2003-814228; ORNL/TM-2001/895; No Copyright; Avail: National Technical Information Service (NTIS)

This report covers progress made at Oak Ridge National Laboratory (ORNL) on research and development projects that contribute to the advancement of fossil energy technologies. Projects on the ORNL Fossil Energy Program are supported by the U.S. Department of Energy (DOE) Office of Fossil Energy, the DOE National Energy Technology Laboratory (NETL), the DOE Fossil Energy Clean Coal Technology (CCT) Program, the DOE National Petroleum Technology Office, and the DOE Fossil Energy Office of Strategic Petroleum Reserve (SPR). The ORNL Fossil Energy Program research and development activities cover the areas of coal, clean coal technology, gas, petroleum, and support to the SPR. An important part of the Fossil Energy Program is technical management of all activities on the DOE Fossil Energy Advanced Research (AR) Materials Program. The AR Materials Program involves research at other DOE and government laboratories, at universities, and at industrial organizations.
NTIS
Fossils; Energy Technology; Crude Oil

20040082237 NASA Marshall Space Flight Center, Huntsville, AL, USA
Meridional Variations of C2H2 and C2H6 in Jupiter's Atmosphere from Cassini CIRS Infrared Spectra
Nixon, C. A.; Achterberg, R. K.; Conrath, B. J.; Irwin, P. G. J.; Fouchet, T.; Parrish, P. D.; Abbas, M.; LeClaire, A.; Romani, P. N.; Simon-Miller, A. A., et al.; 2004; 4 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The abundances of hydrocarbons such as acetylene (C2H2) and ethane (C2H6) in Jupiter's atmosphere are important physical quantities, constraining our models of the chemical and dynamical processes. However, our knowledge of these quantities and their vertical and latitudinal variations has remained sparse. The flyby of the Cassini spacecraft with Jupiter at the end of 2000 provided an excellent opportunity to observe the infrared spectrum with the Composite Infrared Spectrometer (CIRS) instrument, mapping the spatial variation of emissions from 10-1400 cm-1. CIRS spectra taken at the highest resolution (0.5 cm-1) in early December 2000 have been analysed to infer atmospheric temperatures in the stratosphere at 0.5-20 mbar via the v4 of CH4, and in the troposphere at 100-400 mbar, via the hydrogen collision-induced continuum absorption at 600-800 cm. Simultaneously, we have searched for meridional abundance variations in C2H2 and C2H6 via the v5 and vg bands respectively. Tropospheric absorption and stratospheric emission are highly anti-correlated at the CIM resolution, introducing a non-uniqueness into the retrievals, which means that vertical gradient and column abundance cannot be simultaneously found without additional constraints. If we assume the profile shapes from photochemical model calculations, we show that the column abundance of C2H2 must decrease sharply towards the poles, while C2H6 is constant or slightly increasing. The relevance of these results to current photochemical and dynamical knowledge of Jupiter's atmosphere is discussed.
Author
Chemical Reactions; Jupiter Atmosphere; Infrared Spectra; Stratosphere Radiation; Atmospheric Temperature; Acetylene

20040082398 NASA Glenn Research Center, Cleveland, OH, USA
Thermal Effects on a Low Cr Modification of PS304 Solid Lubricant Coating
Stanford, Malcolm K.; Yanke, Anne M.; DellaCorte, Christopher; June 2004; 24 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-708-18-04
Report No.(s): NASA/TM-2004-213111; E-114585; No Copyright; Avail: CASI; A03, Hardcopy

PS304 is a high temperature composite solid lubricant coating composed of Ni-Cr, Cr2O3, BaF2-CaF2 and Ag. The effect of reducing chromium content on the formation of voids in the Ni-Cr particles after heat treatment in PS304 coating was investigated. Coatings were prepared with Ni-20Cr or Ni-10Cr powder and in various combinations with the other constituents of PS304 (i.e., chromia, silver and eutectic BaF2-CaF2 powders) and deposited on metal substrates by plasma spray. Specimens were exposed to 650 C for 24 hr or 1090 C for 15 hr and then examined for changes in thickness, coating microstructure and adhesion strength. Specimens with Ni-10Cr generally had less thickness increase than specimens with Ni-20Cr, but there was great variance in the data. Reduction of chromium concentration in Ni-Cr powder tended to reduce the appearance of voids in the Ni-Cr phase after heat exposure. The presence of BaF2-CaF2 resulted in a significant increase in coating adhesion strength after heat treatment, while coatings without BaF2-CaF2 had no significant change. Chemical composition analysis suggested that the void formation was due to oxidation of chromium in the Ni-Cr constituent.
Derived from text
Coating; Oxidation; Temperature Effects; High Temperature Lubricants; Plasmas (Physics)

20040082404 NASA Marshall Space Flight Center, Huntsville, AL, USA
Interaction of Porosity with a Planar Solid/Liquid Interface
Catalina, Adrian V.; Stefanescu, Doru M.; Sen, Subhayu; Kaukler, William F.; Metallurical and Materials Transactions A; May 2004; Volume 35A, pp. 1525-1538; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-39715; NCC8-66; Copyright; Avail: CASI; A03, Hardcopy

In this article, an investigation of the interaction between gas porosity and a planar solid/liquid (SL) interface is reported. A two-dimensional numerical model able to accurately track sharp SL interfaces during solidification of pure metals and alloys is proposed. The finite-difference method and a rectangular undeformed grid are used for computation. The SL interface is described through the points of intersection with the grid lines. Its motion is determined by the thermal and solute gradients at each particular point. Changes of the interface temperature because of capillarity or solute redistribution as well as any perturbation of the thermal and solute field produced by the presence of non-metallic inclusions can be computed. To validate the model, the dynamics of the interaction between a gas pore and a solidification front in metal alloys was observed using a state of the art X-ray transmission microscope (XTM). The experiments included observation of the distortion of the SL interface near a pore, real-time measurements of the growth rate, and the change in shape of the porosity during interaction with the SL interface in pure Al and Al-0.25 wt pct Au alloy. In addition, porosity-induced solute segregation patterns surrounding a pore were also quantified.
Author
Porosity; Liquid-Solid Interfaces; Gases; Mathematical Models; Two Dimensional Models

20040082410 Minnesota Univ., Saint Paul, MN, USA, Forest Products Lab., Madison, WI, USA
Development of Screenable Pressure Sensitive Adhesives
Severtson, S. J.; Wang, X.; Nowak, M. J.; Guo, J.; Kroll, M. S.; Nov. 28, 2003; In English
Report No.(s): DE2004-819519; No Copyright; Avail: National Technical Information Service (NTIS)

Several approaches were examined for meeting the project objective of developing pressure sensitive adhesive (PSA) products that are engineered for enhanced removal during the processing of recycled fiber, also known as environmentally benign PSAs. These included the (1) design of environmentally benign PSA films, (2) development of paper face stock with high screening removal efficiencies that retain attached PSA films and (3) modification of face stock surface properties to enhance the removal of PSA films. All three approaches yielded promising laboratory results that were confirmed at the pilot scale and appear to be commercially viable. Most of this study focused on hot-melt formulations, which compose a smaller portion of the PSA label market than water-based formulations. However, hot-melt formulations are considerably less complex and allow great flexibility for property modifications. The results of this research have direct application to the study of water-based PSAs, which will be the focus of future work.
NTIS
Adhesives; Surface Properties

20040082412 Lockheed Martin Corp., Syracuse, NY, USA
GaInAsSb/A1GaAsSb/GaSb Thermophotovoltaic Devices with an Internal Back-Surface Reflector Formed by Wafer Bonding
Wang, C. A.; Huang, R. K.; Shiau, D. A.; Connors, M. K.; Murphy, P. G.; Dec. 2002; 20 pp.; In English
Report No.(s): DE2004-821864; LM-02K141; No Copyright; Avail: Department of Energy Information Bridge

A novel implementation for GAInAsSb/AlGaAsSb/GaSb TPV cells with an internal back-surface reflector (BSR) formed by wafer bonding to GaAs is demonstrated. The SiO(sub x)/Ti/Au internal BSR enhances optical absorption within the device, while the dielectric layer provides electrical isolation. This configuration has the potential to improve TPV device performance; is compatible with monolithic series-interconnection of TPV cells for building voltage; and can mitigate the requirements of filters used for front-surface spectral control. At a short-circuit density of 0.4 A/cm(sup 2), the open-circuit voltage of a single TPV cell is 0.2 V, compared to 0.37 and 1.8 V for 2- and 10-junction series-interconnected TPV cells, respectively.
NTIS
Bonding; Electromagnetic Absorption; Dielectrics

20040082425 Forest Service, Portland, OR
Climate Change, Carbon, and Forestry in Northwestern North America: Proceedings of a Workshop November 14-15, 2001 Orcas Island, Washington
Apr. 2004; 134 pp.; In English
Report No.(s): PB2004-106295; PNW-GTR-614; No Copyright; Avail: CASI; A07, Hardcopy
Interactions between forests, climatic change and the Earths carbon cycle are complex and represent a challenge for forest managers they are integral to the sustainable management of forests. In this volume, a number of papers are presented that describe some of the complex relationships between climate, the global carbon cycle and forests. Research has demonstrated that these are closely connected, such that changes in one have an influence not only on the other two, but also on their linkages. Climatic change represents a considerable threat to forest management in the current static paradigm. However, carbon sequestration issues offer opportunities for new techniques and strategies, and those able to adapt their management to this changing situation are likely to benefit. Such changes are already underway in countries such as Australia and Costa Rica, but it will probably take much longer for the forestry sector in the Pacific Northwest region of North America (encompassing Oregon, Washington, Montana, Idaho, British Columbia and Alaska) to change their current practices.
NTIS
Climate Change; Forests

20040082684 Harvard Univ., Cambridge, MA
Nanostructured Functional and Multifunctional Materials
Lieber, Charles M.; Jun. 8, 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0476
Report No.(s): AD-A423704; No Copyright; Avail: CASI; A03, Hardcopy
This project is focused on developing the underlying science and technology required to enable the rational design and synthesis of functional nanoscale assemblies and the hierarchical assembly of these local functional structures into multifunctional systems. To achieve these objectives we are pursuing a highly interdisciplinary program that addresses in parallel the major scientific hurdles of the project, including development of electronically and optically well-defined nanoscale building blocks required to create novel functional nanostructures, and development of flexible and scalable methods for the assembly of these building blocks into novel functional nanostructures and nanostructured multifunctional systems. Significant progress has been made during the past fiscal year in several areas of the project. First, we have developed and demonstrated powerful methods for creating the first axial nanowire superlattice structures in which both composition and doping can be varied; Second, we have demonstrated that the nanowire possess novel photonic behavior and have configured optical bar codes and intrawire nanoscale light-emitting diodes. Third, we have demonstrated that doping modulation can be used to design and synthesize active nanoelectronic devices. These nanowire super lattice materials open up many new opportunities in nanoelectronics and nanophotonics.
DTIC
Electron Microscopy; Nanostructures (Devices)

20040082753 Academy of Sciences (USSR), Novosibirsk
Experimental and Theoretical Studies of Hypersonic Laminar Flow Control Using Ultrasonically Absorptive Coatings (UAC)
Maslov, Anatoly A.; May 2003; 105 pp.; In English
Report No.(s): AD-A423851; ISTC-2172-2001; No Copyright; Avail: CASI; A06, Hardcopy
This report results from a contract tasking Institute of Theoretical and Applied Mechanics as follows: The project is

focused on detail experimental and theoretical studies of hypersonic laminar flow control using ultrasonically absorptive coatings (UAC) of regular porosity. Parametrical calculations of boundary layer stability on porous and solid walls will be conducted and compared with the experimental data to be obtained using the artificial wave- packet method and hot-wire measurements. The experimental investigations will be performed in the blowdown wind tunnel T- 326 in Hypersonic Flow Laboratory of ITAM SBRAS at Mach 6. Both natural and artificially excited disturbances will be investigated on solid and porous surfaces of a sharp cone model. Detailed experimental data on transition loci, characteristics of natural and artificially excited disturbances will be obtained. This will allow us to perform direct validation of theoretical modeling and verify the experimental data previously obtained. Resutts of this project will provide a launching pad for future efforts including breadboard validation of UAC concept for the laminar flow control on blunt bodies, rough surfaces etc.
DTIC
Boundary Layer Control; Hypersonic Flow; Laminar Boundary Layer; Laminar Flow

20040082799 Russian Research Centre Kurchatov Inst., Moscow
Study of Plasma Parameter Distributions in Low Power Hall Effect and Ablative Pulsed Plasma Thrusters
Vesselovzorov, Alexandre; Mar. 24, 2003; 264 pp.; In English
Contract(s)/Grant(s): ISTC-2317
Report No.(s): AD-A423943; ISTC01-7012; No Copyright; Avail: CASI; A12, Hardcopy

This report results from a contract tasking Kurchatov Institute for the results of studying a stationary plasma-low power-thruster (SPT) and an ablative pulsed plasma one (APPT). In the first part of the Report the results of studying the module characteristic for a small SPT and for the thruster plume. In particular there are represented the description of test facility and system of thruster performance and plume parameter measurements as well as the results of these measurements. In the second part of the Report, the results of studying some features of the physical processes in APPT, as well as an analysis of the produced results based on the numerical simulation for increasing their efficiency, are represented. A two-dimensional model of APPT has been developed. lnterferometric investigations inside APPT discharge channel, piezoprobe measurements of dynamic pressure distributions and ultra high-speed photography with visualization of plasma flows have been carried out.
DTIC
Ablation; Hall Effect; Plasma Engines; Plasmas (Physics); Pulsed Plasma Thrusters

20040082856 Air Force Research Lab., Hanscom AFB, MA
Electron Attachment and Detachment and the Electron Affinity of Cyclo-C4F8
Miller, Thomas M.; Friedman, Jeffrey F.; Viggiano, A. A.; Apr. 15, 2004; 6 pp.; In English
Contract(s)/Grant(s): F19628-99-C-0069; Proj-2303
Report No.(s): AD-A424035; AFRL-VS-HA-TR-2004-1065; AFRL-VS-HA-TR-2004-1065; No Copyright; Avail: CASI; A02, Hardcopy

New measurements have been made of rate constants for electron attachment to c-C4F8 (octafluorocyclobutane) and thermal electron detachment from the parent anion, c-C4F8(-), over the temperature range 298-400 K in 133 Pa of He gas in a flowing-afterglow Langmuir-probe apparatus. From these data the electron affinity for c-C4F8 was determined, EA(c-C4F8) = 0.63 +/- 0.05 eV. The motivation was to resolve a discrepancy between our earlier EA estimate and a higher value (EA = 1.05 +/- 0.10 eV) reported from a recent experiment of Hiraoka et all. J. Chem. Phys. 116, 7574 (2002). The electron attachment rate constant is 9.3 +/- 3.0 x 10 (exp -9) cc/s at 298 K. The electron detachment rate constant is negligible at room temperature but climbs to 1945 +/- 680/s at 400 K. G3(MP2) calculations were carried out for the neutral (D sub 2d, Superscript A sub 1) and anion (D sub 4h, Superscript 2 A sub 2u) and yielded EAc-C4F8 (-). From these, dissociative electron attachment is found to be endothermic by at least 1. 55 eV.
DTIC
Chemical Reactions; Cyclobutane; Detachment; Dissociation; Electron Affinity; Electron Attachment; Electron Transfer; Fluorohydrocarbons; Reaction Kinetics

20040082949 Naval Facilities Engineering Service Center, Port Hueneme, CA
The Use of Wetting Agents/Fume Suppressants for Minimizing the Atmospheric Emissions from Hard Chromium Electroplating Baths
Paulson, Kathleen; Matzdorf, Craig; Scwartz, Stephen; Mar. 2004; 232 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423561; NFESC-TR-2243-ENV; No Copyright; Avail: CASI; A11, Hardcopy

This project demonstrates that a ″third″ generation wetting agent/fume suppressant (WA/FS) chemical additive to hard

chromium electroplating baths reduces hexavalent chromium airborne emissions to the environment and reduces employee occupational exposures in the electroplating shop. While emissions are important, maintaining material quality for tactical equipment is paramount, and the WA/FS has no negative effect on electroplating quality or basis metals. Further, once added to the electroplating bath, the WA/FS does not measurably degrade over a period of time. Also, the project demonstrates the use of WA/FS during normal, full- scale plating operations.
DTIC
Airglow; Baths; Chromium; Electroplating; Fumes; Wetting

20040083973 NASA Marshall Space Flight Center, Huntsville, AL, USA
5th Conference on Aerospace Materials, Processes, and Environmental Technology
Cook, M. B., Editor; Stanley, D. Cross, Editor; November 2003; 820 pp.; In English; 5th Conference on Aerospace Materials, Processes, and Environmental Technology, 16-18 Sep. 2002, Huntsville, AL, USA; See also 20040083974 - 20040084060
Report No.(s): NASA/CP-2003-212931; M-1096; No Copyright; Avail: CASI; A99, Hardcopy

Records are presented from the 5th Conference on Aerospace Materials, Processes, and Environmental Technology. Topics included pollution prevention, inspection methods, advanced materials, aerospace materials and technical standards,materials testing and evaluation, advanced manufacturing,development in metallic processes, synthesis of nanomaterials, composite cryotank processing, environmentally friendly cleaning, and poster sessions.
Derived from text
Spacecraft Construction Materials; Composite Materials

20040083983 Bowden Industries, Huntsville, AL, USA
Cleaning to 6 Sigma Standards
Bowden, Donald; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Bowden Industries Inc., a manufacturer of high-volume, industrial parts washing equipment, detergents, and related services, performs cleaning to 6 Sigma standards. 6 Sigma production ″is a quality improvement methodology″ using the statistical measurement of no more than 3 defects per million opportunities. Organizations pursuing 6 Sigma goals focus on obtaining predictable performance in all processes, such as machining, painting, and gauging to increase operating and profit margins. If a company is to meet its 6 Sigma goals, it must demand predictable performance in all processes, including parts washing. The benefits of 6 Sigma cleaning include: Reduction of downstream rejects because of dirty parts, gauging, leak checking, and welding. Reduction of failures related to sand, chips, or other contaminants. Reduction of labor costs by eliminating scheduled servicing. Reduction of energy costs. Elimination of stacks through the roof. Reduction of water and chemical costs. Reduction of required floor space.
Author
Cleaning; Contaminants; Quality Control; Washing

20040084000 NASA Marshall Space Flight Center, Huntsville, AL, USA
Selection of a Non-ODC Solvent for Rubber Processing Equipment Cleaning
Morgan, R. E.; Thornton, T. N.; Semmel, L.; Selvidge, S. A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

NASA/MSFC has recently acquired new equipment for the manufacture and processing of rubber and rubber containing items that are used in the Redesigned Solid Rocket Motor (RSRM) system. Work with a previous generation of rubber equipment at MSFC in the 1970's had involved the use of Oxygen Deficient Center (ODC's) such as 1,1,1-Trichloroethane or VOC's such as Toluene as the solvents of choice in cleaning the equipment. Neither of these options is practical today. This paper addresses the selection and screening of candidate cleaning solvents that are not only effective, but also meet the new environmental standards.
Author
Rubber; Technology Assessment; Cleaning; Selection

20040084003 NASA Marshall Space Flight Center, Huntsville, AL, USA
Correlating Flammability of Materials with FTIR Analysis Test Results
Moore, Robin; Whitfield, Steve; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 2 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this experiment was to correlate flammability data with FTIR test results. Kydex 100 is a blend of chlorinated polyvinyl chloride and polymethylmethacrylate, with some filler materials. Samples supplied were 0.125 in. thick. 10 samples were taken from a sheet of Kydex and analyzed for flammability and by FTIR spectroscopy. This material was utilized as a round robin sample for flammability testing. The flammability test results were found to vary across the same sheet.
Derived from text
Flammability; Infrared Spectroscopy

20040084004 NASA Johnson Space Center, Houston, TX, USA
JSC Metal Finishing Waste Minimization Methods
Sullivan, Erica; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 17 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

THe paper discusses the following: Johnson Space Center (JSC) has achieved VPP Star status and is ISO 9001 compliant. The Structural Engineering Division in the Engineering Directorate is responsible for operating the metal finishing facility at JSC. The Engineering Directorate is responsible for $71.4 million of space flight hardware design, fabrication and testing. The JSC Metal Finishing Facility processes flight hardware to support the programs in particular schedule and mission critical flight hardware. The JSC Metal Finishing Facility is operated by Rothe Joint Venture. The Facility provides following processes: anodizing, alodining, passivation, and pickling. JSC Metal Finishing Facility completely rebuilt in 1998. Total cost of $366,000. All new tanks, electrical, plumbing, and ventilation installed. Designed to meet modern safety, environmental, and quality requirements. Designed to minimize contamination and provide the highest quality finishes.
Derived from text
Anodizing; Pickling (Metallurgy); Surface Finishing

20040084033 Polytechnic Univ., Brooklyn, NY, USA
Synthesis and Coating of Nanoparticles
Ulman, Abraham; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Sonochemistry and microwave heating have been used for the preparation of magnetic and semiconductor nanoparticles. We show that Block copolymer surfactants provide relative control of size and size distribution of cobalt nanoparticles Sonochemistry provides mixing at the atomic level and can be used to prepare nanoparticles with designed properties Microwave heating is an excellent technique for the preparation of semiconductor nanoparticles with controlled size. This ability to control composition, size, and size distribution in nanoparticles is promising when the design of advanced catalysts is concerned.
Author
Nanoparticles; Semiconductors (Materials); Magnetic Materials

20040084040 Boeing Commercial Airplane Co., Seattle, WA, USA
Durable Surface Contamination Standards
Shelley, Paul H.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 8 pp.; In English; See also 20040083973; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Boeing uses portable and laboratory FT-IR systems to measure surface contamination on aircraft skin and parts. Contamination measurements are made with different spot sizes and different reflection angles, different reflection accessories and of course different spectrometers. Methods are also under development for measurement of surface contamination using methods other than infrared spectroscopy. It is important to understand the sensitivity of various measurement systems in order to be sure that the measurements being made have adequate sensitivity for the contamination being measured. It is also important to calibrate the measurement sensitivity of a particular measurement system over time and after repairs or adjustments to the system have been made. Standards with known amounts of contaminants on metal surfaces were needed to calibrate measurement systems and verify proper sensitivity of measurement systems over time. These standards are also useful for evaluation of new contamination measurement instruments or new accessories for existing measurement systems. There are two general classes of contaminants that are generally of interest for aircraft skin and parts. One is hydrocarbon-based materials and the other is silicones. Oils and greases were tested as model contaminants for hydrocarbons,

but these materials transferred to surfaces of measurement systems and changed with use and time. Silicone oils and greases had the same problem. Polystyrene was found to be a durable hydrocarbon standard and it has been an infrared spectroscopy standard for transmission measurements for a long time. Silicone rubber that cures with air and release of methanol was found for a silicone standard and proved to be very durable. This paper details the calibration and measurement of these materials as well as methods for applying the contaminants.
Author
Contaminants; Contamination; Metal Surfaces

20040084050 NASA Marshall Space Flight Center, Huntsville, AL, USA
Infrared Spectroscopy as a Chemical Fingerprinting Tool
Huff, Timothy L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 9 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Infrared (IR) spectroscopy is a powerful analytical tool in the chemical fingerprinting of materials. Any sample material that will interact with infrared light produces a spectrum and, although normally associated with organic materials, inorganic compounds may also be infrared active. The technique is rapid, reproducible and usually non-invasive to the sample. That it is non-invasive allows for additional characterization of the original material using other analytical techniques including thermal analysis and RAMAN spectroscopic techniques. With the appropriate accessories, the technique can be used to examine samples in liquid, solid or gas phase. Both aqueous and non-aqueous free-flowing solutions can be analyzed, as can viscous liquids such as heavy oils and greases. Solid samples of varying sizes and shapes may also be examined and with the addition of microscopic IR (microspectroscopy) capabilities, minute materials such as single fibers and threads may be analyzed. With the addition of appropriate software, microspectroscopy can be used for automated discrete point or compositional surface area mapping, with the latter providing a means to record changes in the chemical composition of a material surface over a defined area. Due to the ability to characterize gaseous samples, IR spectroscopy can also be coupled with thermal processes such as thermogravimetric (TG) analyses to provide both thermal and chemical data in a single run. In this configuration, solids (or liquids) heated in a TG analyzer undergo decomposition, with the evolving gases directed into the IR spectrometer. Thus, information is provided on the thermal properties of a material and the order in which its chemical constituents are broken down during incremental heating. Specific examples of these varied applications will be cited, with data interpretation and method limitations further discussed.
Derived from text
Infrared Spectroscopy; Chemical Composition; Data Processing; Microanalysis; Thermal Analysis

20040084104 Institute of Industrial Technology TNO, Enschede, Netherlands
Development of a Quick Cleaning Test: Examination of Alternative Cleaning Methods for Defence Textiles
Schrijer, G. J. M.; Wijpkema, A.; November 2003; 69 pp.; In Dutch
Contract(s)/Grant(s): A02/KL/152; TNO Proj. 007.62488
Report No.(s): TD-2003-0209; Rept-42/02.005256; Copyright; Avail: Other Sources

At the moment five different cleaning methods are applied in industrial cleaning of textile products. A method had to be developed by which it becomes possible to quickly select the proper cleaning method for textile products in relation to stain removal and maintenance of product e t y . To develop the quick cleaning test stain removal by five different cleaning methods was monitored in comparative cleaning tests performed on artificially stained representative textile cloth. Further the quality maintenance of selected Defence textile products (by example: four types of parkas). With respect to stain removal industrial washing at 40 C performs the best, except for the removal of duty motor oil , which is better cleaned by dry-cleaning with perchloroethylene (″per″). Per-cleaning is second in ranking, but performs only moderate in polymer cleaning. Cleaning with hydrocarbons and cyclosiloxane as well as liquid carbondioxyde (CO2) all three perform on a lower level with respect to several types of staining. Quality losses of the parkas were only small in all of the cleaning methods applied. Exceptions are dimension stability of an interlining during washing and colourfamess during Per-cleaning and washing. It is concluded that a quick cleaning test is possible by performing two cleaning cycles. After the first cycle stain removal can be checked and after the second cycle product quality. Especially on dimension stability, colour fastness and level of oil-/water repellency attention has to be paid.
Author
Cleaning; Performance Tests; Textiles; Staining

20040084170 Princeton Univ., NJ, USA

A Study of Colloidal Crystallization

Kopacka, Wesley M.; Hollingsworth, Andrew D.; Russel, William B.; Chaikin, Paul M.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 97-98; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

One of the still open problems in condensed matter physics today is that of crystallization. The ability to accurately study atomic or molecular crystallization is hindered by the incredibly small length and time scales involved compared to many of the experimental techniques available today. On the biological front, determining the structure of the more than 80,000 proteins in the human body is limited by our inability to crystallize proteins effectively. As a result, only 4000 human protein structures have been solved. Nanotechnologies such as photonic band gap materials and photothermal nanosecond light-switches rely heavily on being able to control crystallization to achieve particular packing structures, spacings, and sizes. A firm understanding of the thermodynamic and kinetic driving forces is therefore essential in fabricating products with specific properties. Model systems to study the physics behind the phase behavior, structure, and dynamics of crystallization are needed to shed light to the various applications being studied today.

Author

Colloids; Condensed Matter Physics; Nanotechnology; Energy Gaps (Solid State)

20040084173 University of Southern California, Los Angeles, CA, USA

Mimicking Microgravity in Bio- and Nano-colloidal Systems Using Supercritical Carbon Dioxide

Lee, C. Ted, Jr.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 106-107; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Density modulation of highly-compressible supercritical carbon dioxide (scCO2) will be used to minimize density differences in scCO2-surfactant mixtures, thereby providing a simple, ground-based approach for approximating microgravity conditions in colloidal and interfacial systems. Density matching will allow investigation of the effects of microgravity on the surface phenomena of complex fluids, suspensions, and multiphase systems, with specific emphasis on interactions between nanometer-sized colloids and nanocolloidal aggregation. Recently, a variety of nanometer-scale surfactant morphologies have been discovered in scCO2 including spherical and cylindrical microemulsions. By adjusting the density of CO2 to match that of the water/surfactant phase, the effects of gravity vanish, allowing an investigation of the impact of microgravity on the fluid dynamics and interfacial phenomena of colloidal systems. Specifically, the influence of effectively-reduced gravity on electrostatic and intermolecular interactions, colloidal aggregation, and the microemulsion critical point can be realized. It has been known since the early 20th century that gravity effects strongly couple with the critical phenomena of pure fluids, fluid mixtures, and colloidal systems a result of large concentration (i.e., density) gradients that develop at the critical point due to molecular or colloidal aggregation. This proposal will allow critical phenomena to be studied independent of gravity in a ground-based experiment.

Author

Carbon Dioxide; Colloids; Molecular Interactions; Gravitational Effects; Electrostatics; Microgravity; Surfactants

24
COMPOSITE MATERIALS

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

20040081322 Cincinnati Univ., OH, USA

Environmental Durability Evaluation of Externally Bonded Composites

Shahrooz, B. M.; Pack, J. R.; Baseheart, T. M.; Rieser, L. A.; Mar. 2004; 306 pp.; In English

Report No.(s): PB2004-105227; UC-CII-03/02; No Copyright; Avail: CASI; A14, Hardcopy

The durability of three types of fiber-reinforced polymer (FRP) composites used for strengthening of concrete structures was evaluated. The materials were: (1) carbon FRP (CFRP) plate, carbon FRP (CFRP) fabric, and glass FRP (GFRP) fabric. The influence of a number of conditions commonly encountered in civil infrastructure on strength and other critical properties of the material and bond to substrate concrete was evaluated. In particular, the following exposures, with durations up to 10,000 hours, were considered: (a) 100% humidity, (b) alkalinity, (c) salt water, (d) dry heat, (e) freeze/thaw cycling, (f) vehicle fuel, and (g) UV radiation. Potential deterioration of material and bond properties as a result of these conditions was established by comparing the properties of the unconditioned and conditioned samples. The test specimens consisted of 507 material samples, 168 bond specimens, and 162.44-m long reinforced concrete beams. Reinforced concrete beams

strengthened with the three materials were exposed to a combined treatment of freeze/thaw cycling and UV radiation, and tested in flexure.
NTIS
Composite Materials; Durability; Bridges

20040082248 NASA Langley Research Center, Hampton, VA, USA
Recent Developments in NASA Piezocomposite Actuator Technology
Wilkie, William K.; Inman, Daniel J.; High, James W.; Williams, R. Brett; April 02, 2004; 4 pp.; In English; 9th International Conference on New Actuators, 14-15 Jun. 2004, Breman, Germany
Contract(s)/Grant(s): 319-03-01; No Copyright; Avail: CASI; A01, Hardcopy

In this paper, we present an overview of recent progress in the development of the NASA Macro-Fiber Composite (MFC) piezocomposite actuator device. This will include a brief history of the development of the MFC, a description of the standard manufacturing process used to fabricate MFC actuators, and a summary of ongoing MFC electromechanical characterization testing. In addition, we describe the development of a prototype single-crystal piezoelectric MFC device, and compare its performance with MFC actuator specimens utilizing conventional piezoceramic materials.
Author
Fabrication; Piezoelectric Actuators; NASA Programs; Technology Utilization; Fiber Composites; Control Equipment; Micromechanics

20040082324 Polish Academy of Sciences, Warsaw, Poland
Combining Hard with Soft Materials in Nanoscale Under High-Pressure High-Temperature Conditions
Palosz, B.; Gierlotka, S.; Swiderska-Sroda, A.; Fietkiewicz, K.; Kalisz, G.; Grzanka, E.; Stel'makh, S.; Palosz, W.; [2004]; 1 pp.; In English; NATO Advanced Research Workshop: Innovative Superhard Materials and Sustainable Coatings, 12-15 May 2004, Kiev, Ukraine
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

Nano-composites with a primary nanocrystalline ceramic matrix and a secondary nanocrystalline material (metal or semiconductor) were synthesized by infiltration of an appropriate liquid into ceramic compacts under pressures of up to 8 GPa and temperatures of up to 2000 K. The purpose of our work is to obtain nanocomposites which constitute homoger?ous mixtures of two phases, both forming nano- grains of about 10 nm in size. The high pressure is used to bring the porosity of the compacted powders down to the nano-scale and force a given liquid into the nano-sized pores. The advantage of the infiltration technique is that, in a single, continuous process, we start with a nanocrystalline powder, compress it to form the matrix of the composite, and crystallize and/or synthesize a second nanomaterial in the matrix pores. The key limitation of this technology is, that the pores in the matrix need to stay open during the entire process of infiltration. Thus the initial powder should form a rigid skeleton, otherwise the so-called self-stop process can limit cr block a further flow of the liquid phase and hinder the process of the composite formation. Therefore powders of only very hard ceramic materials like diamond, Sic, or Alz03, which can withstand a substantial external load without undesired deformation, can be used as the primary phase. With this technique, using diamond and S i c ceramic powders infiltrated by liquid metals (AI, Zn, Sn, Ag, Au) and semiconductors (Si, Ge, GaAs, CdTe), we obtained nano-composites with the grain size in the range of 10 - 30 nm. Our work addresses the key problem in manufacturing bulk nanocrystalline materials, i.e. preservation of nano-scale during the fabrication process. In this paper we discuss basic technical and methodological problems associated with nano-infiltration based on the results obtained for Zn-Sic composites.
Derived from text
Matrix Materials; Semiconductors (Materials); Ceramic Matrix Composites; High Pressure; Nanocomposites; Porosity

20040082455 NASA Glenn Research Center, Cleveland, OH, USA
Modeling the Nonlinear, Strain Rate Dependent Deformation of Woven Ceramic Matrix Composites With Hydrostatic Stress Effects Included
Goldberg, Robert K.; Carney, Kelly S.; June 2004; 20 pp.; In English
Contract(s)/Grant(s): WBS 22-376-70-30-02
Report No.(s): NASA/TM-2004-213125; E-14619; No Copyright; Avail: CASI; A03, Hardcopy

An analysis method based on a deformation (as opposed to damage) approach has been developed to model the strain rate dependent, nonlinear deformation of woven ceramic matrix composites with a plain weave fiber architecture. In the developed model, the differences in the tension and compression response have also been considered. State variable based viscoplastic

equations originally developed for metals have been modified to analyze the ceramic matrix composites. To account for the tension/compression asymmetry in the material, the effective stress and effective inelastic strain definitions have been modified. The equations have also been modified to account for the fact that in an orthotropic composite the in-plane shear stiffness is independent of the stiffness in the normal directions. The developed equations have been implemented into a commercially available transient dynamic finite element code, LS-DYNA, through the use of user defined subroutines (UMATs). The tensile, compressive, and shear deformation of a representative plain weave woven ceramic matrix composite are computed and compared to experimental results. The computed values correlate well to the experimental data, demonstrating the ability of the model to accurately compute the deformation response of woven ceramic matrix composites. Author

Ceramic Matrix Composites; Hydrostatics; Nonlinearity; Strain Rate; Woven Composites; Mathematical Models; Tensile Deformation

20040082745

Nondestructive Evaluation (NDE) of Crack Formation in Advanced Composite Materials and Aluminum During Dynamic Fatigue Tests by SQUID Magnetometry

Kokabi, Hamid R.; Jun. 2003; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423841; F61775-02-W-D078; EOARD-SPC-01-4078; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Universite Pierre et Marie Curie (Paris 6) as follows: The contractor will investigate the use or high sensitivity, nondestructive, SQUID magnetometry to detect and understand crack formation and propagation in composites-based organic matrix materials, as well as in aluminum and carbon composite material used in aircraft structures.

DTIC

Aluminum; Composite Materials; Crack Initiation; Dynamic Tests; Fatigue Tests; Magnetic Measurement; Nondestructive Tests; Superconductivity

20040082805 SBA Materials, Inc., Santa Barbara, CA

New Hierarchically Structured Optical Materials for Dynamic Refractive Index Changes

Chmelka, Bradley F.; Danielson, Earl; Wyrsta, Michael D.; Dec. 31, 2003; 18 pp.; In English

Contract(s)/Grant(s): F49620-02-C-0090

Report No.(s): AD-A423962; SBA_FINAL_REPORT_AFOSR-02-04; AFRL-SR-AR-TR-04-0297; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this proposal was to develop novel materials and devices with dynamically variable refractive index properties, based on new hierarchically ordered composites and porous solids. The dominant innovation is the development of biologically inspired self-assembling inorganic/organic materials, whose versatile response properties can be designed and controlled, according to a variety of specific conditions, field stimuli, and performance criteria. Specifically, it was our goal to create mesostructured composite lens materials with large and reversible changes in their refractive indices (Delta-refractive index values of 0.5-1.0). This was to be demonstrated, by incorporating components with strong charge- transfer responses to applied optical (near-UV and near-IR) and electrical fields. Modes refractive index changes were obtained in thin film preparations of hybrid mesostructured materials (Delta-refractive index values of 0.1-0.27). However. we were unable to achieve An values close to or above 1.0 for isotropic light.

DTIC

Composite Materials; Optical Materials; Refractivity

20040082841 Minnesota Univ., Minneapolis, MN

Computational Tools for the Atomic/Continuum Interface: Nanometer to Millimeter

James, Richard; Apr. 15, 2004; 7 pp.; In English

Contract(s)/Grant(s): F49620-98-1-04330

Report No.(s): AD-A424005; No Copyright; Avail: CASI; A02, Hardcopy

The researchers developed new computational methods and theoretical models appropriate to the passage from atomic to continuum scales. The methods were developed in the context of small scale flight. Major advances were made on discrete simulation monte carlo methods, computational fluid mechanics, computational materials science and density functional

theory. Methods for the growth of ferromagnetic shape memory materials by molecular beam epitaxy were developed, and several new concepts for actuators were discovered.
DTIC
Atoms; Composite Materials; Computer Storage Devices; Continuums; Ferromagnetic Materials; Millimeter Waves

20040084006 NASA Marshall Space Flight Center, Huntsville, AL, USA
Fatigue Crack and Porosity Measurement in Composite Materials by Thermographic and Ultrasonic Methods
Walker, James L.; Russell, Samuel S.; Suits, Michael W.; Workman, Gary L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 16 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. Purpose. Detect thermo-mechanically induced intra-ply fatigue microcracking and manufactured porosity in unlined composite pressure vessels. 2. Defect descriptions. Porosity, microcracking. 3. Thermography. Overview of technique. Strengths and Weaknesses. Examples of its use for porosity detection. 4. Resonant ultrasound spectroscopy. Overview of technique. Strengths and Weaknesses. Examples of its use for microcracking detection. Conclusions.
Derived from text
Composite Materials; Fatigue (Materials); Crack Propagation; Porosity

20040084025 NASA Marshall Space Flight Center, Huntsville, AL, USA
Reference Material Kydex(registered trademark)-100 Test Data Message for Flammability Testing
Engel, Carl D.; Richardson, Erin; Davis, Eddie; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Marshall Space Flight Center (MSFC) Materials and Processes Technical Information System (MAPTIS) database contains, as an engineering resource, a large amount of material test data carefully obtained and recorded over a number of years. Flammability test data obtained using Test 1 of NASA-STD-6001 is a significant component of this database. NASA-STD-6001 recommends that Kydex 100 be used as a reference material for testing certification and for comparison between test facilities in the round-robin certification testing that occurs every 2 years. As a result of these regular activities, a large volume of test data is recorded within the MAPTIS database. The activity described in this technical report was undertaken to mine the database, recover flammability (Test 1) Kydex 100 data, and review the lessons learned from analysis of these data.
Author
Data Bases; Flammability; Thermoplasticity; Materials Tests; Polymers

20040084029 New Orleans Univ., LA, USA
Cryogenic Temperature Effects on Performance of Polymer Composites
Hui, David; Dutta, P. K.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 26 pp.; In English; See also 20040083973; Original contains color illustrations
Contract(s)/Grant(s): NCC8-223; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study is to evaluate the low temperature behavior of polymer composites down to the cryogenic temperature range. This would be accomplished by study of its behavior in several ways. First we would study the microfracture growth by observing the acoustic emission as the temperature is lowered. We would also note any damage growth by ultrasonic velocity testing applying the pulse echo method. Effects of such low temperature would then be studied by examining the shear properties by the short beam shear test, and also the fracture toughness properties over a wide range of strain rate and temperature. At present these studies are continuing. The limited data obtained from these studies are reported in this report.
Author
Polymers; Cryogenic Temperature; Temperature Effects; Acoustic Emission; Microcracks

20040084030 Mississippi State Univ., Mississippi State, MS, USA
Toward Healing of Composite Cryogenic Tanks
Patton, Richard; Schneider, Judy; Pittman, Charles, Jr.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The final report on the X-33 composite hydrogen fuel tank investigation showed that microcracking and the associated leaks of hydrogen played an important role in the failure of the X-33 composite hydrogen fuel tank. Development of future composite tanks would benefit from the incorporation of self-healing technology. Initial experiments concerning crack-healing methods used manual intervention schemes to heal cracks. Recently, a major conceptual breakthrough was reported on the development of a self-healing resin. An epoxy resin was prepared containing micro-encapsulated spheres of the liquid resin precursor, dicyclopentadiene (DCPD). A catalyst to polymerize and crosslink DCPD was also incorporated into the epoxy resin before curing. The resulting cured epoxy resin contained molecularly dispersed catalyst and encapsulated spheres of DCPD. The capsule shells prevented the catalyst from contacting the DCPD until the stress-induced presence of the growing crack tips ruptured the capsules. This released liquid DCPD into the crack where it encountered the catalyst in the walls of the epoxy resin. Upon this encounter, the liquid DCPD cured to polyDCPD, which is a tough resin that plugged, sealed, and healed the crack. Other healing schemes are also possible for optimization of the process to apply toward fuel tank fabrication. Rather than embed capsules of the healing agent in the matrix, alternative methods of transporting the healing agent to the crack(s) are being considered in this study. For example, the tank can be brought to cure temperature, put under pressure, and DCPD monomer added to the tank as a vapor, which infuses the crack and begins the healing process. Use of the self-healing concept in composite tank manufacturing can also consider incorporation of pre-cycling to heal cracks before putting the tank into service. This pre-cycling or tank healing process would subject the tank to repeated cycles of cryocooling, cracking, warming and healing. This technique would be beneficial if a progressive reduction is demonstrated in the tendency of the tank to crack when cryo-cooled is demonstrated, along with retention of toughness.
Author
Cryogenic Fluid Storage; Fuel Tanks; Hydrogen Fuels; X-33 Reusable Launch Vehicle; Epoxy Resins

20040084039 Minnesota Mining and Mfg. Co., Saint Paul, MN, USA
A Lubricant for Machining Carbon Fiber Composites Cleanly
Milbrath, Dean S.; Fox, Matthew E.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Composite materials have become valuable materials of construction in the aerospace industry because of their strength and light weight. Composite components routed to final dimensions and are joined by mechanical fasteners such as bolts and rivets in most assembly operations just as the metal parts they have replaced. To use these fasteners, accurate, precise high quality holes need to be drilled to ensure proper and durable assemblies. In addition some components are joined with high tech adhesives. Conventional machining fluids are somewhat effective for machining of composites such as carbon fiber/resins. Water based fluids cool the tool and oil based fluids provide lubrication, but both types of fluids leave substantial residues of oils, surfactants,a nd additives that can interact with the composite materials and may lead to cracking or delamination in extreme cases. Residues can also interfere with adhesion when parts are bonded and post assembly coating, sealing, and painting if not removed. As a result many routing and drilling operations are done without lubricant or dry to avoid these extra cleaning steps. A fully volatile drilling fluid has been developed for aluminum, which cools, lubricates and evaporates fully. This fluid kept drill bits cool and lubricated the drilling process on carbon fiber/epoxy composite materials such that good quality holes were produced. The volatile fluid also was shown to reduce residues to a small fraction of those produced with conventional cutting fluids. The new volatile fluid appears to deliver good performance and should increase assembly process productivity as a result.
Author
Carbon Fibers; Cleaning; Lubricants; Machining; Epoxy Matrix Composites

20040084042 Southern Research Inst., Birmingham, AL, USA
Hydrogen Permeability of a Polymer Based Composite Tank Material Under Tetra-Axial Strain
Stokes, Eric H.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

In order to increase the performance of future expendable and reusable launch vehicles and reduce per-pound payload launch costs, weight reductions have been sought in vehicle components. Historically, the cryogenic propellant tanks for launch vehicles have been constructed from metal. These are some of the largest structural components in the vehicle and contribute significantly to the vehicles total dry weight. A successful replacement material will be conformable, have a high strength to weight ratio, and have a low gas-permeability to the cryogens being stored, i.e., oxygen and hydrogen. Polymer-based composites are likely candidates to fill this role. Polymer and polymer-based composites in general are known to have acceptable gas permeation properties in their as-cured state.1 The use of polymer-based composites for this application

has been proposed for some time.2 Some successes have been reported with oxygen3, but other than the DC-XA experience, those with hydrogen have been limited. The primary reason for this has been the small molecular diameter of hydrogen, the lower temperatures of the liquid, and that the composite materials examined to date have all been susceptible to microcrack formation in response to the thermal-mechanical cycles experienced in the use-environment. There have been numerous accounts of composite materials with reported acceptable resistance to the formation of microcracks when exposed to various mechanical and/or thermal cycles. However, virtually all of these studies have employed uniaxial loads and there has been no discussion or empirical evidence pertaining to how these loads relate to the biaxial state of stress in the material in its use environment. Furthermore, many of these studies have suffered from a lack of instrument sensitivity in detecting hydrogen permeability, no standards, insufficient documentation of test conditions, testing of cycled materials in their unload state, and/or false assumptions about the nature of the microcracks in the material. This paper documents the results of hydrogen permeability testing on a Bismaleimide (BMI) based graphite fiber composite material under a variety of tetra-axial strain states.

Author

Composite Materials; Reusable Launch Vehicles; Propellant Tanks; Polymer Matrix Composites; Permeability

20040084155 NASA Glenn Research Center, Cleveland, OH, USA

A New Test Method for Material Flammability Assessment in Microgravity and Extraterrestrial Environments

Olson, S. L.; Beeson, H. D.; Haas, J. P.; Baas, J. S.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 121-122; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The standard oxygen consumption (cone) calorimeter (described in ASTM E 1354 and NASA STD 6001 Test 2) is modified to provide a bench-scale test environment that simulates the low velocity buoyant or ventilation flow generated by or around a burning surface in a spacecraft or extraterrestrial gravity level. The Equivalent Low Stretch Apparatus (ELSA) uses an inverted cone geometry with the sample burning in a ceiling fire (stagnation flow) configuration. For a fixed radiant flux, ignition delay times for characterization material PMMA are shown to decrease by a factor of three at low stretch, demonstrating that ignition delay times determined from normal cone tests significantly underestimate the risk in microgravity. The critical heat flux for ignition is found to be lowered at low stretch as the convective cooling is reduced. At the limit of no stretch, any heat flux that exceeds the surface radiative loss at the surface ignition temperature is sufficient for ignition. Regression rates for PMMA increase with heat flux and stretch rate, but regression rates are much more sensitive to heat flux at the low stretch rates, where a modest increase in heat flux of 25 kW/m2 increases the burning rates by an order of magnitude. The global equivalence ratio of these flames is very fuel rich, and the quantity of CO produced in this configuration is significantly higher than standard cone tests. These results [2] demonstrate the ELSA apparatus allows us to conduct normal gravity experiments that accurately and quantifiably evaluate a material s flammability characteristics in the real-use environment of spacecraft or extra-terrestrial gravitational acceleration. These results also demonstrate that current NASA STD 6001 Test 2 (standard cone) is not conservative since it evaluates materials flammability with a much higher inherent buoyant convective flow.

Derived from text

Heat Flux; Flammability; Microgravity; Extraterrestrial Environments; Stagnation Flow; Ignition Temperature; Sensitivity

20040084193 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Heat Flux, Oxygen Concentration and Glass Fiber Volume Fraction on Pyrolysate Mass Flux from Composite Solids

Rich, D. B.; Lautenberger, C. W.; Yuan, Z.; Fernandez-Pello, A. C.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 143; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Experimental work on the effects of heat flux, oxygen concentration and glass fiber volume fraction on pyrolysate mass flux from samples of polypropylene/glass fiber composite (PP/G) is underway. The research is conducted as part of a larger project to develop a test methodology for flammability of materials, particularly composites, in the microgravity and variable oxygen concentration environment of spacecraft and space structures. Samples of PP/G sized at 30x30x10 mm are flush mounted in a flow tunnel, which provides a flow of oxidizer over the surface of the samples at a fixed value of 1 m/s and oxygen concentrations varying between 18 and 30%. Each sample is exposed to a constant external radiant heat flux at a given value, which varies between tests from 10 to 24 kW/m2. Continuous sample mass loss and surface temperature measurements are recorded for each test. Some tests are conducted with an igniter and some are not. In the former case, the research goal is to quantify the critical mass flux at ignition for the various environmental and material conditions described above. The later case generates a wider range of mass flux rates than those seen prior to ignition, providing an opportunity to examine the protective effects of blowing on oxidative pyrolysis and heating of the surface. Graphs of surface temperature and sample mass

loss vs. time for samples of 30% PPG at oxygen concentrations of 18 and 21% are presented in the figures below. These figures give a clear indication of the lower pyrolysis rate and extended time to ignition that accompany a lower oxygen concentration. Analysis of the mass flux rate at the time of ignition gives good repeatability but requires further work to provide a clear indication of mass flux trends accompanying changes in environmental and material properties.
Derived from text
Heat Flux; Oxygen; Glass Fibers; Pyrolysis; Flux (Rate); Flammability; Composite Materials

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20040081321 National Defence Research Establishment, Umea, Sweden
Determination of 90 Sr in Calcium-Rich Materials
Nygren, U.; Appelblad, P.; Nov. 2003; 16 pp.; In Swedish
Report No.(s): PB2004-104628; FOI-R-0903-SE; No Copyright; Avail: CASI; A03, Hardcopy

The aim of this project was to develop an analytical procedure for the determination of (sup 90)Sr in calcium-rich materials such as teeth and milk. The aim was also to use extraction chromatography for separation of Strontium. An initial investigation showed that high concentrations of Calcium interferes with the separation of Sr, and based on that knowledge, three different methods designed to reduce this interference were tested. Two of these methods are based on an initial Ca-Sr separation by nitrate- or phosphate/oxalate precipitation, while the third method utilizes an increased amount of the extraction chromatographic material. The best results were achieved with Method III, which provided chemical yields of approximately 67% and a good precision in the determination of (sup 90)Sr. This method has been validated by analysis of milkpowder spiked from an intercomparison test arranged by Nordic nuclear safety (NKS).
NTIS
Strontium 90; Calcium; Chemical Analysis

20040081352 General Accounting Office, Washington, DC
Defense Management: Opportunities Exist to Improve Implementation of DOD's Long-Term Corrosion Strategy
Jun. 2004; 30 pp.; In English
Report No.(s): PB2004-106131; GAO-04-640; No Copyright; Avail: CASI; A03, Hardcopy

Corrosion and its deteriorating impacts are so extensive that military equipment and military infrastructure are severely affected. The financial burdens are also substantial--estimates show that the Department of Defense (DOD) spends as much as $20 billion a year in direct costs alone to repair the damage caused by corrosion. Corrosion has equally profound impacts on the safety and readiness of the military services. For example, as we recently reported, the Navy suspended carrier operations in March 2002 when one F-14 aircraft crashed because its landing gear collapsed because of corrosion. Our report also indicated that corrosion-related problems had degraded the readiness of all of the Army's approximately 2,450 force modernization helicopters. Congress, in the fiscal year 2003 defense authorization act, directed the Secretary of Defense to develop and implement a long-term strategy to reduce corrosion and the effects of corrosion on the DOD's military equipment and infrastructure.
NTIS
Corrosion; Defense Program; Estimates

20040081368 National Center for Electron Microscopy, Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA, Antwerp Univ., Belgium
Measurement of the Indium Segregation in InGaN based LEDs with Single Atom Sensitivity
Jinschek, J. R.; Kisielowski, C.; Van Dyck, D.; Geuens, P.; 2003; In English
Report No.(s): DE2003-816078; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
Light Emitting Diodes; Sensitivity

20040082180 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Rate Constant for the Reaction H + C2H5 at T = 295 - 150K

Pimentel, Andre S.; Payne, Walter A.; Nesbitt, Fred L.; Cody, Regina J.; Stief, Louis J.; February 27, 2004; 26 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The reaction between the hydrogen atom and the ethyl (C2H3) radical is predicted by photochemical modeling to be the most important loss process for C2H5 radicals in the atmospheres of Jupiter and Saturn. This reaction is also one of the major sources for the methyl radicals in these atmospheres. These two simplest hydrocarbon radicals are the initial species for the synthesis of larger hydrocarbons. Previous measurements of the rate constant for the H + C2H5 reaction varied by a factor of five at room temperature, and some studies showed a dependence upon temperature while others showed no such dependence. In addition, the previous studies were at higher temperatures and generally higher pressures than that needed for use in planetary atmospheric models. The rate constant for the reaction H + C2H5 has been measured directly at T = 150, 202 and 295 K and at P = 1.0 Torr He for all temperatures and additionally at P = 0.5 and 2.0 Torr He at T = 202 K. The measurements were performed in a discharge - fast flow system. The decay of the C2H5 radical in the presence of excess hydrogen was monitored by low-energy electron impact mass spectrometry under pseudo-first order conditions. H atoms and C2H5 radicals were generated rapidly and simultaneously by the reaction of fluorine atoms with H2 and C2H6, respectively. The total rate constant was found to be temperature and pressure independent. The measured total rate constant at each temperature are: k(sub 1)(295K) = (1.02+/-0.24)x10(exp -10), k(sub 1)(202K) = (1.02+/-0.22)x10(exp -10) and k(sub 1)(150K) = (0.93+/-0.21)x10(exp -10), all in units of cu cm/molecule/s. The total rate constant derived from all the combined measurements is k(sub 1) = (l.03+/-0.17)x10(exp -10) cu cm/molecule/s. At room temperature our results are about a factor of two higher than the recommended rate constant and a factor of three lower than the most recently published study.
Author

Hydrogen Atoms; Ethyl Compounds; Radicals; Reaction Kinetics

20040082273 NASA Marshall Space Flight Center, Huntsville, AL, USA

Fluorescent Approaches to High Throughput Crystallography

Minamitani, Elizabeth Forsythe; Pusey, Marc L.; [2004]; 1 pp.; In English; 10th International Conference on the Crystallization of Biological Macromolecules, 5-8 Jun. 2004, Beijing, China; No Copyright; Avail: Other Sources; Abstract Only

X-ray crystallography remains the primary method for determining the structure of macromolecules. The first requirement is to have crystals, and obtaining them is often the rate-limiting step. The numbers of crystallization trials that are set up for any one protein for structural genomics, and the rate at which they are being set up, now overwhelm the ability for strictly human analysis of the results. Automated analysis methods are now being implemented with varying degrees of success, but these typically cannot reliably extract intermediate results. By covalently modifying a subpopulation, less than or = 1%, of a macromolecule solution with a fluorescent probe, the labeled material will add to a growing crystal as a microheterogeneous growth unit. Labeling procedures can be readily incorporated into the final stages of a macromolecules purification. The covalently attached probe will concentrate in the crystal relative to the solution, and under fluorescent illumination the crystals will show up as bright objects against a dark background. As crystalline packing is more dense than amorphous precipitate, the fluorescence intensity can be used as a guide in distinguishing different types of precipitated phases, even in the absence of obvious crystalline features, widening the available potential lead conditions in the absence of clear ″bits.″ Non-protein structures, such as salt crystals, will not incorporate the probe and will not show up under fluorescent illumination. Also, brightly fluorescent crystals are readily found against less fluorescent precipitated phases, which under white light illumination may serve to obscure the crystals. Automated image analysis to find crystals should be greatly facilitated, without having to first define crystallization drop boundaries and by having the protein or protein structures all that show up. The trace fluorescently labeled crystals will also emit with sufficient intensity to aid in the automation of crystal alignment using relatively low cost optics, further increasing throughput at synchrotrons. This presentation will focus on the methodology for fluorescent labeling, the crystallization results, and the effects of the trace labeling on the crystal quality.
Author

Fluorescence; Crystallography; Macromolecules; Amorphous Materials; Image Analysis

20040082422

Propane Dehydrogenation Feasibility Study for Egyptian Petrochemicals Holding Company (Public Version)

Dec. 2003; In English; Original contains color illustrations

Report No.(s): PB2004-105329; No Copyright; Avail: National Technical Information Service (NTIS)

The Egyptian Petrochemicals Holding Company (Echem) is mandated to identify and develop new petrochemical and

chemical production opportunities in cooperation with its sister parastatal organizations, such as the Egyptian General Petroleum Corporation (EGPC) and the Egyptian Gas Holding Company (EGAS), as well as private companies and investors. Propane, which is typically derived from liquids associated with natural gas production, is the feedstock for the production of polypropylene and a variety of other polymers. Propylene is created through the removal of hydrogen from the propane molecule. This process is called propane dehydrogenation (PDH). In September 2002, Echem completed a preliminary study to evaluate the techno-economic feasibility of producing propylene using the PDH process. Based on this study, Echem found that building a new PDH plant of propylene capacity 350, 000 metric tons per annum (MTA) near the new port at Ain El-Sukhna would be feasible. This has since been increased to 4000,000 MTA. EGAS has agreed to deliver propane to the proposed facility and the Oriental Petroleum Company (OPC), a private Egyptian firm, is expected to be the primary propylene off taker for the project. In order to formally proceed with the implementation of the project, Echem has retained Nexant/Fluor to conduct a detailed feasibility study to ascertain the viability of this project based on market analysis and selection of a viable technology.
NTIS
Propane; Dehydrogenation

20040082432 Delaware River Basin Commission, Trenton, NJ, USA
PCB Water Quality Model for Delaware Estuary (DELPCB)
Dec. 2003; In English
Report No.(s): PB2004-106336; No Copyright; Avail: National Technical Information Service (NTIS)

Starting from July 26, 2000, with U.S. EPA Region II's and III's endorsement, the Commission acts as the lead agency in developing the Total Maximum Daily Loads (TMDLs) for PCBs in the Delaware Estuary and worked cooperatively with the signatory parties to the Delaware River Basin Compact and their agencies and affected parties. Due to the compression of the schedule, a two-staged approach has been adopted by the Commission, as recommended by an expert panel of scientists experienced with PCB modeling. In the first stage, a reliable, calibrated, scientific-based PCB model is needed to help understand the PCB behavior in the Delaware River. Based on the same constants, coefficients, and kinetics resulting from model calibration, the model is applied to develop TMDLs. DRBC has been developing a general purpose sorbent dynamic PCB model for the Delaware River Estuary (DELPCB). DELPCB with two organic carbon (live biotic carbon (BIC) and dead particulate detrital carbon (PDC)) state variables and one inorganic solid (IS) as a pseudo-state variable linked with the one-dimensional (1-D) DYNHYD5 to enhance sorbent dynamic simulation.
NTIS
Polychlorinated Biphenyls; Water Quality; Delaware River Basin (Us)

20040082614 Clark Univ., Worcester, MA
Characterization of Nafion as a Permselective Membrane by NMR
Jones, Alan A.; Aug. 11, 2003; 9 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0430
Report No.(s): AD-A423127; ARO-40403.2-CH; No Copyright; Avail: CASI; A02, Hardcopy

NMR measurements were made on three classes of Nafion samples to characterize penetrant diffusion and morphology. Nafion-115 and 117 films in the acid form were swollen with dimethyl metbylphosphonate (DMMP). The translational motion of the DMMP was observed using pulse field gradient NMR and the domain size of the pendant group was measured using fluorine-19 spin diffusion under conditions of high speed magic angle spinning. Both the diffusion and the domain size measurements pointed to a change in the morphology as a function of DMMP concentration with the development of larger domains at high DMMP concentration. Similar measurements of Nafion swollen with water did not involve a change in morphology. Diffusion and morphological measurements were made on calcium neutralized N-115 swollen with DMMP. Large domains and rapid DMMP diffusion were observed. Lastly cast films of Nafion-112 were prepared with and without the addition of fumed silica nanoparticles. Diffusion of water, methanol and DMMP were measure in these cast films which appeared to have smaller domain sizes and increased selectivity for water over DMMP. Also the apparent diffusion constant of DMMP was a strong function of the time over which diffusion occurred indicating a domain structure obstructing translational motion.
DTIC
Carbon Tetrafluoride; Diffusion; Membranes; Nuclear Magnetic Resonance; Permeability; Polymers; Sulfonic Acid

20040082617 Air Force Research Lab., Wright-Patterson AFB, OH
Sol-Gel Technology for Low-VOC, Nonchromated Adhesive Bonding Applications SERDP; Project PP-1113, Task 1
Mazza, James J.; Apr. 2004; 163 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-ARMM
Report No.(s): AD-A423563; AFRL-ML-WP-TR-2004-4063; No Copyright; Avail: CASI; A08, Hardcopy

A government-industry team, primarily funded by the Strategic Environmental Research and Development Program (SERDP) under Project PP-1113, developed new environmentally friendly metal surface preparations for adhesive bonding applications. These processes were based on waterborne, nonchromated chemistry developed by Boeing and designated Boegel-EPII. Preparation of aluminum, titanium, and stainless steel adherends was investigated for on-component repair as well as original equipment manufacturer (OEM) applications. The bulk of the work was conducted to establish pretreatment steps for cleaning, deoxidizing, and roughening metal surfaces. Multiple viable approaches, varying in degree of effectiveness and complexity, were developed. Sol-gel chemistry application processes were also investigated as were post-treatment priming operations. Surface characterization efforts and kitting studies for the multicomponent sol-gel chemistry received significant attention. Performance of surface preparations was primarily evaluated by means of the wedge test, although many additional tests were conducted, on several epoxy-based film and paste adhesives. The best processes developed, utilizing alumina grit-blasting pretreatment, are quite robust and yielded excellent bond strength and moisture durability results, rivaling the best existing practices. Variations using nongrit-blast approaches outperformed many approved repair processes. Government and industry organizations have begun to implement the new sol-gel processes for aluminum, titanium, and steel adhesive bonding applications.
DTIC
Adhesive Bonding; Sol-Gel Processes; Surface Finishing

20040082630 Air Force Research Lab., Edwards AFB, CA
Research in New Ionic Liquids
Drake, Greg; Hawkins, Rommy; May 21, 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A423581; No Copyright; Avail: CASI; A03, Hardcopy

Ionic Liquids are a family of salts which by definition have very low melting points that are at or below the boiling point of water (\h100 C).1-4 They typically have very long liquidous ranges before they decompose, with essentially no vapor pressure in their liquid state and have found a special niche in the field of chemistry. Work in the last decade has experienced exponential growth with effort in applications of ionic liquids as novel solvents for a wide range of reactions. However, efforts in the area have been going on for several decades and most notably those by the USAF. L. King, J. Wilkes, and C. Hussey began pioneering efforts with this unusual class of materials in the 1960's with applications centered upon finding new electrolytes batteries. This work centered heavily upon di N,N alkyl substituted imidazolium salts most of which were water sensitive due to the anion. This long lived effort finally resulted in the discovery of water stable systems in the early 1990's opening the door to many applications. Since that time, much of the effort has centered upon the use of ionic liquids as excellent reaction solvents, extraction media, and as catalyst carriers. Unfortunately, little effort centered upon the basic scientific question of why these salts are low melting and how other systems might be discovered.
DTIC
Electrolytes; Liquids

20040082662 Defence Science and Technology Organisation, Salisbury
Ab Initio Computational Chemical Studies of Molecular Processes and Decomposition in Ammonium Perchlorate
White, A.; Feb. 2004; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423656; DSTO-TR-1552; DODA-AR-013-032; No Copyright; Avail: CASI; A03, Hardcopy

Ammonium perchlorate is widely used as an oxidiser 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.
DTIC
Ammonium Perchlorates; Composite Propellants; Decomposition; Oxidizers; Rocket Engines

20040082687 Massachusetts Univ., Lowell, MA
Biotechnology Route to Conformal Photovoltaics
Kumar, Jayant; Tripathy, Sukant; May 12, 2004; 19 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0178
Report No.(s): AD-A423714; No Copyright; Avail: CASI; A03, Hardcopy

The focus of this proposal is to develop biotechnological approaches for the synthesis of efficient dye sensitizers and redox polyelectrolytes in an environmentally benign way using enzymatic or biomimetic techniques. To further develop processing techniques to fabricate photovoltaic cells on thin conformable substrates and to test the dyes and polyelectrolytes thus prepared in realistic device configurations and establish close collaboration with a company to transition the results of the research.
DTIC
Biomimetics; Biotechnology; Electrolytes; Oxidation-Reduction Reactions; Photovoltaic Conversion; Routes

20040082747 California Univ., Berkeley, CA
Nanocrystal Ceramics
Alivisatos, A. P.; Jun. 26, 2004; 17 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0033
Report No.(s): AD-A423843; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this report are as follows: 1) Ceramic and oxide nanocrystals will be prepared and isolated; 2) Nanocrystals will be characterized structurally; 3) Kinetic studies of reaction and phase transition processes in oxide nanocrystals.
DTIC
Ceramics; Nanocrystals

20040082749 Maryland Univ., College Park, MD
Micro-Combustion for Nano and Pico Satellite Propulsion Systems
Cadou, CHristopher P.; Leach, Timothy T.; May 20, 2003; 95 pp.; In English
Contract(s)/Grant(s): F496200110435
Report No.(s): AD-A423845; AFRL-SR-AR-TR-04-0284; No Copyright; Avail: CASI; A05, Hardcopy

The performance of millimeter-scale combustors intended for micro, nano, and pico-satellite propulsion is strongly influenced by heat exchange to and within the combustor structure. The purpose of this work is to develop models for the effects of fluid-structure coupling on combustion in micro-combustors and to develop non-intrusive methods for making measurements of species concentration and temperature that can be used to validate these models. A simple one-dimensional model based on the thermal theory for flame propagation was extended to include the effects of heat exchange with a conductive structure. The important findings were that heat exchange between the gas and structure in micro- combustors can increase the burning rate and the reaction zone thickness. Micro-combustor geometries that maximize power density were identified. The experimental component of the work developed a non-intrusive technique based on infrared absorption spectroscopy fl%at made measurements of temperature and species concentration in a flame stabilized between two silicon plates spaced less than 1 mm apart.
DTIC
Combustion; Combustion Chambers; Flame Propagation; Heat Exchangers; Propulsion System Configurations; Propulsion System Performance

20040082751 Emory Univ., Atlanta, GA
Theoretical Studies of Gas Phase Elementary Reactions
Morokuma, Keiji; Jun. 4, 2004; 21 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0183
Report No.(s): AD-A423848; AFRL-SR-AR-TR-04-0316; No Copyright; Avail: CASI; A03, Hardcopy

This final technical report begins with the objective the project, followed by detailed technical reports on the new accomplishments and findings obtained in the project. They are presented in three sections: A) Potential Energy Surfaces of Ion-Molecule Reactions; B) Potential Energy Surfaces for Photochemical Reactions and Nonadiabatic Processes; and C) Other Elementary Reactions. The Publication List and Interactions/Transactions conclude the report.
DTIC
Chemical Reactions; Vapor Phases

20040082775 Pennsylvania Univ., Philadelphia, PA
Predissociation and Quenching Dynamics of Electronically Excited Hydroxyl Radicals
Lester, Marsha I.; May 31, 2004; 8 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0095
Report No.(s): AD-A423904; AFRL-SR-AR-TR-04-0287; No Copyright; Avail: CASI; A02, Hardcopy

A series of studies has been conducted to examine the sources and sinks of electronically excited hydroxyl radicals via photon-assisted, unimolecular, and collision- induced processes. Significant progress has been made on three different fronts: (1) simulation of ultraviolet emission data from the Space Shuttle's thruster plume as originating from solar-induced and collision-induced electronic excitation of hydroxyl radicals; (2) detection of hydroxyl radicals in various vibrational levels of the ground electronic state through photoionization via high-lying Rydberg states; and (3) examination of the photodissociation dynamics of highly vibrationally excited hydroxyl radicals at specific ultraviolet wavelengths (243 and 226 nanometers). (2 figures, 13 refs.)
DTIC
Emission Spectra; Excitation; Exhaust Gases; Hydroxyl Radicals; Photodissociation; Plumes

20040082783 Utah Univ., Salt Lake City, UT
Quantum Simulations of Low Temperature High Energy Density Matter
Voth, Gregory A.; May 3, 2004; 8 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0067
Report No.(s): AD-A423914; No Copyright; Avail: CASI; A02, Hardcopy

Solid hydrogen doped with energetic impurities may form the basis for HEDM to be used in rocket propulsion. A key research priority has been to investigate the equilibrium properties of a boron impurity and of an aluminum impurity trapped in solid parahydrogen. The simulation methods used in the study allow us to take into account the quantum nature of the HEDM in question. Using classical molecular dynamics simulations to evaluate these equilibrium properties would predict qualitatively incorrect results for low temperature solid hydrogen, because of the highly quantum nature of the hydrogen matrix. The immediate goal of our group's Air Force- supported low temperature HEDM research program is to understand from large- scale computer simulation the differences in the equilibrium properties of the HEDM when the doped impurity is aluminum, and to asses the effects of anisotropic interactions between the impurity and the pH2 molecule. In low temperature hydrogen HEDM, quantum effects are enormous, so a highly specialized method is required for these demanding computer simulations.
DTIC
Hydrogen; Low Temperature; Propulsion; Quantum Theory; Simulation

20040082789 Florida Univ., Gainesville, FL
Simultaneous Measurement of Specific Discharge and Cr(VI) Mass Flux in Porous Media Using Permeable Adsorbent Device
Campbell, Timothy J.; Hatfield, Kirk; Annable, Michael D.; Jan. 2004; 32 pp.; In English
Report No.(s): AD-A423922; AFRL-ML-TY-TR-2004-4527; No Copyright; Avail: CASI; A03, Hardcopy

The method for simultaneous measurement of local groundwater specific discharge (q) and Cr(VI) mass flux (J(exp Cr)) using a permeable adsorbent device is proposed. The proposed method allows for determination of both q and J(exp Cr) as two-dimensional vectors, with each vector composed of an angular (q(Theta), J(Theta)(exp Cr)) and a radial (q(sub r), J(sub r)(exp Cr)) component. The device consists of a cylindrical container whose outer shell is constructed of highly permeable mesh material with impermeable end caps. The interior of the device is divided into a center well and three outer sectors, each packed with a granular anion exchange resin having high adsorption capacity for the Cr(VI) oxyanions CrO(sub 4)(exp 2-) and HCrO(sub 4)-. The adsorbent in the center well of the device is loaded with berizoate as resident tracer. Experiments were conducted in which these devices were placed in porous packed bed columns through which was passed a measured quantity of simulated groundwater containing Cr(VI). The resin was then removed from the four sectors separately and extracted to determine the masses of Cr(VI) and resident tracer bound in each. A linear solute transport model was used to relate the observed rate of resident tracer displacement to q(Theta) and q(sub r), and a simple mass balance equation was used to calculate J(sub r)Cr. Experimental results showed q(Theta) was measured to an accuracy of plus or minus 1 degrees. Accuracy of the radial specific discharge vector component depended on the degree of displacement of the resident tracer. J(sub r)(exp Cr) mass flux vector radial component was measured to an accuracy of plus or minus 17%. These results demonstrate that the

proposed method represents a promising technique for determination of specific discharge and contaminant mass flux in contaminated aquifers.
DTIC
Adsorbents; Chromium; News Media; Porosity; Porous Materials

20040082796 Engineering Research and Consulting, Inc., Huntsville, AL
History of the AFRL/USC DARPA Program on Polynitrogen Chemistry
Vij, Asbwani; Christe, Karl; May 28, 2004; 119 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP
Report No.(s): AD-A423940; No Copyright; Avail: CASI; A06, Hardcopy

In 1986, Air Force started the High Energy Density Matter (HEDM) Program. Original focus: CBES (Chemically Bound Excited States), meta-stable helium, cryo-solids, and among other things, theoretical studies on polynitrogens and polyoxygens. In 1998, Henric Oestmark approached DARPA to fund an experimental study in polynitrogen chemistry. Henric Y's proposal was reviewed at AERL, and DARPA was convinced to sponsor a broad program iii polynitrogen chemistry involving 8 research grotips, inclnding AERL.
DTIC
Nitrogen Compounds; Oxygen Compounds

20040082801 Maryland Univ., College Park, MD
Micro-Combustion for Nano and Pico Satellite Propulsion Systems
Cadou, Christopher P.; Sep. 2002; 4 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0435
Report No.(s): AD-A423952; No Copyright; Avail: CASI; A01, Hardcopy

This research investigates the physics of micro- scale, fluid-structure coupling in reacting flow systems for the purpose of developing efficient micro-rocket motors. The research is motivated by the U.S. Air Force's need in the coming decade for compact propulsion devices suitable for positioning and attitude control of micro-satellites and other micro-scale space vehicles. While there is a range of technologies that are available for this purpose, chemical rockets remain extremely attractive because of the high energy density of their fuels. However, constructing efficient chemical rocket engine combustors becomes difficult as the size of the motor is reduced. The problems stem from the strong coupling between fluid and structure that exists at small scales. Heat loss and radical quenching at the walls makes it difficult to stabilize and sustain efficient combustion. This research program is in the process of developing appropriate models and acquiring experimental data that will be used to identify the physical parameters and processes that distinguish micro-combustion from combustion at conventional scales.
DTIC
Combustion; Combustion Chambers; Inspection; Microminiaturization; Propulsion; Propulsion System Configurations; Propulsion System Performance; Rocket Engines; Thermochemistry

20040082972 Army Cold Regions Research and Engineering Lab., Hanover, NH
Extending the Season for Concrete Construction and Repair. Phase 1 -Establishing the Technology
Korhonen, Charles J.; Semen, Peter M.; Barna, Lynette A.; Feb. 2004; 146 pp.; In English
Report No.(s): AD-A423761; ERDC/CRREL-TR-04-2; No Copyright; Avail: CASI; A07, Hardcopy

The benefit of combining several commercial admixtures into a formulation to protect fresh concrete against freezing and promote significant strength development while the internal temperature of the concrete is below freezing was investigated. Laboratory studies developed eight potential admixture combinations for use at low temperatures. Each combination was shown in the laboratory to produce concrete that had reasonable workability; that could be entrained with air, that did not freeze until its internal temperature dropped to -5 degrees C, that developed strength while held at -5 degrees C as rapidly as did normal concrete held at -5 degrees C, that could be entrained with air; and that could be finished at --5 degrees C almost as rapidly as normal concrete held at -5 degrees C. Five field trials were conducted to demonstrate that it is possible to mix, transport, place, finish, and cure concrete made with these admixture combinations at air temperatures as low as -20 degrees C, with little or no thermal protection. Several batching sequences were demonstrated in the field trials to accommodate various haul distances and working times. The sequence where all admixtures were dosed into the truck at the jobsite created the most time for the concrete workers to place the concrete. Cost-wise, the admixture combinations tested in the field were shown to be less expensive than the conventional approach to winter concreting, which relies on heated shelters to keep the

concrete warm while it cures. No special tools, techniques, or precautions were required to work with the concretes made with these admixtures.
DTIC
Atmospheric Temperature; Concretes; Construction; Maintenance

20040083992 NASA Marshall Space Flight Center, Huntsville, AL, USA
Use of FT-IR Analysis to Support Contamination Studies for Bonding Surfaces
Boothe, Richard; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The FT-IR analysis technique has become increasingly important for measuring and verifying coating levels on calibration standards and bonding specimens used to evaluate the effects of contamination on rocket motor bondlines. Use of this technique for evaluating solvent effectiveness for contamination removal is also increasing. Typical testing scenarios, analysis techniques, and instrumentation used at MSFC will be described.
Author
Bonding; Contamination; Fourier Transformation; Infrared Spectroscopy

20040084001 Du Pont de Nemours (E. I.) and Co., Wilmington, DE, USA
Ozone Friendly Solvent Alternatives for Aerospace Applications
Merchant, Abid N.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Several new hydrofluorocarbon (HFC) formulations have been developed for cleaning, verification of cleanliness, drying, deposition, and aerosol applications. These formulations are non-ozone depleting and have low global warming impact. This paper will present physical, chemical, and thermodynamic properties and environmental and safety profiles of these solvents, along with field test data on applications.
Author
Aerospace Engineering; Ozone; Solvents; Fluorohydrocarbons

20040084049 Brookhaven National Lab., Upton, NY, USA
The ″Ship-in-a-bottle″ Approach to Synthesis of Nano Materials Via Sonolysis
Mahajan, Devinder; Khalil, Hanaa; Rafailovich, Miriam H.; White, Henry J.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 9 pp.; In English; See also 20040083973; Original contains color and black and white illustrations
Contract(s)/Grant(s): DE-AC02-98CH-10886; No Copyright; Avail: CASI; A02, Hardcopy

In this study, in situ coating of sono-synthesized iron nanoparticles with polyethylene(glycol)-400 is described. The Fe-PEG-400 formation follows zero-order kinetics. The interaction between Fe and PEG via the Fe-O formation is confirmed by FTIR, XRD and XAFS/XANES studies. Morphological studies via TEM show a grape-like morphology of PEG with Fe with particle size less than 2 nm. Preliminary FTIR study indicates that the Fe-PEG-400 is a low temperature nanocoating material because the material conveniently decomposed at 100 C in air. Furthermore, sonolysis is a convenient method to produce nanocoatings that can be stored and conveniently used when needed (the ship-in-a-bottle approach). Work is now in progress to measure the magnetic and other physical properties of these materials. Our study now includes PEG complexes of Mo, Ni and other metals for potential nanocoating application.
Author
Synthesis (Chemistry); Nanoparticles; Coatings; Ultrasonics; Polymers

20040084053 Universities Space Research Association, Huntsville, AL, USA
Synthesis and Characterization of Carbon Nanotubes for Reinforced and Functional Applications
Zhu, Shen; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Many efforts have been engaged recently in synthesizing single-walled and multiwalled carbon nanotubes because of their superior mechanical, electrical, and thermal properties, which could be used for numerous applications to enhance the performance of electronics, sensors, and composites. This presentation will demonstrate the synthesizing process of carbon

nanotubes by thermal chemical vapor deposition and the characterization results by using electron microscopy and optical spectroscopy. Carbon nanotubes could be synthesized on various substances. The conditions of fabricating single-walled or multi-walled carbon nanotubes depend strongly on temperature and hydrocarbon concentration but weakly on pressure. The sizes, orientations, and growth modes of carbon nanotubes will be illustrated. The advantages and limitations of several potential aerospace applications such as reinforced and functional composites using carbon nanotubes will be discussed.
Author
Carbon Nanotubes; Fabrication; Synthesis (Chemistry); Characterization; Mechanical Properties; Aerospace Engineering; Reinforcing Materials

20040084156 NASA Glenn Research Center, Cleveland, OH, USA
Most Probable Fire Scenarios in Spacecraft and Extraterrestrial Habitats: Why NASA's Current Test 1 Might Not Always Be Conservative
Olson, S. L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 123-124; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

NASA s current method of material screening determines fire resistance under conditions representing a worst-case for normal gravity flammability - the Upward Flame Propagation Test (Test 1[1]). Its simple pass-fail criteria eliminates materials that burn for more than 12 inches from a standardized ignition source. In addition, if a material drips burning pieces that ignite a flammable fabric below, it fails. The applicability of Test 1 to fires in microgravity and extraterrestrial environments, however, is uncertain because the relationship between this buoyancy-dominated test and actual extraterrestrial fire hazards is not understood. There is compelling evidence that the Test 1 may not be the worst case for spacecraft fires, and we don t have enough information to assess if it is adequate at Lunar or Martian gravity levels.
Derived from text
Extraterrestrial Environments; Lunar Gravitation; Mars (Planet); Microgravity

20040084160 Michigan Univ., Ann Arbor, MI, USA
Effects of Chemically Passive Suppressants on Laminar Premixed Hydrogen/Air Flames
Qiao, L.; Kim, C. H.; Faeth, G. M.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 137; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Fundamental unstretched laminar burning velocities and flame response to stretch, as characterized by Markstein numbers, were considered experimentally and computationally for outwardly-propagating spherical laminar premixed flames. Experimental and computational conditions were as follows: fuel equivalence ratios of 1.0 and 1.8; pressures of 0.5-1.0 atm; gaseous suppressant including argon, helium, nitrogen and carbon dioxide; and suppressant concentrations in the range of 0-40%, by volume. Predicted flame behavior was obtained from one-dimensional time-dependent numerical simulations treating variable property multi-component transport, with detailed hydrogen/oxygen chemical kinetics from Mueller et al. (1999). The present flames were sensitive to flame stretch, yielding values of unstretched to stretched laminar burning velocities in the range 0.5-1.5 for levels of flame stretch well below quenching conditions, e.g., for Karlovitz numbers less than 0.5. The present passive flame suppressants improved in performance in the following order: argon, helium, nitrogen, and carbon monoxide. This order reflects the capability of suppressants to promote quenching of the reaction zone by either increased specific heats or by enhanced conduction heat losses. Finally, the comparison between measurements and predictions was excellent for present conditions, which involved flames not too near quenching conditions where radiant heat losses were modest.
Derived from text
Laminar Flow; Chemical Analysis; Premixed Flames; Hydrogen; Reaction Kinetics

20040084184 Arizona State Univ., Tempe, AZ, USA
A Continuous Microculture Device for Monitoring the Effects of Space Environments on Living Systems
Martineau, R.; Piccini, M.; Towe, B.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 111; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We report our development of a microculture device that continuously cultures genetically engineered bacterial cells and monitors their response to environmental/chemical stimuli. Responses include changes in culture turbidity, pH, production of fluorescent proteins, and bioluminescence. Cells are maintained in a 10 microliter glass capillary by infusing microliter

quantities of media and reagents using novel, miniature pumps and valves. Metabolic wastes are removed and nutrients delivered through microdialysis. Microbore tubing (150 microns i.d.) forms the fluidic interconnects between components and optical monitoring is accomplished using light emitting diodes as excitation sources and photodiodes as detectors. The system is housed in conventionally machined acrylics with dimensions of 3.0 x 8.9 x 0.6 cubic centimeters. On-board electronics support data acquisition, power delivery, microfluidic component driving, and computer interfacing. All microfluidic components and media are on-board. The device uses a single link to a computer and contains media for a few days. Applications for the device include the testing of potentially stressful stimuli (microgravity, radiations, etc.) for effects on life as well as automated biological assays. Ultimately, we aim to create an array of cultures which contains cells that are selectively responsive to fundamental stressors and to fingerprint an environment by probing bacterial responses via reporter fusions to stress-response pathways.
Author
Aerospace Environments; Culture Techniques; Cells (Biology); Mechanical Devices; Bioengineering; Life Sciences

20040084207 NASA Glenn Research Center, Cleveland, OH, USA
Buoyancy Effects in Strongly-pulsed, Turbulent Diffusion Flames
Hermanson, J. C.; Johari, H.; Ghaem-Maghami, E.; Stocker, D. P.; Hegde, U. G.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 83-84; In English; See also 20040084137
Contract(s)/Grant(s): NCC3-673; NNC04AA37A; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this experiment is to better understand the combustion behavior of pulsed, turbulent diffusion flames by conducting experiments in microgravity. The fuel jet is fully-modulated (i.e., completely shut off between pulses) by an externally controlled valve system leading to enhanced fuel/air mixing compared to acoustically excited or partially-modulated jets. Experiments are conducted both in laboratories at UW and WPI and in the GRC 2.2s Drop Tower. A single fuel nozzle with diameter d = 2 mm is centered in a combustor 20 x 20 cm in cross section and 67 cm in height. The gaseous fuel flow (ethylene or a 50/50 ethylene/nitrogen mixture by volume) is fully-modulated by a fast-response solenoid valve with injection times from tau = 4 to tau = 300 ms. The nominal Reynolds number based on the fuel velocity during injection, U(sub jet), is 5,000. A slow oxidizer co-flow properly ventilates the flame and an electrically heated wire loop serves as a continuous ignition source. Diagnostic techniques include video imaging, fine-wire thermocouples and thermopile radiometers, and gas sampling and standard emissions instruments (the last in the laboratory only).
Author (revised)
Buoyancy; Diffusion Flames; Turbulent Diffusion; Microgravity

20040084210 California Univ., Davis, CA, USA
Electric Current Activated Combustion Synthesis and Chemical Ovens Under Terrestrial and Reduced Gravity Conditions
Unuvar, C.; Frederick, D.; Anselmi-Tamburini, U.; Manerbino, A.; Guigne, J. Y.; Munir, Z. A.; Shaw, B. D.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 177; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Combustion synthesis (CS) generally involves mixing reactants together (e.g., metal powders) and igniting the mixture. Typically, a reaction wave will pass through the sample. In field activated combustion synthesis (FACS), the addition of an electric field has a marked effect on the dynamics of wave propagation and on the nature, composition, and homogeneity of the product as well as capillary flow, mass-transport in porous media, and Marangoni flows, which are influenced by gravity. The objective is to understand the role of an electric field in CS reactions under conditions where gravity-related effects are suppressed or altered. The systems being studied are Ti+Al and Ti+3Al. Two different ignition orientations have been used to observe effects of gravity when one of the reactants becomes molten. This consequentially influences the position and concentration of the electric current, which in turn influences the entire process. Experiments have also been performed in microgravity conditions. This process has been named Microgravity Field Activated Combustion Synthesis (MFACS). Effects of gravity have been demonstrated, where the reaction wave temperature and velocity demonstrate considerable differences besides the changes of combustion mechanisms with the different high currents applied. Also the threshold for the formation of a stable reaction wave is increased under zero gravity conditions. Electric current was also utilized with a chemical oven technique, where inserts of aluminum with minute amounts of tungsten and tantalum were used to allow observation of effects of settling of the higher density solid particles in liquid aluminum at the present temperature profile and wave velocity of the reaction.
Author
Microgravity; Electric Current; Combustion Synthesis; Titanium Aluminides

20040084215 Iowa State Univ. of Science and Technology, Ames, IA, USA
EPS (Electric Particle Suspension) Microgravity Technology Provides NASA with New Tools
Colver, Gerald M.; Greene, Nate; Xu, Hua; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 65; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Electric Particulate Suspension is a fire safety ignition test system being developed at Iowa State University with NASA support for evaluating combustion properties of powders, powder-gas mixtures, and pure gases in microgravity and gravitational atmospheres (quenching distance, ignition energy, flammability limits). A separate application is the use of EPS technology to control heat transfer in vacuum and space environment enclosures. In combustion testing, ignitable powders (aluminum, magnesium) are introduced in the EPS test cell and ignited by spark, while the addition of inert particles act as quenching media. As a combustion research tool, the EPS method has potential as a benchmark design for quenching powder flames that would provide NASA with a new fire safety standard for powder ignition testing. The EPS method also supports combustion modeling by providing accurate measurement of flame-quenching distance as an important parameter in laminar flame theory since it is closely related to characteristic flame thickness and flame structure. In heat transfer applications, inert powder suspensions (copper, steel) driven by electric fields regulate heat flow between adjacent surfaces enclosures both in vacuum (or gas) and microgravity. This simple E-field control can be particularly useful in space environments where physical separation is a requirement between heat exchange surfaces.
Author
Combustion; Microgravity; Heat Transfer

26
METALS AND METALLIC MATERIALS

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

20040081332 Ship Structure Committee, Washington, DC, USA
Interactive Buckling Testing of Stiffened Steel Plate Panels
2004; In English
Report No.(s): PB2004-105930; SSC-433; No Copyright; Avail: National Technical Information Service (NTIS)

A test matrix consisting of four test series was developed to examine the effect of bending moment, interaction index and damage on interactive buckling, or the interaction of plate buckling and overall column buckling. Full-scale specimens that resembled stiffened plate panels in ship structures were fabricated using welded or hot-rolled T-stiffeners. Ten tests, including eight for as-built specimens and two for damaged specimens, were carried out in a high-capacity testing system. This unique system was developed during a previous SSC project to study multiple buckling modes of stiffened plates under combined in-plane and out-of-plane loads, while maintaining an accurate representation of the boundary conditions applicable to a unidirectional stiffened plate within a grillage system.
NTIS
Ships; Buckling; Steels; Metal Plates

20040081421 Nuclear Metals, Inc., West Concord, MA, USA
Technical Papers of the Fifteenth Metallographic Group Meeting
Roman, H. Roth, Compiler; 1 May 1964; 245 pp.; In English; Fifteenth Metallographic Group Meeting, 17-19 May 1961, Aiken, SC, USA; See also 20040081422 - 20040081439
Report No.(s): NMI-4997; CONF-610501; No Copyright; Avail: CASI; A11, Hardcopy

The following papers were processed for inclusion into the NA&SD database:Metallography - Ally of Nondestructive Testing in Evaluating Nuclear Fuel Components; Metallographic Preparation of Hard and Brittle Metals; Measurement of the Thickness of Aluminum Oxide Film; Preliminary Evaluation of a New Polishing Cloth; Metallographic Studies of Uranium-Fissium alloys; Microstructures of Compounds of Uranium, Thorium, and Beryllium; A Micrographic Study of the Effect of Moisture in the Air on Arc-cast Uranium; Monocarbide and Uranium Dicarbide at Room Temperature over Extended Periods; High Temperature Metallography of Uranium; Metallographic Preparation of Alumina Coated UO2 Spheres in Graphite; Hydride Appearance nd Distribution in Zirconium Base Alloys; Metallography of Fused UO; Metallography of Irradiated Dispersion-type Fuel; Hot Cell Metallographic Experience at Battelle; A Remote Metallographic Specimen Grinder; Metallography of U - 2 WT % Zr Alloy Before and After Irradiation; Experience with Vibratory Polishers and Design for Hot-cell Application; Remote Metallographic Preparation of Irradiated Aluminum-clad Lead-bonded Ceramic Fuel Pellets;

and Metallography of Pyrolytic Carbon Coated and Uncoated Uranium Carbide Spheres.
Derived from text
Metallography; Nuclear Fuels; Cladding; Nondestructive Tests

20040081423 Oak Ridge National Lab., TN, USA
Metallography of Pyrolytic Carbon Coated and Uncoated Uranium Carbide Spheres
DuBose, C. K. H.; Gray, R. J.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 198-237; In English; See also 20040081421; No Copyright; Avail: CASI; A03, Hardcopy

Techniques have been developed for the metallographic preparation and examination of carbon-coated and uncoated uranium carbide particles both in the unsupported condition and as-fabricated into graphite matrices. The particle coatings studied were deposited pyrolytically from a hydrocarbon gas, producing two morphological types of pyrolytic carbon coatings. In one type, the coating is smooth on the outer surface and a cross-sectional plane exhibits a laminar onion-ring type structure, while in the other type, the surface has a pebble-like finish with the cross section exhibiting a columnar or conical grain structure. The microstructures of the carbide particles show variations in the amount of UC and UC2 with an average ratio of approximately 70% UC2 and 30% UC. Heat treatments above 1800 C may produce uranium oxides at the particle-coating interface.
Author
Metallography; Uranium Carbides; Pyrolytic Materials; Spheres

20040081424 Oak Ridge National Lab., TN, USA
Experience with Vibratory Polishers and Design for Hot-cell Application
Long, E. L., Jr.; Gray, R. J.; Meador, J. T.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 184-188; In English; See also 20040081421; No Copyright; Avail: CASI; A01, Hardcopy

Vibratory polishers have been in use in the Metallography Group of the Metallurgy Division of Oak Ridge National Laboratory (ORNL) for approximately four years. During this period, vibratory polishing has changed from a complementary tool for standard metallographic techniques to the prime method of specimen preparation. An estimated 90 percent of all specimens are now prepared through vibratory polishing in this department. Because of the inherent advantages offered for remote application, vibratory polishing will be incorporated into the new metallographic hot cells of the alpha-gamma facility now under construction at ORNL. Remote equipment has been designed, fabricated, and tested for semiproduction type work. Initial results are most encouraging. Several necessary design changes were made which in turn had to be compensated for in the vibratory system to maintain proper polishing action. To complement the remoted polishers, a new specimen holder was designed which allows easy insertion and removal of the specimens using master-slave type manipulators.
Author
Vibratory Polishing; Metallography

20040081425 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Metallography of U - 2 wt % Zr Alloy Before and After Irradiation
Angerman, C. L.; McDonell, W. R.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 163-183; In English; See also 20040081421
Contract(s)/Grant(s): AEC-AT(07-2)-1; No Copyright; Avail: CASI; A03, Hardcopy

As part of a general study of the factors that will produce the maximum volume stability of metallic fuel elements for power reactors, optical and electron metallography and electron diffraction were used to characterize (a) the response of unirradiated U - 2 wt. % Zr alloy to heat treatment and (b) the effects of irradiation on the alloy. A new technique was developed for isolating the second-phase particles for identification by electron diffraction. Both the matrix grain size and the second-phase distribution were dependent upon heat treatment before irradiation. Two important observations were (a) the retention of the gamma(sub 1) phase upon quenching from temperatures in the beta + gamma(sub 1) region, and (b) the formation of the delta phase instead of gamma(sub 2) upon annealing at 650 C, which is in the alpha + gamma(sub 2) region. Irradiation of a two-phase structure of alpha + delta formed large concentrations of gas bubbles near the second-phase particles. As the burnup increased, the second-phase particles became distorted and some of the particles dissolved.
Author
Metallography; Uranium Alloys; Zirconium Alloys; Irradiation

20040081426 Argonne National Lab., IL, USA

Metallography: Ally of Nondestructive Testing in Evaluating Nuclear Fuel Components

Bean, C. H.; McGonnagle, W. J.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 1-21; In English; See also 20040081421; No Copyright; Avail: CASI; A03, Hardcopy

In many fabricated metal parts one can ascertain just how bad or how good they are and even determine the internal structure and composition.When inspecting for flaws little or no metallographic preparation is needed to confirm the presence of defects. But with a greater resolution in testing procedures there is a greater need for metallography to evaluate the test results.One can see that as the sensitivity of existing nondestructive equipment improves and the introduction of new testing procedures gains wider acceptance, the individuals responsible for evaluating the results of these tests have to rely on metallographic examinations For example, many members of the Nondestructive Testing Group at Argonne can do metallography. This is not prize winning type metallography but rather metallography to serve as a guide to the nondestructive testing engineer With help from metallography nondestructive testing will be used more and more to determine quantitatively the internal structure of both sound and defective materials. It is hoped,and it is possible, that in time nondestructive tests will gain wider acceptance for describing internal structure and composition.

Derived from text

Metallography; Nondestructive Tests; Nuclear Fuels

20040081429 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA

Measurement of the Thickness of Aluminum Oxide Film

Costas, L. P.; Hoxie, E. C.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 26-35; In English; See also 20040081421

Contract(s)/Grant(s): AEC-AT(07-2)-1; No Copyright; Avail: CASI; A02, Hardcopy

The thickness of corrosion products on the surfaces of aluminum-clad nuclear fuel elements is of great interest and importance in the operation of nuclear reactors. The corrosion products of aluminum cause a resistance to heat transfer that is proportional to their thickness; the resultant increase in cladding and core temperatures causes higher cladding corrosion rates and increases the tendency for fission product gases to form bubbles in the core. After the corrosion products obtain some limiting thickness they may spall from the surface and cause operating difficulties with the reactor because of pluggage of small orifices or create maintenance problems because of increased radioactivity in locations where the corrosion products accumulate. This paper is divided into two parts; the first section describes measurement of corrosion product thickness by metallographic techniques, and the second section describes measurement of corrosion product thickness by optical methods.

Author

Cladding; Nuclear Fuel Elements; Corrosion

20040081430 Argonne National Lab., IL, USA

Metallographic Studies of Uranium-Fissium Alloys

Zegler, S. T.; Nevitt, M. V.; Wilhelmi, R. P.; Conner, R. A., Jr.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 45-54; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

The term ″fissium″ (abbreviation ″Fs″) refers to the complement of fission product elements that remain in a spent reactor fuel following pyrometallurgical refining in fuel recycling programs. In the Experimental Breeder Reactor II program at Argonne National Laboratory, a series of uranium-fissium alloys, inwhich the fissium compleent consists of elements Zr,Nb,Mo,Ru, Rh and Pd, has been of interest during the past several years. Two earlier papers have described portions of an investigation concerned with the structures, phase relations and certain properties of these alloys. One of the alloys studied designated as a U - 5 w/o Fs - 2.25 w/o Zr alloy_ has the composition detailed in Table I. The present paper deals with the metallographic aspects of a recent study concerned with the influence of small additions of Si,Ti, Al and Y in improving the ductility of castings of this alloy. The cast structure of the alloy, which is quite brittle, has been shown to consist of martensitic alpha uranium plus small amounts of two other phases: (i) a phase that is isostructural with the delta phase of the U-Mo system and which exists as a stable phase in the alloy at temperatures i o be ow 552 C; and (2) a CsCl-type phase ZrRu, which occurs as a stable phase from as high as 975 C down to room temperature. The appearance of these phases in the microstructure of a small cast button of the alloy prepared by arc melting and casting is shown in Fig. i. Martensitic alpha uranium is the major phase. The (U_ Mo) delta phase appears as a very fine precipitate (dark) in the alpha matrix. The ZrRu compound occurs in a discontinuous intergranular network (light), to which the brittleness of the alloy is largely attributed.

Author

Nuclear Fuels; Cast Alloys; Metallography; Uranium Alloys

20040081431 Oak Ridge National Lab., TN, USA

A Micrographic Study of the Effect of Moisture in the Air on Arc-cast Uranium Monocarbide and Uranium Dicarbide at Room Temperature over Extended Periods

Gray, R. J.; Dubose, C. K. H.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 62-75; In English; See also 20040081421; No Copyright; Avail: CASI; A03, Hardcopy

The development of fissures in uranium carbide metallographic specimens were observed over a four year period. Specimens consisting primarily of uranium monocarbide showed an increase in the severity of fissures after periodic removal from a storage desicator for examination in ambient laboratory atmosphere. In uranium monocarbide and uranium dicarbide specimens, the amount of fissuring varied inversely with the uranium dicarbide content in the range of 10 to 90 percent. Uranium monocarbide specimens with minor amounts of uranium were observed to develop fissures and minute eruptions in a short time if fully exposed to the ambient atmosphere, but could be sealed in a desiccator and remain inactive for a seemingly indefinite time.

Author

Uranium Carbides; Microstructure

20040081432 Battelle Memorial Inst., Columbus, OH, USA

Microstructures of Compounds of Uranium, Thorium, and Beryllium

Thompson, C. R.; Farkas, M. S.; Bauer, A. A.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 55-61; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

As very high operating temperatures are sought for nuclear reactor operation, metallic fuels and moderators become inadequate. Consequently, high melting point compounds of uranium, thorium, and beryllium are of interest. The metallography of some of the compounds of uranium, thorium, thorium-uranium, and beryllium is discussed.

Author

Microstructure; Metallography; Beryllium Compounds; Thorium Compounds; Uranium Compounds

20040081433 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA

High Temperature Metallography of Uranium

Angerman, C. L.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 76-84; In English; See also 20040081421

Contract(s)/Grant(s): AEC-AT(07-2)-1; No Copyright; Avail: CASI; A02, Hardcopy

This report describes the equipment and procedures used in an additional attempt to observe the microstructure of uranium at elevated temperatures. These techniques were used in a preliminary study of the changes in grain structure during the allotropic transformations.

Author

Uranium; Microstructure

20040081434 Battelle Memorial Inst., Columbus, OH, USA

Metallographic Preparation of Alumina Coated UO2 Spheres in Graphite

Lott, J. M.; Farkas, M. S.; Bauer, A. A.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 85-91; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

Three problems arise in the metallographic preparation of alumina-coated UO 2 in graphite. The maintenance of a flat surface is made difficult by the presence of three materials of different hardness. Secondly, the coated spheres must be retained in the graphite during the cutting and grinding operation. The third problem is that of obtaining the correct, full-density appearance of the alumina and UO 2. Normal preparation methods are discussed and techniques adapted for Hot Cell preparation are explained.

Author

Aluminum Oxides; Metallography; Uranium Oxides

20040081435 General Electric Co., Schenectady, NY, USA

Hydride Appearance nd Distribution in Zirconium Base Alloys

Bibb, A. E.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 92-109; In English; See also 20040081421; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes observations made at KAPL on the appearance and distribution of hydrides in zirconium base

alloys. It is shown that the hydrides may be precipitated on habit planes within grains or at grain boundaries regardless of whether the hydrogen is introduced by means of a Sieverts type apparatus or picked up during corrosion in an aqueous medium. Irradiation in a neutron flux does not alter the tendency of the hydrides to precipitate on habit planes or at grain boundaries.
Author
Zirconium Alloys; Precipitation (Chemistry)

20040081436 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Metallography of Fused UO2
Cole, G. R.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 110-123; In English; See also 20040081421
Contract(s)/Grant(s): AEC-AT(07-2)-1; No Copyright; Avail: CASI; A03, Hardcopy

Arc fusion is an excellent method for producing very dense UO2, but impurities characteristic of the fusion process are often introduced. Metallography has been a valuable supplement to the usual analytical tools for detecting and identifying impurities. Microhardness and tarnishing behavior of microscopic impurities, together with X-ray and chemical techniques, were used to identify excess oxygen, metallic uranium, uranium carbide, and uranium nitride in arcfused uranium dioxide. The shapes of the secondphase inclusions were of little aid to their identification. Microexamination of randomly selected chunks was employed to estimate the content and distribution of uranium and uranium nitride impurities in as-polished UO2. Excess oxygen contentwas estimated by lineal analysis of micrographs of polished-and-etched UO2; results agreed well with those obtained from weight gain on ignition to U308.
Author
Uranium Oxides; Metallography

20040081437 Oak Ridge National Lab., TN, USA
Metallography of Irradiated Dispersion-type Fuel Elements
Richt, A. E.; Manthos, E. J.; Sims, E. D.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 124-133; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

Some unusual effects noted in the metallographic examination of irradiated dispersion-type fuel elements are shown and the significance of these observations on the performance of the elements is discussed,
Author
Metallography; Nuclear Fuel Elements

20040081438 Battelle Memorial Inst., Columbus, OH, USA
Hot Cell Metallographic Experience at Battelle
McGrath, F. E.; Bauer, A. A.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 134-156; In English; See also 20040081421; No Copyright; Avail: CASI; A03, Hardcopy

During the operation of the Battelle Hot Cells, a wide variety of irradiated structural, control, and fuel materials have been examined. The metallographic procedures are outlined and typical results achieved with various materials are shown Observed affects of irradiation are noted.
Author
Metallography; Metal Fuels

20040081439 Argonne National Lab., IL, USA
Remote Metallographic Preparation of Irradiated Aluminum-clad Lead-bonded Ceramic Fuel Pellets
Carlander, R.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 189-197; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

Irradiated aluminum-clad lead-bonded thoria - 26 W/o urania Borax-IV fuel pellets which had been irradiated to 30,000 MWD/T were prepared for metallographic processing by sectioning on an abrasive cutoff machine and by mounting in coldsetting plastic. Extreme care was exercised in the grinding operation to insure particle retention by the mounting material. The samples were ground through 600-grit silicon carbide papers and polished successively on silk cloths impregnated with 3- and 1-micron diamond abrasive. The samples were final-polished with 1/4-micron diamond compound on microcloth. This procedure is convenient in that it is also used for uranium and its alloys, Results of this polishing technique are considered

quite good, especially taking into account the wide variation in hardness of the materials contained in the fuel plate composite. Author

Metallography; Metal Fuels; Polishing

20040082294 Florida Univ., Gainesville, FL, USA

Investigation of Three-Dimensional Stress Fields and Slip Systems for FCC Single Crystal Superalloy Notched Specimens

Arakere, Nagaraj K.; Magnan, Shannon; Ebrahimi, Fereshteh; Ferroro, Luis; [2004]; 1 pp.; In English; ASME Turbo Expo, 14-17 Jun. 2004, Vienna, Austria

Contract(s)/Grant(s): 376-20-20; No Copyright; Avail: Other Sources; Abstract Only

Metals and their alloys, except for a few intermetallics, are inherently ductile, i.e. plastic deformation precedes fracture in these materials. Therefore, resistance to fracture is directly related to the development of the plastic zone at the crack tip. Recent studies indicate that the fracture toughness of single crystals depends on the crystallographic orientation of the notch as well as the loading direction. In general, the dependence of crack propagation resistance on crystallographic orientation arises from the anisotropy of (i) elastic constants, (ii) plastic deformation (or slip), and (iii) the weakest fracture planes (e.g. cleavage planes). Because of the triaxial stress state at the notch tips, many slip systems that otherwise would not be activated during uniaxial testing, become operational. The plastic zone formation in single crystals has been tackled theoretically by Rice and his co-workers and only limited experimental work has been conducted in this area. The study of the stresses and strains in the vicinity of a FCC single crystal notch tip is of relatively recent origin. We present experimental and numerical investigation of 3D stress fields and evolution of slip sector boundaries near notches in FCC single crystal tension test specimens, and demonstrate that a 3D linear elastic finite element model that includes the effect of material anisotropy is shown to predict active slip planes and sectors accurately. The slip sector boundaries are shown to have complex curved shapes with several slip systems active simultaneously near the notch. Results are presented for surface and mid-plane of the specimens. The results demonstrate that accounting for 3D elastic anisotropy is very important for accurate prediction of slip activation near FCC single crystal notches loaded in tension. Results from the study will help establish guidelines for fatigue damage near single crystal notches.

Author

Ductility; Plastic Deformation; Crack Propagation; Crack Tips; Fracture Strength; Single Crystals

20040082321 NASA Marshall Space Flight Center, Huntsville, AL, USA

Alkali Metal Heat Pipe Life Issues

Reid, Robert S.; [2004]; 14 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICAP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains color illustrations

Report No.(s): Paper-4291; No Copyright; Avail: CASI; A03, Hardcopy

One approach to space fission power system design is predicated on the use of alkali metal heat pipes, either as radiator elements, thermal management components, or as part of the core primary heat-transfer system. This synopsis characterizes long-life core heat pipes. References are included where more detailed information can be found. Specifics shown here are for demonstrational purposes and do not necessarily reflect current Project Prometheus point designs.

Author

Alkali Metals; Heat Pipes; Life (Durability); Reactors; Systems Engineering

20040082395 NASA Glenn Research Center, Cleveland, OH, USA

Superalloy Lattice Block Structures

Nathal, M. V.; Whittenberger, J. D.; Hebsur, M. G.; Kantzos, P. T.; Krause, D. L.; June 2004; 18 pp.; In English; 10th International Symposium on Superalloys, 19-23 Sep 2004, Champion, PA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-714-04-06

Report No.(s): NASA/TM-2004-213109; E-14448; No Copyright; Avail: CASI; A03, Hardcopy

Initial investigations of investment cast superalloy lattice block suggest that this technology will yield a low cost approach to utilize the high temperature strength and environmental resistance of superalloys in lightweight, damage tolerant structural configurations. Work to date has demonstrated that relatively large superalloy lattice block panels can be successfully investment cast from both IN-718 and Mar-M247. These castings exhibited mechanical properties consistent with the strength of the same superalloys measured from more conventional castings. The lattice block structure also accommodates significant

deformation without failure, and is defect tolerant in fatigue. The potential of lattice block structures opens new opportunities for the use of superalloys in future generations of aircraft applications that demand strength and environmental resistance at elevated temperatures along with low weight.
Derived from text
Heat Resistant Alloys; Mechanical Properties; Castings

20040082430 Technical Research Centre of Finland, Espoo, Finland
Facts and Views on the Role of Anionic Impurities, Crack Tip Chemistry and Oxide Films in Environmentally Assisted Cracking
Aaltonen, P.; Bojinov, M.; Helin, M.; Kinnunen, P.; Laitinen, T.; 2003; 96 pp.; In English
Report No.(s): PB2004-106322; VTT-RN-2148; No Copyright; Avail: CASI; A05, Hardcopy

The aim of this literature study has been to evaluate the level of understanding of the role of anionic impurities in environmentally assisted cracking (EAC) of iron- and nickel-based alloys in the coolant conditions of a boiling water reactor (BWR) type nuclear power plant, mainly under normal water chemistry (NWC). The study has been motivated by a need to find the most relevant experimental approaches that can be applied when looking for correlations between crack growth rate and measurable electrochemical and chemical parameters.
NTIS
Boiling Water Reactors; Nuclear Power Plants

20040082436 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Berkeley, CA, USA, National Renewable Energy Lab., Golden, CO
Mutual Passivation of Group IV Donors and Isovalent Nitrogen in Diluted GaN(sub x)As(sub 1-x) Alloys
Yu, K. M.; Wu, J.; Walukiewicz, W.; Shan, W.; Beeman, J.; 2003; In English
Report No.(s): DE2003-816786; No Copyright; Avail: National Technical Information Service (NTIS)

We demonstrate the mutual passivation of electrically active group IV donors and isovalent N atoms in the GaN(sub x)As(sub 1-x) alloy system. This phenomenon occurs through the formation of a donor-nitrogen bond in the nearest neighbor IV(sub Ga)-N(sub As) pairs. In Si doped GaInN(sub 0.017)As(sub 0.983) the electron concentration starts to decrease rapidly at an annealing temperature of 700 C from(approx) 3 x 10(sup 19)cm(sup -3) in the as-grown state to less than 10(sup 16)cm(sup -3) after an annealing at 900 C for 10 s. At the same time annealing of this sample at 950 C increases the gap by about 35 meV, corresponding to a reduction of the concentration of the active N atoms by an amount very close to the total Si concentration. We also show that the formation of Si(sub Ga)-N(sub As) pairs is controlled by the diffusion of Si via Ga vacancies to the nearest N(sub As) site. The general nature of this mutual passivation effect is confirmed by our study of Ge doped GaN(sub x)As(sub 1-x) layers formed by N and Ge co-implantation in GaAs followed by pulsed laser melting.
NTIS
Gallium Arsenides; Passivity; Electron Density (Concentration)

20040082833 Texas Univ., Austin, TX
Response and Crushing of Cellular Solids Under Uniaxial and Multiaxial Loadings
Kyriakides, S.; Apr. 21, 2004; 9 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0145
Report No.(s): AD-A423997; AFRL-SR-AR-TR-04-0270; No Copyright; Avail: CASI; A02, Hardcopy

The compressive response of many cellular materials is characterized by a sharp initial rise to a load maximum followed by an extended load plateau which terminates by a second sharp rise in load. This behavior was illustrated using aluminum and polymeric honeycombs under in-plane loads. It was shown that these characteristics are associated with inelastic buckling and a localization process in which only a narrow zone of cells experiences collapse at any given time. The collapse spreads in a steady-state fashion until all the material is affected. Models of several levels were developed and used to establish the mechanical properties of interest including the elastic modulus, the ″yield″ stress and the energy absorption capacity under both uniaxial and multiaxial loading conditions. The project continued with a similar investigation of open cell aluminum and polymeric foams. The mechanical response of such foams has the same general characteristics as those seen in honeycombs. The modeling of this behavior again requires proper representation of the cellular microstructure and appropriate modeling of the base material. The work on foams continues beyond d the termination of this project.
DTIC
Amount; Crushing; Solids

20040083976 NASA Marshall Space Flight Center, Huntsville, AL, USA

Metal Matrix Composite LOX Turbopump Housing via Novel Tool-less Net-Shape Pressure Infiltration Casting Technology

Shah, Sandeep; Lee, Jonathan; Bhat, Biliyar; Wells, Doug; Gregg, Wayne; Marsh, Matthew; Genge, Gary; Forbes, John; Salvi, Alex; Cornie, James A., et al.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 23 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Metal matrix composites for propulsion components offer high performance and affordability, resulting in low weight and cost. The following sections in this viewgraph presentation describe the pressure infiltration casting of a metal matrix composite LOX turbopump housing: 1) Baseline Pump Design and Stress Analysis; 2) Tool-less Advanced Pressure Infiltration Casting Process; 3) Preform Splicing and Joining for Large Components such as Pump Housing; 4) Fullscale Pump Housing Redesign.

Derived from text

Metal Matrix Composites; Engine Parts; Turbine Pumps; Casting

20040083987 NASA Marshall Space Flight Center, Huntsville, AL, USA

Environmentally Compatible Vapor-Phase Corrosion Inhibitor for Space Shuttle Hardware

Novak, Howard L.; Hall, Phillip B.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 9 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

USA-SRB Element is responsible for the assembly and refurbishment of the non-motor components of the SRB as part of Space Shuttle. Thrust Vector Control (TVC) frames structurally support components of the TVC system located in the aft skirt of the SRB. TVC frames are exposed to the seacoast environment after refurbishment and, also, to seawater immersion after splashdown, and during tow-back to CCAFS-Hangar AF refurbishment facilities. During refurbishment operations it was found that numerous TVC frames were experiencing internal corrosion and coating failures, both from salt air and seawater intrusions. Inspectors using borescopes would visually examine the internal cavities of the complicated aluminum alloy welded tubular structure. It was very difficult for inspectors to examine cavity corners and tubing intersections and particularly, to determine the extent of the corrosion and coating anomalies. Physical access to TVC frame internal cavities for corrosion removal and coating repair was virtually impossible, and an improved method using a Liquid (water based) Vapor-phase Corrosion Inhibitor (LVCI) for preventing initiation of new corrosion, and mitigating and/or stopping existing corrosion growth was recommended in lieu of hazardous paint solvents and high VOC / solvent based corrosion inhibitors. In addition, the borescopic inspection method used to detect corrosion, and/or coating anomalies had severe limitations because of part geometry, and an improved non-destructive inspection (NDI) method using Neutron Radiography (N-Ray) was also recommended.

Derived from text

Corrosion Prevention; Space Shuttles; Neutron Radiography; Thrust Vector Control; Anomalies; Pipes (Tubes); Endoscopes

20040083990 NASA Marshall Space Flight Center, Huntsville, AL, USA

Syntactic Metals: A Survey of Current Technology

Erikson, Ray; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A02, Hardcopy

Syntactic metals are a relatively new development in materials science. Several approaches to synthesizing these materials have been tried, and the handful of researchers in this field are beginning to make progress in defining useful compositions and processes. Syntactic metals can provide materials with dramatically improved specific strength and stiffness over their parent alloys, while retaining the isotropy that makes ordinary metals preferable to fiber-reinforced laminated composites in many applications. This paper reviews syntactic material concepts in general, the current state of the art (including the author's own work in syntactic aluminum), and the direction of future developments.

Author

Metals; Materials Science; Technology Utilization; Surveys

20040083996 European Aeronautic Defence and Space Co. Launch Vehicles, Les Mureaux, France

Aluminum Lithium Alloys Use for Reusable Future Launcher Cryogenic Metallic Tanks

Bonnafe, Jean Pierre; Gabard, Daniel; Grosjean, Eric; 5th Conference on Aerospace Materials, Processes, and Environmental

Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

In the context of future European TSTO (Two Stages To Orbit) reusable launch vehicles, development of reusability concepts implies the strong evolution of both technical and mechanical requirements on the launcher structure design, and more precisely on the cryogenics tanks. It is now necessary to introduce new design criteria and mechanical requirements in order to achieve mass reduction of the different structures of the launcher with improved and increased stress conditions, together with a capability to be reused after reduced maintenance operations. This is particularly crucial on cryogenic tanks which will be for the first time reusable.

Derived from text

Reusable Launch Vehicles; Design Analysis; Cryogenics; Lithium Alloys; Fuel Tanks

20040084034 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Corrosion of Highly Specular Vapor Deposited Aluminum (VDA) on Earthshade Door Sandwich Structure

Plaskon, Daniel; Hsieh, Cheng; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

High-resolution infrared (IR) imaging requires spacecraft instrument design that is tightly coupled with overall thermal control design. The JPL Tropospheric Emission Spectrometer (TES) instrument measures the 3-dimensional distribution of ozone and its precursors in the lower atmosphere on a global scale. The TES earthshade must protect the 180-K radiator and the 230-K radiator from the Earth IR and albedo. Requirements for specularity, emissivity, and solar absorptance of inner surfaces could only be met with vapor deposited aluminum (VDA). Circumstances leading to corrosion of the VDA are described. Innovative materials and processing to meet the optical and thermal cycle requirements were developed. Examples of scanning electronmicroscope (SEM), atomic force microscope (AFM), and other surface analysis techniques used in failure analysis, problem solving, and process development are given. Materials and process selection criteria and development test results are presented in a decision matrix. Examples of conditions promoting and preventing galvanic corrosion between VDA and graphite fiber-reinforced laminates are provided.

Author

Vapor Deposition; Aluminum; Corrosion; Sandwich Structures

20040084041 NASA Marshall Space Flight Center, Huntsville, AL, USA

Effects of Thermal Exposure on Properties of Al-Li Alloys

Shah, S.; Wells, D.; Stanton, W.; Lawless, K.; Russell, C.; Wagner, J.; Domack, M.; Babel, H.; Farahmand, B.; Schwab, D., et al.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 25 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this investigation is to evaluate the effects of thermal exposure on the mechanical properties of both production mature and developmental Al-Li alloys

Derived from text

Evaluation; Thermodynamic Properties; Mechanical Properties

20040084048 NASA Marshall Space Flight Center, Huntsville, AL, USA

High Strength and Wear Resistant Aluminum Alloy for High Temperature Applications

Lee, Jonathan A.; Chen, Po Shou; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 6 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A02, Hardcopy

Originally developed by NASA as high performance piston alloys to meet U.S. automotive legislation requiring low exhaust emission, the novel NASA alloys now offer dramatic increase in tensile strength for many other applications at elevated temperatures from 450 F (232 C) to about 750 F (400 C). It is an ideal low cost material for cast automotive components such as pistons, cylinder heads, cylinder liners, connecting rods, turbo chargers, impellers, actuators, brake calipers and rotors. It can be very economically produced from conventional permanent mold, sand casting or investment casting, with silicon content ranging from 6% to 18%. At high silicon levels, the alloy exhibits excellent thermal growth stability, surface hardness and wear resistant properties.

Author

Aluminum Alloys; High Temperature; High Strength; Thermal Stability; Wear Resistance; Investment Casting

20040084051 NASA Marshall Space Flight Center, Huntsville, AL, USA

Vacuum Plasma Spray Forming of Copper Alloy Liners for Regeneratively Cooled Liquid Rocket Combustion Chambers

Zimmerman, Frank; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Vacuum plasma spray (VPS) has been demonstrated as a method to form combustion chambers from copper alloys NARloy-Z and GRCop-84. Vacuum plasma spray forming is of particular interest in the forming of CuCrNb alloys such as GRCop-84, developed by NASA s Glenn Research Center, because the alloy cannot be formed using conventional casting and forging methods. This limitation is related to the levels of chromium and niobium in the alloy, which exceed the solubility limit in copper. Until recently, the only forming process that maintained the required microstructure of CrNb intermetallics was powder metallurgy formation of a billet from powder stock, followed by extrusion. This severely limits its usefulness in structural applications, particularly the complex shapes required for combustion chamber liners. This paper discusses the techniques used to form combustion chambers from CuCrNb and NARloy-Z, which will be used in regeneratively cooled liquid rocket combustion chambers.

Author

Combustion Chambers; Copper Alloys; Regenerative Cooling; Vacuum; Plasmas (Physics); Structural Design; Chromium

20040084161 Michigan Univ., Ann Arbor, MI, USA

Spatially Heterogeneous Dynamics and the Early Stages of Crystal Nucleation and Growth in Metastable Liquids and Colloids

Bergroth, M.; Solomon, T.; Gebremichael, Y.; Keys, A. S.; Vogel, M.; Solomon, M. J.; Glotzer, S. C.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 55-56; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

In this poster, we show that particle motion in simulated supercooled, metastable liquids is highly coordinated and that particles move primarily along one-dimensional, string-like paths. We further show the tendency for particles in the metastable liquid to form clusters in which the particles are arranged in icosahedra, and we show how strings emanate from and wrap around these clusters. We show that particle motion is dynamically facilitated, supporting recent theoretical predictions. We further show how the degree of facilitation and cooperative particle motion increases with the degree of undercooling. Finally, we present preliminary results on the early stages of nucleation in the deeply supercooled liquid.

Derived from text

Metallic Glasses; Metastable State; Solidification; Crystal Growth

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20040081427 Oak Ridge National Lab., TN, USA

Preliminary Evaluation of a New Polishing Cloth

Crouse, R. S.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 36-44; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

A new type of commercial polishing cloth has recently been evaluated by the Metallography Group of the Metallurgy Division at the Oak Ridge National Laboratory. The cloth was tested using vibratory and hand polishing methods with several metals and alloys. The polishing action provided is quite rapid and reduces the time for the primary polishing step by about fifty percent, It was not suitable for polishing aluminum nor for final polishing with Linde B abrasive. The cloth, sold under the trade name Pellon, is not as universally applicable as nylon or silk but definitely has a place in metallographic operations.

Author

Polishing; Fabrics; Metals

20040081428 Illinois Inst. of Tech., Chicago, IL, USA
Metallographic Preparation of Hard and Brittle Metals
Dvorak, J. R.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 22-25; In English; See also 20040081421; No Copyright; Avail: CASI; A01, Hardcopy

A new and somewhat unconventional method has been developed for the metallographic preparation of boroncarbon alloys. These hard and brittle materials are polished in three steps utilizing an automatic mechanical polisher. Two of these operations are performed without the use of conventional cloth-covered wheels. The abrasive is applied directly to a wheel which is fabricated from selected materials. Although the polishing procedure is somewhat time consuming_ it would be almost impossible to polish these samples by conventional techniques. The results are excellent; very little relief is produced even in samples of the boron carbide-graphite eutectic. No chipping or ″pullouts″ are produced in the extremely brittle phases. This same polishing technique can be successfully applied to other brittle materials.
Author
Boron Carbides; Metallography; Polishing

20040082066 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Improving UV Resistance of High Strength Fibers Used In Large Scientific Balloons
Said, M.; Gupta, A.; Seyam, A.; Mock, G.; Theyson, T.; February 20, 2004; 2 pp.; In English; 35th COSPAR 2004, July 2004; No Copyright; Avail: Other Sources; Abstract Only

For the last three decades, NASA has been involved in the development of giant balloons that are capable of lifting heavy payloads of equipment (such as large telescopes and scientific instruments) to the upper atmosphere. While the use of such balloons has led to scientific discoveries, the demand for competitive science payloads and observational programs continues to rise. The NASA Balloon Program Office has entered a new phase of research to develop an Ultra Long Duration Balloon (ULDB) that will lift payloads of up to 3,600 kg to altitudes of up to 40 km. The flight duration is targeted to ranges between 30 to 100 days. Attaining these target durations requires the development of a super-pressure balloon design. The use of textile structures have already been established in these missions in the form of high strength tendons essential for the super pressure pumpkin design. Unfortunately, high strength fibers lose significant strength upon exposure to Ultra Violet (UV) radiation. Such UV degradation poses a serious challenge for the development of the ULDB. To improve the mission performance of the ULDB, new methods for protecting the tendons from the environmental effects need to be developed. NASA and NC State University College of Textiles are undertaking a research program to address these issues. Four tracks have been identified to prepare finishes that are believed to enhance the resistance of high strength fibers to UV. These tracks are: (a) self-polymerizing, (b) diffusion application, (c) polymer-filled with 30-40% UV absorber, and (d) combination of dyeing plus surface application. Four high performance fibers have been selected for this research investigation. These are Vectran (trademark), Spectra (trademark), Kevlar (trademark) and, PBO (Zylon (trademark)). This work will address the current progress of evaluating the performance of the UV finishes. This will be accomplished by comparing the tensile properties (strength, breaking elongation, modulus, etc) of untreated, unexposed to UV fibers; untreated exposed to UV fibers; and treated exposed to UV fibers.
Author
High Altitude Balloons; Fibers; Ultraviolet Radiation; Radiation Shielding

20040082246 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Contamination of Critical Surfaces from NVR Glove Residues Via Dry Handling and Solvent Cleaning
Sovinski, Marjorie F.; April 2004; 21 pp.; In English
Report No.(s): NASA/TM-2004-212752; Rept-2004-01401-1; No Copyright; Avail: CASI; A03, Hardcopy

Gloves are often used to prevent the contamination of critical surfaces during handling. The type of glove chosen for use should be the glove that produces the least amount of non-volatile residue (NVR). This paper covers the analysis of polyethylene, nitrile, latex, vinyl, and polyurethane gloves using the contact transfer and gravimetric determination methods covered in the NASA GSFC work instruction Gravimetric Determination and Contact Transfer of Non-volatile Residue (NVR) in Cleanroom Glove Samples, 541-WI-5330.1.21 and in the ASTM Standard E-1731M-95, Standard Test Method for Gravimetric Determination of Non-Volatile Residue from Cleanroom Gloves. The tests performed focus on contamination of critical surfaces at the molecular level. The study found that for the most part, all of the gloves performed equally well in the contact transfer testing. However, the polyethylene gloves performed the best in the gravimetric determination testing, and therefore should be used whenever solvent contact is a possibility. The nitrile gloves may be used as a substitute for latex gloves when latex sensitivity is an issue. The use of vinyl gloves should be avoided, especially if solvent contact is a

possibility. A glove database will be established by Goddard Space Flight Center (GSFC) Code 541 to compile the results from future testing of new gloves and different glove lots.
Derived from text
Solvents; Gloves; Gravimetry; Polyethylenes

20040082317 NASA Marshall Space Flight Center, Huntsville, AL, USA
Subsurface Stress Fields in FCC Single Crystal Anisotropic Contacts
Arakere, Nagaraj K.; Knudsen, Erik; Swanson, Gregory R.; Duke, Gregory; Ham-Battista, Gilda; [2004]; 11 pp.; In English; 2004 ASME Turbo Expo, 14-17 Jun. 2004, Vienna, Austria; Original contains color illustrations
Contract(s)/Grant(s): 376-20-20
Report No.(s): GT2004-53913; Copyright; Avail: CASI; A03, Hardcopy

Single crystal superalloy turbine blades used in high pressure turbomachinery are subject to conditions of high temperature, triaxial steady and alternating stresses, fretting stresses in the blade attachment and damper contact locations, and exposure to high-pressure hydrogen. The blades are also subjected to extreme variations in temperature during start-up and shutdown transients. The most prevalent high cycle fatigue (HCF) failure modes observed in these blades during operation include crystallographic crack initiation/propagation on octahedral planes, and non-crystallographic initiation with crystallographic growth. Numerous cases of crack initiation and crack propagation at the blade leading edge tip, blade attachment regions, and damper contact locations have been documented. Understanding crack initiation/propagation under mixed-mode loading conditions is critical for establishing a systematic procedure for evaluating HCF life of single crystal turbine blades. This paper presents analytical and numerical techniques for evaluating two and three dimensional subsurface stress fields in anisotropic contacts. The subsurface stress results are required for evaluating contact fatigue life at damper contacts and dovetail attachment regions in single crystal nickel-base superalloy turbine blades. An analytical procedure is presented for evaluating the subsurface stresses in the elastic half-space, based on the adaptation of a stress function method outlined by Lekhnitskii. Numerical results are presented for cylindrical and spherical anisotropic contacts, using finite element analysis (FEA). Effects of crystal orientation on stress response and fatigue life are examined. Obtaining accurate subsurface stress results for anisotropic single crystal contact problems require extremely refined three-dimensional (3-D) finite element grids, especially in the edge of contact region. Obtaining resolved shear stresses (RSS) on the principal slip planes also involves considerable post-processing work. For these reasons it is very advantageous to develop analytical solution schemes for subsurface stresses, whenever possible.
Author
Single Crystals; Stress Functions; Triaxial Stresses; Surface Properties; Anisotropy

20040082335 NASA Glenn Research Center, Cleveland, OH, USA
Current Status of Hybrid Bearing Damage Detection
Dempsey, Paula J.; Certo, Joseph M.; Morales, Wilfredo; June 2004; 17 pp.; In English; 2004 Annual Meeting and Exhibition, 17-29 Nat 2004, Toronto, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-704-01-03; DA Proj 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-212882; ARL-TR-3119; E-14296; No Copyright; Avail: CASI; A03, Hardcopy

Advances in material development and processing have led to the introduction of ceramic hybrid bearings for many applications. The introduction of silicon nitride hybrid bearings into the high pressure oxidizer turbopump, on the space shuttle main engine, led NASA to solve a highly persistent and troublesome bearing problem. Hybrid bearings consist of ceramic balls and steel races. The majority of hybrid bearings utilize Si3N4 balls. The aerospace industry is currently studying the use of hybrid bearings and naturally the failure modes of these bearings become an issue in light of the limited data available. In today s turbine engines and helicopter transmissions, the health of the bearings is detected by the properties of the debris found in the lubrication line when damage begins to occur. Current oil debris sensor technology relies on the magnetic properties of the debris to detect damage. Since the ceramic rolling elements of hybrid bearings have no metallic properties, a new sensing system must be developed to indicate the system health if ceramic components are to be safely implemented in aerospace applications. The ceramic oil debris sensor must be capable of detecting ceramic and metallic component damage with sufficient reliability and forewarning to prevent a catastrophic failure. The objective of this research is to provide a background summary on what is currently known about hybrid bearing failure modes and to report preliminary results on the detection of silicon nitride debris, in oil, using a commercial particle counter.
Derived from text
Ceramics; Hybrid Composites; Turbine Pumps; Damage; Transmissions (Machine Elements); High Pressure

20040082416 Swedish Defence Research Establishment, Tumba
Future Ceramic Armours
Lundberg, P.; Magnusson, P.; Sep. 2003; 20 pp.; In Swedish
Report No.(s): PB2004-104632; FOI-R-0921-SE; No Copyright; Avail: CASI; A03, Hardcopy

A gradient material, useful for armor application, is under development at FOI. The idea is to improve the protection capability and multi-impact performance by mechanically joining the ceramic and the backing. The final material must have sufficient hardness on the outside to be able to erode and stop tungsten carbide projectiles. A graded material based on titanium carbide and titanium has been produced. Future work will focus on optimization of the gradient to get the best relation between protection performance and structural properties.
NTIS
Armor; Ceramics; Projectiles

20040082791 Georgia Inst. of Tech., Atlanta, GA
Lightweight, Robust and Low Cost Carbide/Tungsten Composites in Near Net Shapes for Advanced Solid-Fueled Rocket Nozzles for the IHPRPT Program
Sandhage, Ken H.; Feb. 2004; 64 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0349
Report No.(s): AD-A423925; AFRL-SR-AR-TR-04-0288; No Copyright; Avail: CASI; A04, Hardcopy

The DCP process has been used to synthesize very- high-melting, lightweight tungsten/carbide or tungsten/boride composites via conversion reactions of the following type: (M) + WX(s) = MX(s) + W(s) (1) where (M) is a reactive element dissolved within a Cu-bearing melt, and WX and MX are ceramic reactant and product phases, respectively. Reactions leading to ZrC/W, TiC/W, HfC/W, and ZrB2/W composites at \h1300 deg C have been demonstrated. Conversion reactions leading to ZrC/W and HfC/W composites proceeded via the formation of a layer of ZrC or HfC on a layer of W that, in turn, formed on the WC reactant particles. Hence, upon complete reaction, the sizes and distributions of the carbide and tungsten products were directly related to the sizes and distributions of the WC reactant particles. Conversion reactions leading to ZrB2/W and TiC/W composite proceeded via the formation of discrete ZrB2 or TiC particles in the melt, so that the sizes and distributions of these product phases were not highly correlated to the sizes and distributions of the WB and WC reactant articles, respectively . Porous WC preforms with hourglass shapes (for rocket nozzle liners) were produced by gel casting.
DTIC
Carbides; Ceramic Matrix Composites; Fabrication; Low Cost; Refractory Materials; Rocket Nozzles; Shapes; Tungsten; Tungsten Carbides

20040082836 Clemson Univ., SC
Effects of Scale-Hierarchy in Ordered Electro- Active Polymer Nanocomposites
May 15, 2004; 20 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0105
Report No.(s): AD-A424000; AFRL-SR-AR-TR-04-0298; No Copyright; Avail: CASI; A03, Hardcopy

Electroactive nanocomposites are generally composed of a ″minority″ nanophase and a majority-phase host. Interaction between the phases is three fold: exchange of charge mediation of radiative energy, and morphological based on energy minimization. The mesostructure of the nanophase can strongly influence the properties of the composite to the point of being totally dissimilar to the original pure organic. This program was intended to introduce levels of order from studies of fractally connected to fully coordinated assembly.
DTIC
Carbon Nanotubes; Hierarchies; Nanocomposites; Nanostructures (Devices)

20040082845 University of Central Florida, Orlando, FL
PTR Glass Melting Facility for Fabrication of Diffractive Optical Elements
Glebov, Leonid; May 15, 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0303; Proj-3484
Report No.(s): AD-A424017; AFRL-SR-AR-TR-04-0299; No Copyright; Avail: CASI; A03, Hardcopy

The proposed research instrumentation, a Photo- Thermo-Refractive (PTR) glass Melting Facility, is used to support MDA-funded and new research initiatives in the study of photosensitive glass for rugged volume diffractive optical elements. This instrumentation significantly impacts existing efforts in hologram recording in PTR glasses. Diffractive optical elements

made from this glass are used in the BMDO/MDA- funded program ″Holographic Narrow-Band Filter and Data Storage for Optical Target Characterization″ and a number of PTR-related projects funded by DARPA, AFRL, and ARL. The author's significant achievements in the creation of these new diffractive optical elements were enabled by a ″COMPUTER CONTROLLED RECORDING and TESTING SYSTEM FOR STUDIES of HOLOGRAPHIC OPTICAL ELEMENTS″ that was designed and constructed under a BMDO/ DURIP project that was started in the year 2000. The level of current and future efforts is limited by having to use 400 ml fused silica crucibles for melting PTR glass. The new melting system is based on the use of a platinum crucible that allows fabrication of PTR glass blanks with a diameter of up to 50 mm and a homogeneity of refractive index better than 10(exp -5). This homogeneous photosensitive glass enables the creation of diffractive optical components with the spectral and angular selectivity that are necessary for further development of PTR technology for high power laser beam control and optical target characterization. Glass produced by the requested system will be utilized in new research efforts for high-accuracy holographic optical elements used in laser and opto-electronic devices for optical target characterization, such as narrow band filters, attenuators, beam splitters, samplers, and multiplexers. (15 figures, 11 refs.)
DTIC
Diffractive Optics; Fabrication; Glass; Holography; Melting; Optical Equipment; Optical Materials; Photosensitivity

20040082981 Oak Ridge National Lab., TN, USA, Army Research Lab., Aberdeen Proving Ground, MD, USA, Missouri Univ., Rolla, MO, USA
Compressive Creep and Thermophysical Performance of Mullite Refractories
Hemrick, J. G.; Wereszczak, A. A.; Karakus, M.; Liu, K. C.; Wang, H.; 2003; In English
Report No.(s): DE2003-814325; ORNL/TM-2002/84; No Copyright; Avail: National Technical Information Service (NTIS)
Compressive creep testing of ten commercially available mullite refractories was performed at 1300-1450 C and at static stresses between 0.2-0.6 MPa. These refractories were examined because they are used in borosilicate glass furnace crowns and superstructures along with in sidewall applications. Additionally, despite their high cost ((approx)$500/ft(sup 3)) they are cheaper than other refractories such as chrome alumina ((approx)$3000/ft(sup 30) or fusion-cast alumina ((approx)900/ft(sup 3)) which are used as replacements for traditional silica refractories in harsh oxy-fuel environments. The corrosion resistances of these ten materials were also evaluated. In addition, measurements were made that tracked their dimensional stability, phase content, microstructure, and composition as a function of temperature and time. The techniques used for these characterizations and their respective analyses are described. An intent of this study was to provide objective and factual results whose interpretations were left to the reader.
NTIS
Mullites; Refractories

20040083029 Aerospace Corp., El Segundo, CA
Friction at the Contact Between Bearing Balls and Cotton-Phenolic Cage Material
Bertrand, P. A.; Jun. 10, 2004; 27 pp.; In English
Contract(s)/Grant(s): FA8802-04-C-0001
Report No.(s): AD-A423792; TR-2004(8565)-3; SMC/EL-TR-04-15; No Copyright; Avail: CASI; A03, Hardcopy
Current analytical models of ball-bearing behavior generally use values of cage (also called ball separator or ball retainer) friction that do not accurately reflect the dependence of cage friction on the lubrication regime at the cage interfaces (boundary, mixed, or hydrodynamic; starved or fully flooded) , ball speed, lubricant identity, ball material and cage material, or they use values that are essentially adjustable parameters. This work reports measurements of coefficient of friction (COF) for balls of three different materials against flats of cotton-phenolic retainer material using three different oils. COFs were measured at 200 g load and sliding speeds between 0. 007 and 9.7 m/s. Steel, silicon nitride, and TiC-coated steel balls were used; a mineral oil, a poly-alpha-olefin, and a trialkylated cyclopentane of the same viscosity were used as lubricants. The complex variation of COF with experimental conditions is related to current theories of lubricant behavior. The data are provided in an appendix for use in modeling programs.
DTIC
Ball Bearings; Cotton; Friction; Lubricating Oils

20040083974 Luna Innovations, Inc., Blacksburg, VA, USA
Rotational Molding of Thermotropic Liquid Crystal Polymers
Rogers, Martin; Stevenson, Paige; Clark, Paul; Baird, Donald; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 5 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Rotational molding is a unique process for producing hollow plastic parts. Rotational molding offers low cost tooling and can produce very large parts with complicated shapes. Products made by rotational molding include water tanks with capacities up to 20,000 gallons, truck bed liners, playground equipment, air ducts, Nylon fuel tanks, pipes, toys, stretchers, kayaks, pallets, corn harvest points, and many others. Rotational molding forms hollow structural parts adopting the shape of the inside wall of the mold. An illustration of the rotational molding process is presented. The four basic steps in the rotational molding process of thermotropic liquid crystal polymers are also described.
Derived from text
Liquid Crystals; Polymers; Molding Materials; Anisotropy; Polyester Resins

20040083999 Colorado School of Mines, Golden, CO, USA
The Effect of Gravity on the Combustion Synthesis of Porous Biomaterials
Castillo, M.; Zhang, X.; Moore, J. J.; Schowengerdt, F. D.; Ayers, R. A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 6 pp.; In English; See also 20040083973; Original contains black and white illustrations
Contract(s)/Grant(s): NCCW-0096; NCC8-238; NCC3-659; No Copyright; Avail: CASI; A02, Hardcopy

Production of highly porous composite materials by traditional materials processing is limited by difficult processing techniques. This work investigates the use of self propagating high temperature (combustion) synthesis (SHS) to create porous tricalcium phosphate (Ca3(PO4)2), TiB-Ti, and NiTi in low and microgravity. Combustion synthesis provides the ability to use set processing parameters to engineer the required porous structure suitable for bone repair or replacement. The processing parameters include green density, particle size, gasifying agents, composition, and gravity. The advantage of the TiB-Ti system is the high level of porosity achieved together with a modulus that can be controlled by both composition (TiB-Ti) and porosity. At the same time, NiTi exhibits shape memory properties. SHS of biomaterials allows the engineering of required porosity coupled with resorbtion properties and specific mechanical properties into the composite materials to allow for a better biomaterial.
Derived from text
Gravitational Effects; Combustion Synthesis; Porous Materials

20040084036 NASA Glenn Research Center, Cleveland, OH, USA
Standardization Efforts for Mechanical Testing and Design of Advanced Ceramic Materials and Components
Salem, Jonathan A.; Jenkins, Michael G.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 11 pp.; In English; See also 20040083973; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Advanced aerospace systems occasionally require the use of very brittle materials such as sapphire and ultra-high temperature ceramics. Although great progress has been made in the development of methods and standards for machining, testing and design of component from these materials, additional development and dissemination of standard practices is needed. ASTM Committee C28 on Advanced Ceramics and ISO TC 206 have taken a lead role in the standardization of testing for ceramics, and recent efforts and needs in standards development by Committee C28 on Advanced Ceramics will be summarized. In some cases, the engineers, etc. involved are unaware of the latest developments, and traditional approaches applicable to other material systems are applied. Two examples of flight hardware failures that might have been prevented via education and standardization will be presented.
Author
Ceramics; Standardization; Mechanical Engineering

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*.

20040082061 Mainstream Engineering Corp., Rockledge, FL, USA
Low-Pressure Long-Term Xenon Storage for Electric Propulsion
Grisnik, Stanley, Technical Monitor; Back, Dwight D.; Ramos, Charlie; December 1998; 175 pp.; In English
Contract(s)/Grant(s): NAS3-97184; WU 632-1B-1B-0D; SBIR-00.00-0000
Report No.(s): NASA/CR-1998-208685; E-11448; No Copyright; Avail: CASI; A08, Hardcopy

This Phase I SBIR demonstrated the capabilities of an advanced Xe storage and delivery system for electric propulsion having less-complex Xe management and control hardware, much reduced storage pressures, and competitive weights and volumes compared with compressed gas and two phase storage. Flow rates of 5-50 sccm were typically controlled to within +/-0.4-0.6% in steady flow tests by applying a maximum power of about 30 W. These flow rates are also variable by applying different levels of power. The flow control hardware (heater, restrictor, isolation valve, pressure sensor, PID controller) weighs a fraction of current XFC/PMS systems at about 273 g. The stored energy is a factor of 5 or more lower than compressed gas or two phase storage, which greatly reduces the risk of catastrophic space accidents (e.g., mishaps with comet/asteroid rendevous, planetary landing impact, micro-meteors) and minimizes pre-launch loading/handling hazards. The lower pressures of the system also make it ideal for long-term missions where venting (two phase) or micro-leaks (compressed gas) may reduce or risk viable storage times. This Xe storage and delivery design is applicable to LEO, MEO, or GEO NSSK, and space missions such as Mars and Europa.
Author
Xenon; Electric Propulsion; Propellant Properties; Propellant Storage

20040083985 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using Isothermal Microcalorimetry to Determine Compatibility of Structural Materials with High Test Hydrogen Peroxide (HTP) Propellant
Gostowski, Rudy; Villegas, Yvonne; Nwosisi, Genne; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

High-Test Hydrogen Peroxide (HTP) propellant (greater than or equal to 70%) offers many advantages in space launch applications; however, materials used in construction of propulsion systems must be shown to be compatible with HTP. Isothermal Microcalorimetry (IMC) was used to determine the compatibility of several metallic and non-metallic materials with 90% HTP. The results of these experiments agreed with those from immersion bath tests when the values were converted to %Active Oxygen Loss per week (%AOL/wk).
Author
Hydrogen Peroxide; Calorimeters; Rocket Propellants; Compatibility; Isothermal Processes; Heat Measurement

20040083991 Qualis Corp., Huntsville, AL, USA
Standard Chemical Ignition Source Characteristics for Flammability Testing
Engel, Carl D.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; Original contains color illustrations
Contract(s)/Grant(s): NAS8-01050; No Copyright; Avail: CASI; A01, Hardcopy

A viewgraph presentation on the composition and performance specifications of chemical ignitors used in material flammability testing is presented.
CASI
Flammability; Ignition; Chemical Compounds; Functional Design Specifications

20040083998 NASA White Sands Test Facility, NM, USA
Standards Development Activities at White Sands Test Facility
Baker, D. L.; Beeson, H. D.; Saulsberry, R. L.; Julien, H. L.; Woods, S. S.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A02, Hardcopy

The development of standards and standard activities at the JSC White Sands Test Facility (WSTF) has been expanded to include the transfer of technology and standards to voluntary consensus organizations in five technical areas of importance to NASA. This effort is in direct response to the National Technology Transfer Act designed to accelerate transfer of technology to industry and promote government-industry partnerships. Technology transfer is especially important for WSTF, whose longterm mission has been to develop and provide vital propellant safety and hazards information to aerospace designers, operations personnel, and safety personnel. Meeting this mission is being accomplished through the preparation of consensus guidelines and standards, propellant hazards analysis protocols, and safety courses for the propellant use of hydrogen, oxygen, and hypergols, as well as the design and inspection of spacecraft pressure vessels and the use of pyrovalves

in spacecraft propulsion systems. The overall WSTF technology transfer program is described and the current status of technology transfer activities are summarized.
Author
Standards; Test Facilities; Technology Transfer; Propulsion System Performance

20040084008 DE Technologies, Inc., King of Prussia, PA, USA
Evaluation of EL-Form Rhenium for Zero Erosion Materials
Foedinger, Richard; Price, Jeffrey; Lanam, RIchard; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

High-performance solid rocket motors (SRMs) for hypervelocity missile systems utilize reduced smoke propellants that have very high burning rates to deliver very short burn times (less than 1 sec) at high pressures (3000 to 5000 psia). In addition, they must be energetic and deliver high specific impulse and thrust; thus, flame temperatures exceed 5000 F. These high flame temperatures in conjunction with high operating pressures with relatively small nozzle throat diameters (1 to 2 in.) and high mass flow rates lead to unacceptable nozzle throat erosion rates, which, in turn, adversely affect motor-delivered performance and, therefore, missile system performance. Current SRM nozzle materials can experience significant throat erosion under these environments, resulting in lower delivered thrust and impulse levels. Initial testing performed under a Phase II Small Business Innovation Research Program has demonstrated the performance of an electroformed (EL-Form) rhenium nozzle liner that offers zero erosion in a high burn rate, high-pressure and temperature environment. Further development and follow-on tests are underway to evaluate El-Form rhenium-coated graphite throat inserts. The results of the nozzle insert design development, analysis, and testing will be discussed.
Author
Electroforming; Erosion; Rhenium; Missile Systems; Solid Propellant Rocket Engines

20040084016 Lockheed Martin Michoud Space Systems, New Orleans, LA, USA
Composite LOX Tank Development
McBain, Michael C.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The development of polymer composite cryogenic tanks is a critical step in creating the next generation of launch vehicles. Future launch vehicles need to minimize the gross liftoff weight (GLOW), which is possible due to the 28%-41% reduction in weight that composite materials can provide over current aluminum technology. The development of composite cryogenic tankage, feedlines, and un-pressurized structure are key enabling technologies for performance and cost enhancements for Reusable Launch Vehicles (RLVs). The technology development for composite tanks has provided direct and applicable data for feedlines, un-pressurized structure, material compatibility, and cryogenic fluid containment for highly loaded complex structures and interfaces. All three types of structure have similar material systems, processing parameters, scaling issues, analysis methodologies, NDE development, damage tolerance, and repair scenarios. Composite cryogenic tankage is the most complex of the 3 areas and provides the largest breakthrough in technology. A building block approach has been employed to bring this family of difficult technologies to maturity. This approach has matured composite materials, processes, design, analysis, and test methods technologies through a series of composite test programs beginning with the NASP program, to meet aggressive performance goals for reusable launch vehicles. In this paper, the development and application of advanced composites for RLV use is described with special emphasis on the X-34 composite LOX tank test article.
Author
Liquid Oxygen; Propellant Tanks; Composite Materials; Polymers; X-34 Reusable Launch Vehicle

20040084026 NASA White Sands Test Facility, NM, USA
Shuttle Primary Reaction Control Subsystem Thruster Fuel Valve Pilot Seal Extrusion: A Failure Correlation
Waller, Jess; Saulsberry, Regor L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 18 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Pilot operated valves (POVs) are used to control the flow of hypergolic propellants monomethylhydrazine (fuel) and nitrogen tetroxide (oxidizer) to the Shuttle orbiter Primary Reaction Control Subsystem (PRCS) thrusters. The POV

incorporates a two-stage design: a solenoid-actuated pilot stage, which in turn controls a pressure-actuated main stage. Isolation of propellant supply from the thruster chamber is accomplished in part by a captive polytetrafluoroethylene (PTFE) pilot seal retained inside a Custom 455.1 stainless steel cavity. Extrusion of the pilot seal restricts the flow of fuel around the pilot poppet, thus impeding or preventing the main valve stage from opening. It can also prevent the main stage from staying open with adequate force margin, particularly if there is gas in the main stage actuation cavity. During thruster operation on-orbit, fuel valve pilot seal extrusion is commonly indicated by low or erratic chamber pressure or failure of the thruster to fire upon command (Fail-Off). During ground turnaround, pilot seal extrusion is commonly indicated by slow gaseous nitrogen (GN2) main valve opening times (greater than 38 ms) or slow water main valve opening response times (greater than 33 ms). Poppet lift tests and visual inspection can also detect pilot seal extrusion during ground servicing; however, direct metrology on the pilot seat assembly provides the most quantitative and accurate means of identifying extrusion. Minimizing PRCS fuel valve pilot seal extrusion has become an important issue in the effort to improve PRCS reliability and reduce associated life cycle costs.
Author
Fuel Valves; Space Shuttle Orbiters; Extruding; Seals (Stoppers); Aircraft Pilots; Reaction Kinetics; Hypergolic Rocket Propellants; Control Systems Design; Failure Analysis

20040084140 San Diego State Univ., San Diego, CA, USA
Flammability Map for Microgravity Flame Spread
Bhattacharjee, Subrata; Paolini, Chris; Wakai, Kazunori; Takahashi, Shuhei; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 57-58; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Recently, a simplified theory has been advanced to predict radiative extinction in a quiescent environment. It has been shown that steady flame spread over a fuel with a thickness greater than a critical thickness is impossible in a microgravity environment, irrespective of any ambient or fuel parameters. Building upon this result, we have extended this analysis to a general case of microgravity flame spread at low opposing velocity over fuels of any thickness - thermally thin or thick. Spread rate expressions, similar to de Ris formulas have been developed by including surface radiation as a representative loss mechanism in the surface energy balance.
Derived from text
Flame Propagation; Flammability; Microgravity

20040084143 Purdue Univ., West Lafayette, IN, USA
Nickel-coated Aluminum Particles: A Promising Fuel for Mars Missions
Shafirovich, Evgeny; Varma, Arvind; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 151-152; In English; See also 20040084137
Contract(s)/Grant(s): NNC04AA36A; No Copyright; Avail: CASI; A01, Hardcopy

Combustion of metals in carbon dioxide is a promising source of energy for propulsion on Mars. This approach is based on the ability of some metals (e.g. Mg, Al) to burn in CO2 atmosphere and suggests use of the Martian carbon dioxide as an oxidizer in jet or rocket engines. Analysis shows that CO2/metal propulsion will reduce significantly the mass of propellant transported from Earth for long-range mobility on Mars and sample return missions. Recent calculations for the near-term missions indicate that a 200-kg ballistic hopper with CO2/metal rocket engines and a CO2 acquisition unit can perform 10-15 flights on Mars with the total range of 10-15 km, i.e. fulfill the exploration program typically assigned for a rover. Magnesium is currently recognized as a candidate fuel for such engines owing to easy ignition and fast burning in CO2. Aluminum may be more advantageous if a method for reducing its ignition temperature is found. Coating it by nickel is one such method. It is known that a thin nickel layer of nickel on the surface of aluminum particles can prevent their agglomeration and simultaneously facilitate their ignition, thus increasing the efficiency of aluminized propellants.
Author
Coatings; Nickel; Carbon Dioxide; Atmospheric Composition; Metal Combustion; Metal Propellants; Fuel Combustion

20040084191 California Univ., Berkeley, CA, USA
Effect of Varied Air Flow on Flame Structure of Laminar Inverse Diffusion Flames
Mikofski, M. A.; Blevins, L. G.; Williams, T. C.; Shaddix, C. R.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 113-114; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The structure of laminar inverse diffusion flames (IDFs) of methane and ethylene in air was studied using a cylindrical

co-flowing burner. Inverse diffusion flames are similar to normal diffusion flames, except that the relative positions of the fuel and oxidizer are reversed. Several flames of the same fuel flow-rate yet various air flow-rates were examined. Flame heights were obtained using visible images and measurements of hydroxyl (OH) laser-induced fluorescence (LIF). Radiation from soot surrounding the IDF was found to mask the reaction zone in visible images. As a result, flame heights determined from visible images were overestimated. The height of the reaction zone as indicated by OH LIF was shown to be a more relevant measure of height. The concentration and position of polycyclic aromatic hydrocarbons (PAHs) and soot were observed using LIF and laser-induced incandescence (LII). PAH LIF and soot LII indicated that PAH and soot are present on the fuel side of the flame, and that soot is located closer to the reaction zone than PAH. Ethylene flames produced significantly higher PAH LIF and soot LII signals than methane flames, which is consistent with the sooting propensity of ethylene. Photographs of ethylene IDFs, shown, demonstrate that flame height scales with air flow-rate. Radiating soot almost entirely covers each ethylene flame, and only a small portion of the blue region is visible near the base of each flame. The upside-down U shape in each panel of Fig. 2 is OH LIF, which indicates the location of the reaction zone. PAHs are present on the outer (fuel) side of the reaction zone. PAH LIF is vaguely present in the LII images. The soot and PAH are present on the fuel side of the reaction zone, but the soot is closer to the reaction zone than the PAH.
Derived from text
Air Flow; Flames; Laminar Flow

20040084200 Kansas State Univ., Manhattan, KS, USA
Aggregates and Superaggregates of Soot with Four Distinct Fractal Morphologies
Sorensen, C. M.; Kim, W.; Fry, D.; Chakrabarti, A.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 161; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Soot formed in laminar diffusion flames of heavily sooting fuels evolves through four distinct growth phases which give rise to four distinct aggregate fractal morphologies. These results were inferred from large and small angle static light scattering from the flames, microphotography of the flames, and analysis of soot sampled from the flames. The growth stages occur approximately over five successive orders of magnitude in aggregate size. Computer simulations can reproduce the kinetics observed in aggregation and aerogelation of soot clusters and indicate that these four growth stages involve either diffusion limit aggregation or percolation in either three or two dimensions.
Author
Soot; Fractals; Aggregates; Diffusion Flames; Light Scattering

20040084208
Reducing Fuel Slosh In Spacecraft Propulsion Systems
Tolmachoff, Erik; Kezirian, Michael T.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 173; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Understanding the sloshing motion of liquid propellants in a partially-filled fuel tank is essential for determining and controlling spacecraft attitude (pointing). This investigation evaluates the importance of incorporating dynamic surface properties into the complete fluid transport model used to determine hydrodynamic flow stability. Pointing stability requirements necessitate an understanding of the fuel motion and its interaction with the complete spacecraft flexible dynamic model. This investigation relates the fluid fuel motion, which at launch can account for approximately one half of the total spacecraft mass, to the overall attitude control. The numerical model developed for this investigation simulates the motion of a liquid fuel and quantifies the surface waves which appear at the interface and the internal waves in the bulk fluid.
Author
Liquid Rocket Propellants; Liquid Sloshing

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*.

20040079786 NASA Wallops Flight Center, Wallops Island, VA, USA
Giant Vehicles
Said, Magdi A; Schur, Willi W.; Gupta, Amit; Mock, Gary N.; Seyam, Abdelfattah M.; Theyson, Thomas; 2004; 22 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Science and technology development from balloon-borne telescopes and experiments is a rich return on a relatively modest involvement of NASA resources. For the past three decades, the development of increasingly competitive and complex science payloads and observational programs from high altitude balloon-borne platforms has yielded significant scientific discoveries. The success and capabilities of scientific balloons are closely related to advancements in the textile and plastic industries. This paper will present an overview of scientific balloons as a viable and economical platform for transporting large telescopes and scientific instruments to the upper atmosphere to conduct scientific missions. Additionally, the paper sheds the light on the problems associated with UV degradation of high performance textile components that are used to support the payload of the balloon and proposes future research to reduce/eliminate Ultra Violet (UV) degradation in order to conduct long-term scientific missions.
Author
High Altitude Balloons; Radiation Effects; Fibers

20040082371 NASA Langley Research Center, Hampton, VA, USA
The Need for a Shear Stress Calibration Standard
Scott, Michael A.; [2004]; 9 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 23-762-55-MA
Report No.(s): AIAA Paper 2004-2302; No Copyright; Avail: CASI; A02, Hardcopy

By surveying current research of various micro-electro mechanical systems (MEMS) shear stress sensor development efforts we illustrate the wide variety of methods used to test and characterize these sensors. The different methods of testing these sensors make comparison of results difficult in some cases, and also this comparison is further complicated by the different formats used in reporting the results of these tests. The fact that making these comparisons can be so difficult at times clearly illustrates a need for standardized testing and reporting methodologies. This need indicates that the development of a national or international standard for the calibration of MEMS shear stress sensors should be undertaken. As a first step towards the development of this standard, two types of devices are compared and contrasted. The first type device is a laminar flow channel with two different versions considered: the first built with standard manufacturing techniques and the second with advanced precision manufacturing techniques. The second type of device is a new concept for creating a known shear stress consisting of a rotating wheel with the sensor mounted tangentially to the rim and positioned in close proximity to the rim. The shear stress generated by the flow at the sensor position is simply tau = (mu)r(omega)/h, where mu is the viscosity of the ambient gas, r the wheel radius, omega the angular velocity of the wheel, and h the width of the gap between the wheel rim and the sensor. Additionally, issues related to the development of a standard for shear stress calibration are identified and discussed.
Author
Calibrating; Microelectromechanical Systems; Sensors; Shear Stress

20040082631 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC
Defense Science Board Task Force on Missile Defense: Phase 3 - Modeling and Simulation
Mar. 2004; 96 pp.; In English
Report No.(s): AD-A423582; No Copyright; Avail: CASI; A05, Hardcopy

This report covers Phase III of the work of the Defense Science Board (DSB) Task Force on Missile Defense. Phase I examined mid- course discrimination. Phase II, a 2002 DSB Summer Study, examined the four issues shown in the chart above. Following completion of the Phase II report, the Director, Missile Defense Agency (MDA) asked the Task Force to examine modeling and simulation (M&S). The Under Secretary Defense for Acquisition, Technology and Logistics (USDAT&L) concurred. The request was further refined to the five areas shown. After a brief introduction, this report will cover each of the five issues in turn.
DTIC
Missile Defense; Missiles; Simulation

20040082741 Cincinnati Univ., OH
Noncontacting Thermoelectric Detection of Material Imperfections in Metals
Nagy, Peter B.; May 2004; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0293
Report No.(s): AD-A423831; AFRL-SR-AR-TR-04-0301; No Copyright; Avail: CASI; A02, Hardcopy

A unique nondestructive materials characterization facility has been established for non-contacting thermoelectric inspection of metals. The measurement system is based on a high-temperature SQUID magnetic scanner that is capable of detecting the weak magnetic field of thermoelectric currents developing around material imperfections when a conducting metal is subjected to external heating and cooling. Since the surrounding intact material serves as the reference electrode and there is no artificial interface between the host and the imperfect region to be detected, the inspection sensitivity is much higher than that of conventional thermoelectric systems. This new nondestructive inspection technique offers the following distinct advantages over conventional methods: (1) high sensitivity to subtle variations in material properties; (2) insensitivity to the size, shape, and other geometrical features of the specimen; (3) noncontacting nature with a substantial stand-off distance; and (4) the ability of probing deep into the material and penetrating through thick, multiple-layer structures. The potential applications of this method include detection of metallic inclusions, segregations, inhomogeneities, and tight cracks as well as quantitative characterization of hardening, fatigue, texture, and residual stresses.
DTIC
Defects; Inspection; Magnetometers; Metals; Nondestructive Tests; Thermoelectric Materials; Thermoelectricity

20040082773 Mohawk Innovative Technology, Inc., Albany, NY
Advanced Universal High Temperature Tribometer
Heshmat, Hooshang; May 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-02-C-0100
Report No.(s): AD-A423902; 02K02-11-50128; No Copyright; Avail: CASI; A03, Hardcopy

Small, mesoscopic-sized, steam-powered machines are being developed using new materials while operating at high speeds and temperatures in an effort to achieve high efficiencies and power densities. It is imperative that an in- depth understanding of material tribological properties be gained to ensure that the goal of long life and high efficiency are achieved in the developed machinery. Due to the wide range of parameters affecting wear, an advanced tribometer that accurately models the application environment and operating conditions is needed. The main objective of the high temperature steam tribometer project was to design, build, and test a new and advanced tribometer capable of determining friction wear and wear characteristics of various mesoscopic steam engine materials. The specimens installed in the developed tribometer can be tested at surface velocities greater than 50 m/s, under loads up to 400 N, while subjected to superheated steam at temperatures up to 600 degrees C. Metallic or ceramic test specimen discs from 1 to 4 inches in diameter and ball/pin specimens of 0. 25 inches in diameter may be used. The computer controls the tests and records friction force, environmental conditions, and disc speed. Key aspects of the building and testing of the tribometer are described, such as the installation and alignment of the samples, dynamics of the loading device, and the measurement system (normal load, friction, and wear rate). Tribological results of some initial tests on ceramics, metals and composites with steam lubrication also are presented. (20 figures)
DTIC
Friction; High Temperature; Steam; Superheating; Thermal Resistance; Tribology; Wear Resistance

20040083977 NASA Marshall Space Flight Center, Huntsville, AL, USA
Manufacturing Process Simulation of Large-Scale Cryotanks
Babai, Majid; Phillips, Steven; Griffin, Brian; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 5 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

NASA's Space Launch Initiative (SLI) is an effort to research and develop the technologies needed to build a second-generation reusable launch vehicle. It is required that this new launch vehicle be 100 times safer and 10 times cheaper to operate than current launch vehicles. Part of the SLI includes the development of reusable composite and metallic cryotanks. The size of these reusable tanks is far greater than anything ever developed and exceeds the design limits of current manufacturing tools. Several design and manufacturing approaches have been formulated, but many factors must be weighed during the selection process. Among these factors are tooling reachability, cycle times, feasibility, and facility impacts. The manufacturing process simulation capabilities available at NASA.s Marshall Space Flight Center have played a key role in down selecting between the various manufacturing approaches. By creating 3-D manufacturing process simulations, the varying approaches can be analyzed in a virtual world before any hardware or infrastructure is built. This analysis can detect and eliminate costly flaws in the various manufacturing approaches. The simulations check for collisions between devices, verify that design limits on joints are not exceeded, and provide cycle times which aide in the development of an optimized process flow. In addition, new ideas and concerns are often raised after seeing the visual representation of a manufacturing process flow. The output of the manufacturing process simulations allows for cost and safety comparisons to be performed between the various manufacturing approaches. This output helps determine which manufacturing process options reach the

safety and cost goals of the SLI. As part of the SLI, The Boeing Company was awarded a basic period contract to research and propose options for both a metallic and a composite cryotank. Boeing then entered into a task agreement with the Marshall Space Flight Center to provide manufacturing simulation support. This paper highlights the accomplishments of this task agreement, while also introducing the capabilities of simulation software.
Derived from text
Manufacturing; Computerized Simulation; Cryogenic Tanks; Reusable Launch Vehicles; Optimization

20040083984 NASA, USA
Precision Clean Hardware: Maintenance of Fluid Systems Cleanliness
Sharp, Sheila; Pedley, Mike; Bond, Tim; Quaglino, Joseph; Lorenz, Mary Jo; Bentz, Michael; Banta, Richard; Tolliver, Nancy; Golden, John; Levesque, Ray, et al.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 37 pp.; In English; See also 20040083973; Original contains color illustrations
Contract(s)/Grant(s): NAS15-10000; No Copyright; Avail: CASI; A03, Hardcopy

The ISS fluid systems are so complex that fluid system cleanliness cannot be verified at the assembly level. A ″build clean / maintain clean″ approach was used by all major fluid systems: Verify cleanliness at the detail and subassembly level. Maintain cleanliness during assembly.
Derived from text
Cleanliness; Maintenance; Contaminants; Elimination

20040084059 NASA Marshall Space Flight Center, Huntsville, AL, USA
Organic Binder Developments for Solid Freeform Fabrication
Cooper, Ken; Mobasher, Amir A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A number of rapid prototyping techniques are under development at Marshall Space Flight Center's (MSFC) National Center for Advanced Manufacturing Rapid Prototyping Laboratory. Commercial binder developments in creating solid models for rapid prototyping include: 1) Fused Deposition Modeling; 2) Three Dimensional Printing; 3) Selective Laser Sintering (SLS). This document describes these techniques developed by the private sector, as well as SLS undertaken by MSFC.
CASI
Rapid Prototyping; Manufacturing; Binders (Materials)

20040084107 Physics and Electronics Lab. TNO, The Hague, Netherlands
C4I Life Cycle Support
Gillis, M. P. W.; Koevoets, K. G. M.; June 2004; 37 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 015.32198
Report No.(s): FEL-03-A164; TD-2003-0073; Copyright; Avail: Other Sources

The life cycle support of C41 systems is a complex task due to the relative short life cycle. This study focussed on the current situation on life cycle support (design, procurement, upkeep, use and retirement), shortfalls in this process and possible ways to improve the life cycle support by the RNIN. Enhancing the testing capability and evolutionary introduction of new equipment (e.g. pilot projects) are both promising improvements. Both are shared under the name of ″Rapid improvement″. Besides Rapid improvement, a prominent role is foreseen for knowledge management and configuration management.
Author
Life (Durability); Life Support Systems; Configuration Management; Test Equipment

20040084144 Illinois Univ., Chicago, IL, USA
Partially Premixed Flame (PPF) Research for Fire Safety
Puru, Ishwar K.; Aggarwal, Suresh K.; Lock, Andrew J.; Hegde, Uday; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 135-136; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Incipient fires typically occur after the partial premixing of fuel and oxidizer. The mixing of product species into the fuel/oxidizer mixture influences flame stabilization and fire spread. Therefore, it is important to characterize the impact of different levels of fuel/oxidizer/product mixing on flame stabilization, liftoff and extinguishment under different gravity conditions. With regard to fire protection, the agent concentration required to achieve flame suppression is an important

consideration. The initial stage of an unwanted fire in a microgravity environment will depend on the level of partial premixing and the local conditions such as air currents generated by the fire itself and any forced ventilation (that influence agent and product mixing into the fire). The motivation of our investigation is to characterize these impacts in a systematic and fundamental manner.
Derived from text
Flame Propagation; Microgravity; Stabilization; Oxidizers

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COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20040081351 General Accounting Office, Washington, DC
Military Operations: Recent Campaigns Benefited from Improved Communications and Technology, but Barriers to Continued Progress Remain
Jun. 2004; 58 pp.; In English
Report No.(s): PB2004-106129; GAO-04-547; No Copyright; Avail: CASI; A04, Hardcopy

Recent U.S. combat operations in Kosovo, Afghanistan, and Iraq benefited from new Department of Defense (DOD) strategies and technologies, such as improvements in force networks and increased use of precision weapons, designed to address changes in the security environment resulting from the continuing terrorist threat and the advent of the information age. Based on the authority of the Comptroller General, GAO reviewed these conflicts, with a focus on bombing operations, to gain insight into the changes being implemented by DOD. This report focuses on (1) assessing the impact on operational effectiveness of improvements in force networks and in the use of precision weapons and (2) identifying key barriers to continued progress.
NTIS
Military Operations; Defense Program; System Effectiveness

20040082337 NASA Glenn Research Center, Cleveland, OH, USA
RF Telemetry System for an Implantable Bio-MEMS Sensor
Simons, Rainee N.; Hall, David G.; Miranda, Felix A.; June 2004; 11 pp.; In English; 2004 International Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-251-30-15
Report No.(s): NASA/TM-2004-212899; E-14307; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, a novel miniature inductor and a pick-up antenna for contact less powering and RF telemetry from implantable bio-MEMS sensors are presented. The design of the inductor and the pick-up antenna are discussed. In addition, the measured characteristics at the design frequency of 330 MHz have been shown.
Derived from text
Telemetry; Inductors; Remote Sensing; Microelectromechanical Systems

20040082339 NASA Glenn Research Center, Cleveland, OH, USA
Channel Temperature Model for Microwave AlGaN/GaN HEMTs on SiC and Sapphire MMICs in High Power, High Efficiency SSPAs
Freeman, Jon C.; June 2004; 20 pp.; In English; 2004 International Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA
Contract(s)/Grant(s): WBS 22-319-80-P5
Report No.(s): NASA/TM-2004-212900; E-14315-1; No Copyright; Avail: CASI; A03, Hardcopy

A key parameter in the design trade-offs made during AlGaN/GaN HEMTs development for microwave power amplifiers is the channel temperature. An accurate determination can, in general, only be found using detailed software; however, a quick estimate is always helpful, as it speeds up the design cycle. This paper gives a simple technique to estimate the channel temperature of a generic microwave AlGaN/GaN HEMT on SiC or Sapphire, while incorporating the temperature dependence of the thermal conductivity. The procedure is validated by comparing its predictions with the experimentally measured temperatures in microwave devices presented in three recently published articles. The model predicts the temperature to within

5 to 10 percent of the true average channel temperature. The calculation strategy is extended to determine device temperature in power combining MMICs for solid-state power amplifiers (SSPAs).
Derived from text
High Electron Mobility Transistors; Power Amplifiers; Silicon Carbides; Microwave Equipment; Solid State Devices; Temperature Dependence

20040082341 NASA Glenn Research Center, Cleveland, OH, USA
Printed Multi-Turn Loop Antenna for RF Bio-Telemetry
Simons, Rainee N.; Hall, David G.; Miranda, Felix A.; June 2004; 11 pp.; In English; 2004 Antennas and Propagation Society International Symposium, 20-26 Jun. 2004, Monterey, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-251-30-15
Report No.(s): NASA/TM-2004-212982; E-14374; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, a novel printed multi-turn loop antenna for contact-less powering and RF telemetry from implantable bio-MEMS sensors at a design frequency of 300 MHz is demonstrated. In addition, computed values of input reactance, radiation resistance, skin effect resistance, and radiation efficiency for the printed multi-turn loop antenna are presented. The computed input reactance is compared with the measured values and shown to be in fair agreement. The computed radiation efficiency at the design frequency is about 24 percent.
Derived from text
Loop Antennas; Telemetry; Radio Frequencies; Microelectromechanical Systems

20040082441 Technical Research Centre of Finland, Espoo, Finland
Communications Technologies. The VTT Roadmaps
Sipila, M.; 2002; In English
Report No.(s): PB2004-106320; VTT-RN-2146; No Copyright; Avail: National Technical Information Service (NTIS)

The view of VTT (Technical Research Centre of Finland) on the development of selected information and communication technologies is presented. The views are given as technology roadmaps in the areas of interoperability and mobility in future networks, micromechanical radio frequency systems, service architectures and smart human environments. The work is a part of a theme called Future Communications Technologies, one of VTT's strategic technology themes. The purpose of the work is to help the planners and players direct their activities towards better competitiveness in this rapidly developing field.
NTIS
Telecommunication; Interoperability; Micromechanics

20040082682 Army War Coll., Carlisle Barracks, PA
Reliable and Relevant National Communications System
Lake, Timothy L.; May 3, 2004; 27 pp.; In English
Report No.(s): AD-A423696; No Copyright; Avail: CASI; A03, Hardcopy

The National Communications System is a federal government command and control emergency communications system that requires a complete comprehensive review and emerging technological overhaul to ensure its reliability and relevance. Since its establishment in the early 1960s the system has gone through several organizational restructurings and System upgrades. With our nation under increased terrorist threats within our borders the reliability of the National Communications System is under extreme scrutiny. In 2002 a Presidential Directive transferred oversight of the organization from the Department of Defense to the newly established Department of Homeland Security. This paper will analyze the current National Communications System review its origins and recommend emerging technological improvements to support the National Security Council. It also will review the needs of federal state and local governments and then recommend implementation of emerging technological capabilities to enhance system reliability and relevance. Today more than ever before the commercial telecommunications infrastructure provides critical communications connectivity for our government's daily operations as well as emergency communications. The roles of civilian communications companies and their infrastructure also will be analyzed as it applies to emergency national communications support.
DTIC
Telecommunication

20040082685 Army War Coll., Carlisle Barracks, PA
Airpower Command and Control: Evolution of the Air and Space Operations Center as a Weapon System
Justice, Joseph H., III; Mar. 19, 2004; 29 pp.; In English
Report No.(s): AD-A423705; No Copyright; Avail: CASI; A03, Hardcopy

The primary purpose of this paper is to analyze the current direction of the AF Chief of Staff (CSAF) on the legitimacy of the AOC as a weapon system. The first step in this analysis process is to look at the evolution of the AOC and current construct as directed by the CSAF. The manning and training for the AOC is the focus of this research. Additionally this paper will address any issues or concerns in the development of the AOC as a weapon system. Finally the analysis will provide an overall assessment and recommendation to determine if the AOC as a weapon system meets the demands of a capabilities-based approach in the 21st century.
DTIC
Command and Control; Weapon Systems

20040082724 Army War Coll., Carlisle Barracks, PA
Network Centric Warfare - Transforming the U.S. Army
Porter, Carl D.; Mar. 19, 2004; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423794; No Copyright; Avail: CASI; A03, Hardcopy

The old paradigms of U.S. military operations in the industrial age are dead. Military relevance in the information-dominated 21st Century no longer comes from the industrial age concept of massing forces or attrition warfare. Rather, it comes from a new information age paradigm in which access to information enables the rapid employment of the right force at the right place and time to achieve strategic objectives, while preventing any adversary from doing the same. To achieve this position of dominance, the Department of Defense has embraced the concepts of Network Centric Warfare (NCW) as a way to transform the force and achieve Joint Vision 2020 objectives. This information age concept provides a systems view of the battle space that can radically compress the strategic, operational, and tactical levels of war and dramatically increase combat power through shared awareness and self-synchronization. The concept will not take hold in the U.S. Army, however, without a substantial effort to overcome impediments and a corresponding co-evolution of processes, organizations, and technology infrastructure. This research paper provides a summary of network centric warfare concepts and highlights some of the challenges of applying them throughout a transformed Army force. (4 tables, 2 figures, 69 refs.)
DTIC
Command and Control; Communication Networks; Military Operations; Situational Awareness; Warfare

20040082817 BAE Systems Integrated Defense Solutions, Inc., Austin, TX
Sensor Agent Processing Software (SAPS)
Beck, Steve; Reynolds, Joe; May 2004; 79 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-C-0159; Proj-H579
Report No.(s): AD-A423980; AFRL-IF-RS-TR-2004-122; No Copyright; Avail: CASI; A05, Hardcopy

The Defense Advanced Research Projects Agency (DARPA) Information Technology Office (ITO) sponsored the Sensor Information Technology (SensIT) program to develop and then demonstrate technologies for large wireless networks. Numerous commercial firms, universities, and research laboratories were given contracts to develop specific technologies required to support the overall objectives. Products from each organization were combined in a common architecture to demonstrate the capability of large wireless networks when applied to a large number of networked sensors collaborating to provide battlefield intelligence. BAE Systems, under contract with Air Force Research Laboratory (AFRL), was primarily responsible for the Sensor Agent Processing Software (SAPS). This report describes the scientific and technical work performed by BAE Systems under Contract F30602-99-C-0159. This includes design and development of the processor application software architecture, development of signal processing algorithms, and implementation of SAPS architecture to support numerous field tests and demonstrations. The report also describes how the BAE Systems' SAPS was combined with other key technologies developed by other SensIT participants to demonstrate that the technologies exist to effectively deploy and utilize large scale sensor networks. The report also addresses efforts undertaken by BAE systems to leverage the SensIT R&D success to develop sensor networks that can be deployed and used in environments such as Afghanistan and Iraq.
DTIC
Communication Networks

20040082961 Army War Coll., Carlisle Barracks, PA
Center for Strategic leadership, Issue Paper. October 2003, Volume 08-03. Reporters on the Ground: The Military and the Media's Joint Experience During Operation Iraqi Freedom
Pasquarett, Michael; Oct. 2003; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423934; No Copyright; Avail: CASI; A01, Hardcopy

During the planning for Operation Iraqi Freedom (OIF), the Department of Defense (DoD) developed an embedded media program that planned for larger numbers of embedded reporters throughout military units. Unlike Vietnam in the 1970s, this program resulted in television reporting from within Iraq, especially from those reporters embedded with front-line units, almost instantaneously. The speed that these reports made it on the air often outpaced the military's communication channels. Although it gave the American citizens an immediate close tip report of what their armed forces were doing, it handicapped media analysts and stateside reporters in their ability to put the raw reporting from the field into a larger context. Conversely, those TV journalists supplying these spectacular reports and engrossing pictures from the front line were also handicapped in that they were reporting in a vacuum, unable themselves to obtain any kind of perspective or context. How well did this program work? What went right and wrong and why? What needs to be done in the future to create a program that better informs the American people? These were just some of the issues discussed in a unique and wide-ranging workshop conducted by the USA Army War College's Center for Strategic Leadership.
DTIC
Embedding; Leadership

20040082973 Wisconsin Univ., Madison, WI, USA
Location-Centric Distributed Computational and Signal Processing in Microsensor Networks
Ramanathan, Parameswaran; May 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0555; DARPA ORDER-K285; Proj-K285
Report No.(s): AD-A423786; AFRL-IF-RS-TR-2004-121; No Copyright; Avail: CASI; A03, Hardcopy

The project addressed the following key challenges in the design of microsensor networks: (1) the need for simple and flexible programming abstraction, (2) the need for energy and bandwidth efficient collaborative signal processing algorithms, and (3) the need for robustness to sensor device failures. To address these challenges, the project developed an approach called location-centric computing. A library of communication primitives was developed based on this approach. These communication primitives were used to build a target tracking application that was robust to a large number of device failures. The associated collaborative signal processing algorithms and the corresponding information fusion algorithms were also developed as part of this project. The effectiveness of the approach and the associated algorithms were demonstrated through network simulations and through experimentation on a sensor network testbed.
DTIC
Communication Networks; Distributed Processing; Microinstrumentation; Position (Location); Sensors; Signal Processing

20040083035 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Netwars Based Study of a Joint Stars Link-16 Network
Cruz, Charlie I.; Mar. 2004; 62 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423871; AFIT/GCS/ENG/04-06; No Copyright; Avail: CASI; A04, Hardcopy

Both secure and anti-jam resistant, the Link-16 is the primary communications channel used by the Joint Surveillance Target Attack Radar System (Joint STARS) for the exchange of real-time tactical data among various ground, air, and sea platforms of the USA of America and North Atlantic Treaty Organization forces. This research explored the effect of increasing network traffic for imagery transfer to the mean delay when operating under different network topologies. Using Network Warfare Simulation (NETWARS), three different missions were simulated to run on five network topologies having a different number of participants, different assigned time slots, and stacked nets. As a result, this study determined that the Link-16 network is able to handle the increase in network traffic, from 30 kilobits per second to 50 kilobits per second, when using multiple stacked net configurations while assigning an adequate number of time slots. However, because each participant is limited to 128 time slots per second, the increased network traffic limits the communication ability of other participants.
DTIC
A Stars; Communication Networks; Data Links; Data Transmission

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*.

20040081340 Technical Research Centre of Finland, Espoo, Finland
The Utilization of Services Provided by Networked Home Appliances
Paakkonen, P.; 2002; 80 pp.; In Finnish
Report No.(s): PB2004-106087; VTT/RN-2157; No Copyright; Avail: CASI; A05, Hardcopy

This diploma thesis deals with the utilization of services provided by networked home appliances from outside of the home environment. Services are considered to be any information provided by a home appliance which the outside user can utilize. The processing of this information often produces functions in the controlled home devices. The biggest problems related to this subject are the wide variety of technologies used to network home appliances and the safety related to the control of these devices. The goal of this thesis is to implement the utilization of services from outside of the home environment offered by simple home networked appliances using a nomadic terminal.
NTIS
Networks; Controllers

20040081396 Ljubljana Univ., Ljubljana, Slovenia
Electrotechnical Review, Volume 71, No. 1-2
Zajc, Baldomir, Editor; Solina, Franc, Editor; Bajd, Tadej, Editor; Babic, Hrvoje, Editor; Brglez, Franc, Editor; Divjal, Sasa, Editor; Drnovsek, Janko, Editor; Furlan, Joze, Editor; Groselj, Bojan, Editor; Gubina, Ferdo, Editor, et al.; 2004; ISSN 0013-5852; 86 pp.; In English; In Slovene; Copyright; Avail: Other Sources; Abstract Only

The articles in this issue include: 1) Scene-Adaptive Illumination; 2) Feasibility Study of Car Bulb Filament Alignment Automation using Computer Vision; 3) Quantifying Hand Movements and Gestures as an Input Device for Human-Computer Interactions in Virtual Environments; 4) High-Voltage Pulse Source for In Vivo Electropermeabilization of the Cell Membrane; 5) Share of Harmonic Distortion on the Consumer and Utility Side of the Electrical Power Network; 6) On Shielding Design of Extremely Low Frequency Magnetic Fields; 7) Steady-State Frequency Characteristics of a Shunt-Connected Static Compensator; 8) Numerical calculation of the motor rotor and oil coupling temperatures in the start-up process of rubber-belt conveyors; 9) A Nonlinear Model of the Linear Synchronous Reluctance Motor: Effects of Cross-Saturation during Transients; 10) An Analysis of Measuring and Control of Cabin Unit Air Flows; 11) Measurement System for Calibrating the Heating Inductor Loop of the Carbon Communicator Soldering Device; 12) Delay Characteristics of the Synchronous Bulk Packet Switch Loaded with Real Traffic; 13) Solved Problems of Fundamentals of Electromagnetics on the Web and System Usage Evaluation.
CASI
Electrical Engineering; Electromechanical Devices; Electronic Equipment

20040081499 California Univ., Santa Cruz, CA, USA
Plasma Enhanced Growth of Carbon Nanotubes For Ultrasensitive Biosensors
Cassell, Alan M.; Li, J.; Ye, Q.; Koehne, J.; Chen, H.; Meyyappan, M.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS2-03144; No Copyright; Avail: Other Sources; Abstract Only

The multitude of considerations facing nanostructure growth and integration lends itself to combinatorial optimization approaches. Rapid optimization becomes even more important with wafer-scale growth and integration processes. Here we discuss methodology for developing plasma enhanced CVD growth techniques for achieving individual, vertically aligned carbon nanostructures that show excellent properties as ultrasensitive electrodes for nucleic acid detection. We utilize high throughput strategies for optimizing the upstream and downstream processing and integration of carbon nanotube electrodes as functional elements in various device types. An overview of ultrasensitive carbon nanotube based sensor arrays for electrochemical biosensing applications and the high throughput methodology utilized to combine novel electrode technology with conventional MEMS processing will be presented.
Author
Carbon Nanotubes; Vapor Deposition

20040082092 NASA Goddard Space Flight Center, Greenbelt, MD, USA

PEM-INST-001: Instructions for Plastic Encapsulated Microcircuit (PEM) Selection, Screening, and Qualification

Teverovsky, Alexander; Sahu, Kusum; May 2003; 48 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TP-2003-212244; No Copyright; Avail: CASI; A03, Hardcopy

Potential users of plastic encapsulated microcircuits (PEMs) need to be reminded that unlike the military system of producing robust high-reliability microcircuits that are designed to perform acceptably in a variety of harsh environments, PEMs are primarily designed for use in benign environments where equipment is easily accessed for repair or replacement. The methods of analysis applied to military products to demonstrate high reliability cannot always be applied to PEMs. This makes it difficult for users to characterize PEMs for two reasons: 1. Due to the major differences in design and construction, the standard test practices used to ensure that military devices are robust and have high reliability often cannot be applied to PEMs that have a smaller operating temperature range and are typically more frail and susceptible to moisture absorption. In contrast, high-reliability military microcircuits usually utilize large, robust, high-temperature packages that are hermetically sealed. 2. Unlike the military high-reliability system, users of PEMs have little visibility into commercial manufacturers proprietary design, materials, die traceability, and production processes and procedures. There is no central authority that monitors PEM commercial product for quality, and there are no controls in place that can be imposed across all commercial manufacturers to provide confidence to high-reliability users that a common acceptable level of quality exists for all PEMs manufacturers. Consequently, there is no guaranteed control over the type of reliability that is built into commercial product, and there is no guarantee that different lots from the same manufacturer are equally acceptable. And regarding application, there is no guarantee that commercial products intended for use in benign environments will provide acceptable performance and reliability in harsh space environments. The qualification and screening processes contained in this document are intended to detect poor-quality lots and screen out early random failures from use in space flight hardware. However, since it cannot be guaranteed that quality was designed and built into PEMs that are appropriate for space applications, users cannot screen in quality that may not exist. It must be understood that due to the variety of materials, processes, and technologies used to design and produce PEMs, this test process may not accelerate and detect all failure mechanisms. While the tests herein will increase user confidence that PEMs with otherwise unknown reliability can be used in space environments, such testing may not guarantee the same level of reliability offered by military microcircuits. PEMs should only be used where due to performance needs there are no alternatives in the military high-reliability market, and projects are willing to accept higher risk.

Author

Encapsulated Microcircuits; Plastics; Qualifications; Aerospace Environments

20040082330 NASA Goddard Space Flight Center, Greenbelt, MD, USA

COTS Ceramic Chip Capacitors: An Evaluation of the Parts and Assurance Methodologies

Brusse, Jay A.; Sampson, Michael J.; [2004]; 13 pp.; In English; 2004 Capacitator and Resistor Technology Symposium, 2004, San Antonio, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy

Commercial-Off-The-Shelf (COTS) multilayer ceramic chip capacitors (MLCCs) are continually evolving to reduce physical size and increase volumetric efficiency. Designers of high reliability aerospace and military systems are attracted to these attributes of COTS MLCCs and would like to take advantage of them while maintaining the high standards for long-term reliable operation they are accustomed io when selecting military qualified established reliability (MIL-ER) MLCCs. However, MIL-ER MLCCs are not available in the full range of small chip sizes with high capacitance as found in today's COTS MLCCs. The objectives for this evaluation were to assess the long-term performance of small case size COTS MLCCs and to identify effective, lower-cost product assurance methodologies. Fifteen (15) lots of COTS X7R dielectric MLCCs from four (4) different manufacturers and two (2) MIL-ER BX dielectric MLCCs from two (2) of the same manufacturers were evaluated. Both 0805 and 0402 chip sizes were included. Several voltage ratings were tested ranging from a high of 50 volts to a low of 6.3 volts. The evaluation consisted of a comprehensive screening and qualification test program based upon MIL-PRF-55681 (i.e., voltage conditioning, thermal shock, moisture resistance, 2000-hour life test, etc.). In addition, several lot characterization tests were performed including Destructive Physical Analysis (DPA), Highly Accelerated Life Test (HALT) and Dielectric Voltage Breakdown Strength. The data analysis included a comparison of the 2000-hour life test results (used as a metric for long-term performance) relative to the screening and characterization test results. Results of this analysis indicate that the long-term life performance of COTS MLCCs is variable -- some lots perform well, some lots perform poorly. DPA and HALT were found to be promising lot characterization tests to identify substandard COTS MLCC lots prior to conducting more expensive screening and qualification tests. The results indicate that lot- specific screening and qualification are still recommended for high reliability applications. One significant and concerning observation is that MIL- type voltage

conditioning (100 hours at twice rated voltage, 125 C) was not an effective screen in removing infant mortality parts for the particular lots of COTS MLCCs evaluated.
Author
Commercial Off-the-Shelf Products; Ceramics; Chips; Capacitors; Performance Tests; Moisture Resistance

20040082356 NASA Marshall Space Flight Center, Huntsville, AL, USA
Modeling of Optical Waveguide Poling and Thermally Stimulated Discharge (TSD) Charge and Current Densities for Guest/Host Electro Optic Polymers
Watson, Michael D.; Ashley, Paul R.; Abushagur, Mustafa; May 12, 2004; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

A charge density and current density model of a waveguide system has been developed to explore the effects of electric field electrode poling. An optical waveguide may be modeled during poling by considering the dielectric charge distribution, polarization charge distribution, and conduction charge generated by the poling field. These charge distributions are the source of poling current densities. The model shows that boundary charge current density and polarization current density are the major source of currents measured during poling and thermally stimulated discharge These charge distributions provide insight into the poling mechanisms and are directly related to E(sub A), and, alpha(sub r). Initial comparisons with experimental data show excellent correlation to the model results.
Author
Optical Waveguides; Models; Charge Distribution

20040082462 NASA Glenn Research Center, Cleveland, OH, USA
Validation of Radio Frequency Telemetry Concept in the Presence of Biological Tissue-Like Stratified Media
Miranda, Felix A.; Simons, Rainee N.; Haal, David G.; June 2004; 13 pp.; In English; 2004 Antennas and Propagation Society International Symposium and URSI National Radio Science Meeting, 20-26 Jun. 2004, Monterey, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-319-80-B5
Report No.(s): NASA/TM-2004-213127; E-14377-1; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we discuss a novel radio frequency (RF) telemetry concept for biomedical applications. The concept consists of a miniaturized spiral inductor/antenna for bio-MEMS sensors and an external pick-up antenna integrated into a handheld device. The measured relative signal strength in the presence of biological phantoms ranged from 5.9 to 7.5 dB for antenna separations of 5 and 10 cm. These relative signal strengths are easily measurable, therefore validating the RF telemetry concept for biomedical applications.
Author
Radio Frequencies; Tissues (Biology); Biotelemetry; Microelectromechanical Systems; Media; Stratified Flow

20040082696 Delaware Univ., Newark, DE
Proceedings IEEE Lester Eastman Conference on High Performance Devices at University of Delaware, Newark, Delaware, August 6, 7, and 8. 2002
Leoni, Robert E.; Kolodzey, James; Aug. 8, 2002; 521 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0407
Report No.(s): AD-A423729; No Copyright; Avail: CASI; A22, Hardcopy

Professor Eastman is one of the world leaders in the physics and technology of compound semiconductor materials and devices. He has invented, fabricated, and investigated many novel semiconductor materials and devices, and his work on so many occasions has resulted in breakthroughs enabling important practical applications. The best solid-state device groups have followed his ideas with great success, and his former students and associates work in leadership positions in hundreds of leading companies, research laboratories and Universities in the USA and around the globe.
DTIC
Conferences; Research Facilities; Semiconductors (Materials); Solid State

20040082717 Sarnoff Corp., Princeton, NJ
Resonant Enhanced Modulators
Abeles, J. H.; Lepore, A. N.; Kwakernaak, M. H.; Mohseni, H.; Pajer, G. A.; May 2004; 453 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0116; Proj-J811
Report No.(s): AD-A423777; AFRL-SN-RS-TR-2004-115; No Copyright; Avail: CASI; A20, Hardcopy

We developed fabrication technology, advanced materials and design techniques to realize resonance enhanced modulators with ring-resonators. The devices are based on a lateral geometry with deeply etched waveguides in InP. ICP etching techniques and masks were developed to obtain sub- micrometer deep etched waveguides with nanometer residual sidewall roughness for low optical loss and high quality resonators. Ultra compact multi-mode interference (MMI) couplers are designed and fabricated for coupling of the ring- resonators with superior reproducibility and low excess loss. Design and test procedures were established for ring- resonators and resonance enhanced modulators. We developed three-step quantum wells in GalnAsP/InP for enhanced electro- optic coefficients. Measured electro-optic coefficient of the three-step quantum wells is nearly three times higher than the conventional rectangular quantum well at 1.55 micrometers. The enhanced electro-optic effect, combined with a low optical absorption coefficient alpha\h1 /cm increases a modulator figure of merit by nearly 36 times, and decreases the power consumption by nearly one order of magnitude compared with a conventional quantum well design. MMI-coupled electro- refractive ring resonators have been fabricated using deeply etched InGaAsP/InP waveguides. We demonstrated the first electro-refractive ring-resonator modulators. RF-modulation with the ring resonator is demonstrated. Resonance enhanced modulation efficiency with the ring-resonance was confirmed.
DTIC
Electro-Optics; Modulators

20040082719 Northeastern Univ., Boston, MA
Strongly Modulated Photonic Crystal With Tailor Made Negative Refractive Index
Vodo, P.; Parimi, V.; Lu, W. T.; Sridhar, S.; May 10, 2004; 10 pp.; In English
Contract(s)/Grant(s): F33615-01-1-1007; Proj-2305
Report No.(s): AD-A423781; No Copyright; Avail: CASI; A02, Hardcopy

Negative refraction and left-handed electromagnetism in a metallic photonic crystal (PC) wedge are demonstrated in free space for both transverse magnetic and electric mode propagation. The experimental results are in excellent agreement with numerical calculations based on the band structure with no fit parameters used in modeling. The results demonstrate precision control on the design and fabrication of the PC to achieve tailor-made refractive indices between -0.6 to +1.
DTIC
Crystals; Magnetic Fields; Numerical Analysis; Refractivity

20040082722 University of Southern California, Los Angeles, CA
Microphotonic RF Receiver Components
Levi, A. F.; Hossein-zadeh, Mani; Harriague, Fernando; Cohen, David; Jun. 15, 2004; 116 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0458
Report No.(s): AD-A423788; No Copyright; Avail: CASI; A06, Hardcopy

A novel microphotonic RF wireless receiver that exploits nonlinear modulation in a LiNbO3 microdisk to achieve direct photonic down-conversion from a RF carrier without using any high-speed electronic elements has been demonstrated. Laboratory experiments include receiving a wireless Ku band RF signal by conversion to an optical carrier, processed in the optical domain, and then extracting base band information using self-homodyne direct detection.
DTIC
Down-Converters; Microstructure; Radio Equipment; Receivers

20040082733 Voss Scientific, Albuquerque, NM
Modes of a Double-Baffled, Cylindrical, Coaxial Waveguide
Courtney, Clifton C.; , Donald E; Aug. 2003; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-03-M-0101; Proj-3005
Report No.(s): AD-A423813; AFRL-DE-TR-2003-1139; No Copyright; Avail: CASI; A03, Hardcopy

There is considerable interest in antenna and transmission line structures that are conformal to curved and cylindrical surfaces. The double-baffled, coaxial transmission line is defined by inner and outer raddii, and an arc length. It is conformal to curved surfaces, particularly structures cylindrical in nature. In this note we derive the TE and TM, axially propagating modes of a double-baffled, coaxial transmission line. First, the characteristic equations that define the cutoff frequencies of each mode are derived, then the electric fields are explicitly expressed. Finally, an example double-baffled, coaxial

transmission line geometry is defined for which the lowest TE and TM mode cutoff frequencies are computed and graphs of the normalized field components are presented.
DTIC
Baffles; Cylindrical Bodies; Transmission Lines; Waveguides

20040082781 Luxtera, Inc., Pasadena, CA
Nanophotonic Integrated Circuits
Gunn, Cary; May 14, 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-02-C-0077
Report No.(s): AD-A423912; AFRL-SR-AR-TR-04-0317; No Copyright; Avail: CASI; A01, Hardcopy

Luxtera's Phase I activities have yielded a large number of useful passive nanophotonic devices. The nanophotonic grating coupler and ring resonator are of particular importance. First, an update on the progress with these two components will be given, and then a description of an optimal system for leveraging these two components in the form of a multi-wavelength source will be described. Luxtera has developed these resonators in two configurations. First as a filter alongside a single waveguide, which provides a notch filtering function to the light passing through the waveguide. The second configuration is where the ring is placed between two waveguides, and on resonance light is dropped from one waveguide to the other. Luxtera proposes to use a variation of this second configuration to provide narrowband feedback to the active medium.
DTIC
Gratings (Spectra); Integrated Circuits

20040082818 CFD Research Corp., Huntsville, AL
Opto-Electronic and Interconnects Hierarchical Design Automation System (OE-IDEAS)
Turowski, M.; Przekwas, A.; Tramel, R.; Yang, H. Q.; Ding, H.; May 2004; 135 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0552; Proj-M064
Report No.(s): AD-A423982; AFRL-SN-RS-TR-2004-125; No Copyright; Avail: CASI; A07, Hardcopy

As microelectronics technology continues to advance, the associated electrical interconnection technology is not likely to keep pace, due to many parasitic effects appearing in metallic interconnections. Hence, the optical interconnections and photonic-electronic chips seem to be the most viable technology for future multi-GHz mixed-signal electronics. Therefore, this project developed, demonstrated, and validated Design Tools for Opto-Electronic Integrated Circuits and Interconnects. The two crucial issues are the efficient and fast techniques of extraction of parasitics as well as revolutionary new methods of modeling parasitics in electrical interconnects, where high-frequency electromagnetic effects will not allow for using SPICE-type models anymore, and the new, comprehensive CAD tools for integrated opto- electronic (O/E) circuits and systems, which would allow designers to analyze and optimize the full-path signal characteristics, at all the stages of the optically communicating circuits.
DTIC
Automatic Control; Electro-Optics

20040082958 Army War Coll., Carlisle Barracks, PA
Collins Center Senior Symposium ″DOD, NORTHCOM, and the Department of Homeland Security″. Voluem 03-03
Tussing, Bert B.; Kievit, James; Apr. 2003; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423908; No Copyright; Avail: CASI; A01, Hardcopy

In summary, the panel's consensus was that homeland security is not a National Guard mission (Though the National Guard must play a significant role); it is a joint all-component mission. Homeland Security is not a military mission (though DOD may have to commit significant intellectual and material resources); it is an integrated interagency mission. Homeland Security is not a Federal mission(though the Federal government must provide capabilities localities don't possess and cannot afford); it is a national mission, spread over the cognizant range of federal, regional, state, and local authorities. Moreover, the panel held that while Homeland Security will require Federal support and Federal resources- it will not inherently or automatically require Federal control.
DTIC
Conferences; Security; Systems Integration

20040083979 Santec Systems, Inc., Wheeling, IL, USA

Acoustography-Based Inspection of Companies

Sandhu, J.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 29 pp.; In English; See also 20040083973; Original contains color illustrations

Contract(s)/Grant(s): DAAD17-00-C-0014; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: What is Acoustography? Motivation. Basic Principles. Potential Advantages. NDT System Development. NDT Applications. Summary. Future Developments.

Derived from text

Radiography; Photography; Analogs; Nondestructive Tests

20040084169 New Jersey Inst. of Tech., Newark, NJ, USA

Electric-field-driven Phenomena for Manipulating Particles in Micro-devices

Khusid, Boris; Acrivos, Andreas; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 95; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Compared to other available methods, ac dielectrophoresis is particularly well-suited for the manipulation of minute particles in micro- and nano-fluidics. The essential advantage of this technique is that an ac field at a sufficiently high frequency suppresses unwanted electric effects in a liquid. To date very little has been achieved towards understanding the micro-scale field-and shear driven behavior of a suspension in that, the concepts currently favored for the design and operation of dielectrophoretic micro-devices adopt the approach used for macro-scale electric filters. This strategy considers the trend of the field-induced particle motions by computing the spatial distribution of the field strength over a channel as if it were filled only with a liquid and then evaluating the direction of the dielectrophoretic force, exerted on a single particle placed in the liquid. However, the exposure of suspended particles to a field generates not only the dielectrophoretic force acting on each of these particles, but also the dipolar interactions of the particles due to their polarization. Furthermore, the field-driven motion of the particles is accompanied by their hydrodynamic interactions. We present the results of our experimental and theoretical studies which indicate that, under certain conditions, these long-range electrical and hydrodynamic interparticle interactions drastically affect the suspension behavior in a micro-channel due to its small dimensions.

Author

Electrophoresis; High Frequencies; Electric Fields; Field Strength

20040084172 Notre Dame Univ., IN, USA

AC Electrokinetic Jets and Sprays for Space Applications

Lastochkin, Dmitri; Wang, Ping; Chang, Hsueh-Chia; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 101; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

New mechanisms for ejecting drops and bubbles using high-frequency AC electric fields are reported for: (i)-generating micron-sized liquid drops of electrolytes in air and (ii)-generating a micron-sized bubble jet in an electrolyte within a microfluidic device. (i) AC Electro-sprays: The new AC electrospray ejects drops from a meniscus at the tip of a capillary filled with the liquid to be sprayed. A needle electrode is inserted into the capillary such that its tip is just behind the meniscus. The other electrode is on the air side a short distance beyond the meniscus. When a high voltage (1000 V to 2000 V) AC field is activated, a micro-jet forms intermittently at the meniscus and ejects drops. Unlike DC electro-sprays, these drops are larger and are electro-neutral. In contrast, DC electro-spray, which is widely used in the pharmaceutical industry in conjunction with a mass spectrometer for drug testing, generates only charged liquid drops. The electro-neutral drops generated by the current high-frequency AC electro-spray immediately extend the utility of electro-sprays to a much wider area of potential application. Its negligible current and wattage also imply that the spray can be driven by miniature and portable power packs and without consuming much power from the on-board power sources. DC electrosprays are currently used to position and stabilize space crafts. The larger drop size and the electro-neutral drops of the AC spray should allow more precise and yet stronger manipulation actions. Possible other space applications include dispensing contents of biochips and medical diagnostic chips into on-board analytical instrument. (ii) Micro-bubble Jet Pump. A new micron-sized bubble jet in an electrolyte within a microfluidic device is reported. An intense (1000 V) AC high-frequency electric field is established between two orthogonal line electrodes (less than 25 microns in diameter) with a large peak-to-peak voltage drop. This intense field at the tip triggers a local electrolysis reaction that generates small bubbles at the tip at high speeds. The field also shapes each air bubble into a sharp cone and then pinches it off at high rates to form a jet consisting of a stream of fast-moving bubble train. These bubbles stream off the cone tip at velocities higher than 10 cm/second and drag the surrounding liquid with it. This produces a

two-phase jet of bubble and liquid with a linear velocity in excess of 10 cm/second. The jet also drives a high-intensity vortex around it. The streaming bubbles are less than 10 microns in diameter and quickly dissolve into the electrolyte. The bubbles hence do not accumulate within the micro-fluidic device. The metal loss from the electrode due to reaction and the resulting contamination are also negligible. The jet can be used as a microfluidic pump to transport fluids in micro-heat exchangers, fuel cells, CPU cooling, biochips in space crafts and space stations. It functions well in micro-gravity environments and is hence ideal for space applications. It does not contaminate the liquid and requires only a miniature power source ideal for space application.
Author
Drops (Liquids); Electrokinetics; Electromagnetic Fields; Sprayers; Microfluidic Devices

20040084225 Michigan Univ., Ann Arbor, MI, USA
Medical Lab on a Chip
Burns, Mark A.; Johnson, Brian N.; Pal, Rohit; Yang, Ming; Lin, Rongsheng; Srivastava, Nimisha; Razzacki, S. Zafar; Chomistek, Kenneth J.; Heldsinger, Dylan; Yim, Moon-Bin, et al.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 7; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The low per-unit cost of microfabricated devices along with the ability to integrate multiple components on a single device allows for the construction of a variety of complex chemical analysis system. These complex systems can be only a squared centimeter or less in size but can perform functions normally associated with benchtop equipment. Such devices can, in essence, function as micron-scale intelligent sensors. We are constructing such devices on silicon, glass, and polymer substrates for the analysis saliva, blood, and other medically relevant fluids. The devices consist of a combination of micron-scale fluidic channels, reaction chambers, and/or electrophoresis units. The devices can also include electronic control and sensing systems such as resistive heaters, temperature sensors, and fluorescence detectors. Liquid samples are injected into these devices and moved between components by a variety of techniques including hydrophobic/hydrophilic patterning, pressure manifolds, and/or phase-change valves. The output from these devices can then be used to determine physical and/or chemical properties of the liquid sample and ultimately the medical condition of the patient from which the sample was obtained. Results will be presented for the analysis of both physical (e.g., viscosity) and chemical (e.g., DNA) properties.
Author
Fabrication; Chips (Electronics); Medical Electronics; Bioengineering

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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*.

20040082058 NASA Langley Research Center, Hampton, VA, USA
Simulation of Flow Through Breach in Leading Edge at Mach 24
Gnoffo, Peter A.; Alter, Stephen J.; [2004]; 12 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 23-376-70-30-08
Report No.(s): AIAA Paper 2004-2283; No Copyright; Avail: CASI; A03, Hardcopy

A baseline solution for CFD Point 1 (Mach 24) in the STS-107 accident investigation was modified to include effects of holes through the leading edge into a vented cavity. The simulations were generated relatively quickly and early in the investigation by making simplifications to the leading edge cavity geometry. These simplifications in the breach simulations enabled: 1) A very quick grid generation procedure; 2) High fidelity corroboration of jet physics with internal surface impingements ensuing from a breach through the leading edge, fully coupled to the external shock layer flow at flight conditions. These simulations provided early evidence that the flow through a 2 inch diameter (or larger) breach enters the cavity with significant retention of external flow directionality. A normal jet directed into the cavity was not an appropriate model for these conditions at CFD Point 1 (Mach 24). The breach diameters were of the same order or larger than the local, external boundary-layer thickness. High impingement heating and pressures on the downstream lip of the breach were

computed. It is likely that hole shape would evolve as a slot cut in the direction of the external streamlines. In the case of the 6 inch diameter breach the boundary layer is fully ingested.
Author
Columbia (Orbiter); Accident Investigation; Leading Edges; Hypersonic Flow; Hole Geometry (Mechanics)

20040082077 Massachusetts Inst. of Tech., Cambridge, MA, USA
Turbomachinery for Low-to-High Mach Number Flight
Tan, Choon S.; Shah, Parthiv N.; [2004]; 50 pp.; In English
Contract(s)/Grant(s): NAG3-2767; No Copyright; Avail: CASI; A03, Hardcopy

The thrust capability of turbojet cycles is reduced at high flight Mach number (3+) by the increase in inlet stagnation temperature. The 'hot section' temperature limit imposed by materials technology sets the maximum heat addition and, hence, sets the maximum flight Mach number of the operating envelope. Compressor pre-cooling, either via a heat exchanger or mass-injection, has been suggested as a means to reduce compressor inlet temperature and increase mass flow capability, thereby increasing thrust. To date, however, no research has looked at compressor cooling (i.e., using a compressor both to perform work on the gas path air and extract heat from it simultaneously). We wish to assess the feasibility of this novel concept for use in low-to-high Mach number flight. The results to-date show that an axial compressor with cooling: (1) relieves choking in rear stages (hence opening up operability), (2) yields higher-pressure ratio and (3) yields higher efficiency for a given corrected speed and mass flow. The performance benefit is driven: (i) at the blade passage level, by a decrease in the total pressure reduction coefficient and an increase in the flow turning; and (ii) by the reduction in temperature that results in less work required for a given pressure ratio. The latter is a thermodynamic effect. As an example, calculations were performed for an eight-stage compressor with an adiabatic design pressure ratio of 5. By defining non-dimensional cooling as the percentage of compressor inlet stagnation enthalpy removed by a heat sink, the model shows that a non-dimensional cooling of percent in each blade row of the first two stages can increase the compressor pressure ratio by as much as 10-20 percent. Maximum corrected mass flow at a given corrected speed may increase by as much as 5 percent. In addition, efficiency may increase by as much as 5 points. A framework for characterizing and generating the performance map for a cooled compressor has been developed. The approach is based upon CFD computations and mean line analysis. Figures of merit that characterize the bulk performance of blade passage flows with and without cooling are extracted from CFD solutions. Such performance characterization is then applied to a preliminary compressor design framework (mean line). The generic nature of this approach makes it suitable for assessing the effect of different types of compressor cooling schemes, such as heat exchange or evaporative cooling (mass injection). Future work will focus on answering system level questions regarding the feasibility of compressor cooling. Specifically, we wish to determine the operational parametric space in which compressor cooling would be advantageous over other high flight Mach number propulsion concepts. In addition, we will explore the design requirements of cooled compressor turbomachinery, as well as the flow phenomena that limit and control its operation, and the technology barriers that must be crossed for its implementation.
Derived from text
Computational Fluid Dynamics; Turbomachinery; Thermodynamics; Cooling; Propulsion

20040082078 Ohio Aerospace Inst., Brook Park, OH, USA
CFD Code Development for Combustor Flows
Norris, Andrew; [2003]; 9 pp.; In English
Contract(s)/Grant(s): NCC3-534; No Copyright; Avail: CASI; A02, Hardcopy

During the lifetime of this grant, work has been performed in the areas of model development, code development, code validation and code application. For model development, this has included the PDF combustion module, chemical kinetics based on thermodynamics, neural network storage of chemical kinetics, ILDM chemical kinetics and assumed PDF work. Many of these models were then implemented in the code, and in addition many improvements were made to the code, including the addition of new chemistry integrators, property evaluation schemes, new chemistry models and turbulence-chemistry interaction methodology. Validation of all new models and code improvements were also performed, while application of the code to the ZCET program and also the NPSS GEW combustor program were also performed. Several important items remain under development, including the NOx post processing, assumed PDF model development and chemical kinetic development. It is expected that this work will continue under the new grant.
Derived from text
Computational Fluid Dynamics; Thermodynamics; Reaction Kinetics; Combustion Chambers; Thermal Simulation

20040082173 NASA Langley Research Center, Hampton, VA, USA

The Isolated Synthetic Jet in Crossflow: A Benchmark for Flow Control Simulation

Schaefler, Norman W.; Jenkins, Luther N.; 2004; 20 pp.; In English; 2nd AIAA Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Report No.(s): AIAA Paper 2004-2219; No Copyright; Avail: CASI; A03, Hardcopy

An overview of the data acquisition, reduction, and uncertainty of experimental measurements of the flowfield created by the interaction of an isolated synthetic jet and a turbulent boundary layer is presented. The experimental measurements were undertaken to serve as the second of three computational fluid dynamics validation databases for Active Flow Control. The validation databases were presented at the NASA Langley Research Center Workshop on CFD Validation of Synthetic Jets and Turbulent Separation Control in March, 2004. Detailed measurements were made to document the boundary conditions for the flow and also for the phase-averaged flowfield itself. Three component Laser-Doppler Velocimetry, 2-D Particle Image Velocimetry, and Stereo Particle Image Velocimetry were utilized to document the phase averaged velocity field and the turbulent stresses.

Author

Control Simulation; Flow Distribution; Data Acquisition; Active Control; Boundary Conditions; Turbulent Boundary Layer; Velocity Distribution; Computational Fluid Dynamics

20040082217 North Carolina State Univ., Raleigh, NC, USA

Algorithmic Enhancements for the VULCAN Navier-Stokes Solver

Edwards, Jack R.; 2004; 4 pp.; In English

Contract(s)/Grant(s): NAG5-2216; No Copyright; Avail: CASI; A01, Hardcopy

Work performed over the last three years has resulted in the addition of several new algorithms to the VULCAN code, NASA's standard for Navier-Stokes calculations in high-speed aeropropulsion devices. This final report describes the new techniques in brief and presents sample results from their use.

Author

Algorithms; Navier-Stokes Equation; Computer Programs; Augmentation

20040082231 NASA Langley Research Center, Hampton, VA, USA

A Separation Control CFD Validation Test Case, Part 1, Baseline and Steady Suction

Greenblatt, David; Paschal, Keith B.; Yao, Chung-Sheng; Harris, Jerome; Schaeffler, Norman W.; Washburn, Anthony E.; [2004]; 17 pp.; In English; 2nd AIAA Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Report No.(s): AIAA Paper 2004-2220-Pt-1; Copyright; Avail: CASI; A03, Hardcopy

Low speed flow separation over a wall-mounted hump, and its control using steady suction, were studied experimentally in order to generate a data set for a workshop aimed at validating CFD turbulence models. The baseline and controlled data sets comprised static and dynamic surface pressure measurements, flow field measurements using Particle Image Velocimetry (PIV) and wall shear stress obtained via oil-film interferometry. In addition to the specific test cases studied, surface pressures for a wide variety of conditions were reported for different Reynolds numbers and suction rates. Stereoscopic PIV and oil-film flow visualization indicated that the baseline separated flow field was mainly two- dimensional. With the application of control, some three-dimensionality was evident in the spanwise variation of pressure recovery, reattachment location and spanwise pressure fluctuations. Part 2 of this paper, under preparation for the AIAA Meeting in Reno 2005, considers separation control by means of zero-efflux oscillatory blowing.

Author

Separated Flow; Boundary Layer Separation; Computational Fluid Dynamics; Turbulence Models; Flow Distribution; Shear Stress; Dynamic Pressure

20040082238 NASA Langley Research Center, Hampton, VA, USA

Numerical Modeling of Active Flow Control in a Boundary Layer Ingesting Offset Inlet

Allan, Brian G.; Owens, Lewis R.; Berrier, Bobby L.; [2004]; 18 pp.; In English; 2nd AIAA Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Report No.(s): AIAA Paper 2004-2318; No Copyright; Avail: CASI; A03, Hardcopy

This investigation evaluates the numerical prediction of flow distortion and pressure recovery for a boundary layer ingesting offset inlet with active flow control devices. The numerical simulations are computed using a Reynolds averaged Navier-Stokes code developed at NASA. The numerical results are validated by comparison to experimental wind tunnel tests

conducted at NASA Langley Research Center at both low and high Mach numbers. Baseline comparisons showed good agreement between numerical and experimental results. Numerical simulations for the inlet with passive and active flow control also showed good agreement at low Mach numbers where experimental data has already been acquired. Numerical simulations of the inlet at high Mach numbers with flow control jets showed an improvement of the flow distortion. Studies on the location of the jet actuators, for the high Mach number case, were conducted to provide guidance for the design of a future experimental wind tunnel test.
Author
Boundary Layers; Mathematical Models; Ingestion (Engines); Wind Tunnel Tests; Flow Distribution; Engine Inlets; Control Systems Design; Computational Fluid Dynamics

20040082247 NASA Langley Research Center, Hampton, VA, USA
Experimental Characterization of Piezoelectric Radial Field Diaphragms for Fluidic Control
Bryant, R. G.; Kavli, S. E.; Thomas, R. A., Jr.; Darji, K. J.; Mossi, K. M.; [2004]; 4 pp.; In English; Actuator 2004: 9th International Conference on New Actuators, 14-16 Jun. 2004, Breman, Germany
Contract(s)/Grant(s): 23-762-93-AB; No Copyright; Avail: CASI; A01, Hardcopy

NASA has recently developed a new piezoelectric actuator, the Radial Field Diaphragm or RFD. This actuator uses a radially-directed electric field to generate concentric out-of-plane (Z-axis) motion that allows this packaged device to be used as a pump or valve diaphragm. In order to efficiently use this new active device, experimental determination of pressure, flow rate, mechanical work, power consumption and overall efficiency needs to be determined by actually building a pump. However, without an optimized pump design, it is difficult to assess the quality of the data, as these results are inherent to the actual pump. Hence, separate experiments must be conducted in order to generate independent results to help guide the design criteria and pump quality. This paper focuses on the experiments used to generate the RFD's operational parameters and then compares these results to the experimentally determined results of several types of ball pumps. Also discussed are how errors are inherently introduced into the experiments, the pump design, experimental hardware and their effects on the overall system efficiency.
Author
Fluidics; Piezoelectric Actuators; Radial Flow; Control Valves; Fabrication; Diaphragms (Mechanics); Valves

20040082249 NASA Dryden Flight Research Center, Edwards, CA, USA
Hypothetical Reentry Thermostructural Performance of Space Shuttle Orbiter With Missing or Eroded Thermal Protection Tiles
Ko, William L.; Gong, Leslie; Quinn, Robert D.; July 2004; 44 pp.; In English
Contract(s)/Grant(s): WU 090-50-00-SE-RR
Report No.(s): NASA/TM-2004-212850; H-2553; No Copyright; Avail: CASI; A03, Hardcopy

This report deals with hypothetical reentry thermostructural performance of the Space Shuttle orbiter with missing or eroded thermal protection system (TPS) tiles. The original STS-5 heating (normal transition at 1100 sec) and the modified STS-5 heating (premature transition at 800 sec) were used as reentry heat inputs. The TPS missing or eroded site is assumed to be located at the center or corner (spar-rib juncture) of the lower surface of wing midspan bay 3. For cases of missing TPS tiles, under the original STS-5 heating, the orbiter can afford to lose only one TPS tile at the center or two TPS tiles at the corner (spar-rib juncture) of the lower surface of wing midspan bay 3. Under modified STS-5 heating, the orbiter cannot afford to lose even one TPS tile at the center or at the corner of the lower surface of wing midspan bay 3. For cases of eroded TPS tiles, the aluminum skin temperature rises relatively slowly with the decreasing thickness of the eroded central or corner TPS tile until most of the TPS tile is eroded away, and then increases exponentially toward the missing tile case.
Author
Space Shuttle Orbiters; Thermal Protection; Tiles; Erosion; Uncontrolled Reentry (Spacecraft); Space Transportation System; Aerothermodynamics

20040082251 NASA Langley Research Center, Hampton, VA, USA
Impact of CGNS on CFD Workflow
Poinot, M.; Rumsey, C. L.; Mani, M.; [2004]; 12 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 23-762-45-CA
Report No.(s): AIAA Paper 2004-2142; Copyright; Avail: CASI; A03, Hardcopy

CFD tools are an integral part of industrial and research processes, for which the amount of data is increasing at a high rate. These data are used in a multi-disciplinary fluid dynamics environment, including structural, thermal, chemical or even electrical topics. We show that the data specification is an important challenge that must be tackled to achieve an efficient workflow for use in this environment. We compare the process with other software techniques, such as network or database type, where past experiences showed how difficult it was to bridge the gap between completely general specifications and dedicated specific applications. We show two aspects of the use of CFD General Notation System (CGNS) that impact CFD workflow: as a data specification framework and as a data storage means. Then, we give examples of projects involving CFD workflows where the use of the CGNS standard leads to a useful method either for data specification, exchange, or storage. Author

Computational Fluid Dynamics; Applications Programs (Computers); Data Structures; Software Engineering

20040082254 NASA Langley Research Center, Hampton, VA, USA

Computations of Wall Distances Based on Differential Equations

Tucker, Paul G.; Rumsey, Chris L.; Spalart, Philippe R.; Bartels, Robert E.; Biedron, Robert T.; [2004]; 18 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Contract(s)/Grant(s): EEPSRC-GR/S28402/01; 23-762-45-CA

Report No.(s): AIAA Paper 2004-2232; Copyright; Avail: CASI; A03, Hardcopy

The use of differential equations such as Eikonal, Hamilton-Jacobi and Poisson for the economical calculation of the nearest wall distance d, which is needed by some turbulence models, is explored. Modifications that could palliate some turbulence-modeling anomalies are also discussed. Economy is of especial value for deforming/adaptive grid problems. For these, ideally, d is repeatedly computed. It is shown that the Eikonal and Hamilton-Jacobi equations can be easy to implement when written in implicit (or iterated) advection and advection-diffusion equation analogous forms, respectively. These, like the Poisson Laplacian term, are commonly occurring in CFD solvers, allowing the re-use of efficient algorithms and code components. The use of the NASA CFL3D CFD program to solve the implicit Eikonal and Hamilton-Jacobi equations is explored. The re-formulated d equations are easy to implement, and are found to have robust convergence. For accurate Eikonal solutions, upwind metric differences are required. The Poisson approach is also found effective, and easiest to implement. Modified distances are not found to affect global outputs such as lift and drag significantly, at least in common situations such as airfoil flows.

Author

Differential Equations; Walls; Mathematical Models; Distance; Iteration; Computational Fluid Dynamics

20040082296 NASA Langley Research Center, Hampton, VA, USA

Summary of the 2004 CFD Validation Workshop on Synthetic Jets and Turbulent Separation Control

Rumsey, C. L.; Gatski, T. B.; Sellers, W. L., III; Vatsa, V. N.; Viken, S. A.; [2004]; 31 pp.; In English; 2nd AIAA 2nd Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Contract(s)/Grant(s): 23-762-45-CA

Report No.(s): AIAA Paper 2004-2217; Copyright; Avail: CASI; A03, Hardcopy

A CFD validation workshop for synthetic jets and turbulent separation control (CFDVAL2004) was held in Williamsburg, Virginia in March 2004. Three cases were investigated: synthetic jet into quiescent air, synthetic jet into a turbulent boundary layer crossflow, and flow over a hump model with no-flow-control, steady suction, and oscillatory control. This paper is a summary of the CFD results from the workshop. Although some detailed results are shown, mostly a broad viewpoint is taken, and the CFD state-of-the-art for predicting these types of flows is evaluated from a general point of view. Overall, for synthetic jets, CFD can only qualitatively predict the flow physics, but there is some uncertainty regarding how to best model the unsteady boundary conditions from the experiment consistently. As a result. there is wide variation among CFD results. For the hump flow, CFD as a whole is capable of predicting many of the particulars of this flow provided that tunnel blockage is accounted for, but the length of the separated region compared to experimental results is consistently overpredicted.

Author

Computational Fluid Dynamics; Proving; Jet Flow; Separated Flow

20040082300 NASA Marshall Space Flight Center, Huntsville, AL, USA

Design Development Analyses in Support of a Heatpipe-Brayton Cycle Heat Exchanger

Steeve, Brian E.; Kapernick, Richard J.; [2004]; 10 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICARP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains black and white illustrations

Report No.(s): Paper-4325; No Copyright; Avail: CASI; A02, Hardcopy

One of the power systems under consideration for nuclear electric propulsion or as a planetary surface power source is a heatpipe-cooled reactor coupled to a Brayton cycle. In this system, power is transferred from the heatpipes to the Brayton gas via a heat exchanger attached to the heatpipes. This paper discusses the fluid, thermal and structural analyses that were performed in support of the design of the heat exchanger to be tested in the SAFE-100 experimental program at the Marshall Space Flight Center: An important consideration throughout the design development of the heat exchanger w its capability to be utilized for higher power and temperature applications. This paper also discusses this aspect of the design and presents designs for specific applications that are under consideration.
Derived from text
Brayton Cycle; Planetary Surfaces; Structural Analysis; Heat Pipes; Heat Exchangers

20040082323 NASA Marshall Space Flight Center, Huntsville, AL, USA
Sodium Based Heat Pipe Modules for Space Reactor Concepts: Stainless Steel SAFE-100 Core
Martin, James J.; Reid, Robert S.; [2004]; 9 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICAPP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains color illustrations
Report No.(s): Paper-4275; No Copyright; Avail: CASI; A02, Hardcopy

A heat pipe cooled reactor is one of several candidate reactor cores being considered for advanced space power and propulsion systems to support future space exploration applications. Long life heat pipe modules, with designs verified through a combination of theoretical analysis and experimental lifetime evaluations, would be necessary to establish the viability of any of these candidates, including the heat pipe reactor option. A hardware-based program was initiated to establish the infrastructure necessary to build heat pipe modules. This effort, initiated by Los Alamos National Laboratory and referred to as the Safe Affordable Fission Engine (SAFE) project, set out to fabricate and perform non-nuclear testing on a modular heat pipe reactor prototype that can provide 100 kilowatt from the core to an energy conversion system at 700 C. Prototypic heat pipe hardware was designed, fabricated, filled, closed-out and acceptance tested.
Derived from text
Heat Pipes; Modules; Propulsion System Configurations; Space Exploration; Stainless Steels; Thermodynamics

20040082344 NASA Marshall Space Flight Center, Huntsville, AL, USA
Fluctuations, Stratification and Stability in a Liquid Fluidized Bed at Low Reynolds Number
Segre, P. N.; McClymer, J. P.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The sedimentation dynamics of extremely low polydispersity, non-colloidal, particles are studied in a liquid fluidized bed at low Reynolds number, Re much less than 1. When fluidized, the system reaches a steady state, defined where the local average volume fraction does not vary in time. In steady state, the velocity fluctuations and the particle concentrations are found to strongly depend on height. Using our results, we test a recently developed stability model for steady state sedimentation. The model describes the data well, and shows that in steady state there is a balancing of particle fluxes due to the fluctuations and the concentration gradient. Some results are also presented for the dependence of the concentration gradient in fluidized beds on particle size; the gradients become smaller as the particles become larger and fewer in number.
Author
Fluidized Bed Processors; Low Reynolds Number; Stratification; Stability; Variations; Liquids

20040082347 NASA Marshall Space Flight Center, Huntsville, AL, USA
Difference in Icosahedral Short-Range Order in Early and Late Transition Metal Liquids
Lee, G. W.; Gangopadbyay, A. K.; Kelton, K. F.; Hyers, R. W.; Rathz, T. J.; Rogers, J. R.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

New short-range order data are presented for equilibrium and undercooled liquids of Ti and Ni. These were obtained from in-situ synchrotron x-ray diffraction measurements of electrostatically-levitated droplets. While the short-range order of liquid Ni is icosahedral, consistent with Frank's hypothesis, significantly distorted icosahedral order is observed in liquid Ti. This is the first experimental observation of distorted icosahedral short-range order in any liquid. although this has been predicted by theoretical studies on atomic clusters.
Author
X Ray Diffraction; In Situ Measurement; Drops (Liquids); Atomic Clusters; Transition Metals

20040082369 NASA Langley Research Center, Hampton, VA, USA
Analysis Tools for CFD Multigrid Solvers
Mineck, Raymond E.; Thomas, James L.; Diskin, Boris; [2004]; 14 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 23-762-45-CA
Report No.(s): AIAA Paper 2004-2531; No Copyright; Avail: CASI; A03, Hardcopy

Analysis tools are needed to guide the development and evaluate the performance of multigrid solvers for the fluid flow equations. Classical analysis tools, such as local mode analysis, often fail to accurately predict performance. Two-grid analysis tools, herein referred to as Idealized Coarse Grid and Idealized Relaxation iterations, have been developed and evaluated within a pilot multigrid solver. These new tools are applicable to general systems of equations and/or discretizations and point to problem areas within an existing multigrid solver. Idealized Relaxation and Idealized Coarse Grid are applied in developing textbook-efficient multigrid solvers for incompressible stagnation flow problems.
Author
Computational Fluid Dynamics; Fluid Flow

20040082378 NASA Marshall Space Flight Center, Huntsville, AL, USA
Temperature Dependence of Density, Viscosity and Electrical Conductivity for Hg-Based II-VI Semiconductor Melts
Li, C.; Ban, H.; Lin, B.; Scripa, R. N.; Su, C.-H.; Lehoczky, S. L.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The relaxation phenomenon of semiconductor melts, or the change of melt structure with time, impacts the crystal growth process and the eventual quality of the crystal. The thermophysical properties of the melt are good indicators of such changes in melt structure. Also, thermophysical properties are essential to the accurate predication of the crystal growth process by computational modeling. Currently, the temperature dependent thermophysical property data for the Hg-based II-VI semiconductor melts are scarce. This paper reports the results on the temperature dependence of melt density, viscosity and electrical conductivity of Hg-based II-VI compounds. The melt density was measured using a pycnometric method, and the viscosity and electrical conductivity were measured by a transient torque method. Results were compared with available published data and showed good agreement. The implication of the structural changes at different temperature ranges was also studied and discussed.
Author
Crystal Growth; Semiconductors (Materials); Melts (Crystal Growth); Temperature Dependence; Thermophysical Properties; Electrical Resistivity

20040082382 NASA Marshall Space Flight Center, Huntsville, AL, USA
Density, Electrical Conductivity and Viscosity of Hg(sub 0.8)Cd(sub 0.2)Te Melt
Li, C.; Scripa, R. N.; Ban, H.; Lin, B.; Su, C.-H.; Lehoczky, S. L.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The density, viscosity, and electrical conductivity of Hg(sub 0.8)Cd(sub 0.2)Te melt were measures as a function of temperature. A pycnometric method was used to measure the melt density in the temperature range of 1072 to 1122 K. The viscosity and electrical conductivity were determined using a transient torque method from 1068 to 1132 K. The density result from this study is within 0.3% of the published data. However, the current viscosity result is approximately 30% lower than the existing data. The electrical conductivity of Hg(sub 0.8)Cd(sub 0.2)Te melt as a function of temperature, which is not available in the literature, is also determined. The analysis of the temperature dependent electrical conductivity and the relationship between the kinematic viscosity and density indicated that the structure of the melt appeared to be homogeneous when the temperature was above 1090 K. A structural transition occurred in the Hg(sub 0.8)Cd(sub 0.2)Te melt as the temperature was decreased to below 1090 K.
Author
Electrical Resistivity; Viscosity; Mercury Cadmium Tellurides; Melts (Crystal Growth); Density (Mass/Volume)

20040082392 Ohio Aerospace Inst., Brook Park, OH, USA
Cross Flow Effects on Glaze Ice Roughness Formation
Tsao, Jen-Ching; May 2004; 18 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC3-938; WBS 728-41-17
Report No.(s): NASA/CR-2004-213086; AIAA Paper 2003-1219; E-14564; No Copyright; Avail: CASI; A03, Hardcopy

The present study examines the impact of large-scale cross flow on the creation of ice roughness elements on the leading edge of a swept wing under glaze icing conditions. A three-dimensional triple-deck structure is developed to describe the local interaction of a 3 D air boundary layer with ice sheets and liquid films. A linear stability analysis is presented here. It is found that, as the sweep angle increases, the local icing instabilities enhance and the most linearly unstable modes are strictly three dimensional.
Derived from text
Surface Roughness; Glazes; Ice; Cross Flow; Boundary Layers

20040082405 California Univ., Berkeley, CA, USA
CFD Analysis of LLNL Downdraft Table
Finlayson, E. U.; Jayaraman, B.; Kristoffersen, A. R.; Gadgil, A. J.; Oct. 08, 2003; In English
Report No.(s): DE2003-817257; LBNL-53883; No Copyright; Avail: National Technical Information Service (NTIS)

This study examines the airflow and contaminant transport in an existing room (89 inch x 77 inch x 98 inch) that houses a downdraft table at LLNL. The facility was designed and built in the 1960's and is currently being considered for redesign. One objective of the redesign is to reduce airflow while maintaining or improving user safety. Because this facility has been used for many years to handle radioactive material it is impractical to conduct extensive experimental tests in it. Therefore, we have performed a Computational Fluid Dynamic (CFD) analysis of the facility. The study examines the current operational condition and some other cases with reduced airflow. Reducing airflow will lead to savings in operating costs (lower fan power consumption), and possible improvements in containment from reduced turbulence. In addition, we examine three design (geometry) changes. These are: (1) increasing the area of the HVAC inlet on the ceiling, (2) adding a 15(sup o) angled ceiling inlet and (3) increasing the area of the slot in the doorway. Of these three geometry modifications, only the larger doorway slot leads to improved predicted containment.
NTIS
Contaminants; Radioactive Materials; Containment; Air Flow

20040082498 NASA Langley Research Center, Hampton, VA, USA
Computational Aerothermodynamic Simulation Issues on Unstructured Grids
Gnoffo, Peter A.; White, Jeffery A.; [2004]; 17 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-376-70-30-08
Report No.(s): AIAA Paper 2004-2371; No Copyright; Avail: CASI; A03, Hardcopy

The synthesis of physical models for gas chemistry and turbulence from the structured grid codes LAURA and VULCAN into the unstructured grid code FUN3D is described. A directionally Symmetric, Total Variation Diminishing (STVD) algorithm and an entropy fix (eigenvalue limiter) keyed to local cell Reynolds number are introduced to improve solution quality for hypersonic aeroheating applications. A simple grid-adaptation procedure is incorporated within the flow solver. Simulations of flow over an ellipsoid (perfect gas, inviscid), Shuttle Orbiter (viscous, chemical nonequilibrium) and comparisons to the structured grid solvers LAURA (cylinder, Shuttle Orbiter) and VULCAN (flat plate) are presented to show current capabilities. The quality of heating in 3D stagnation regions is very sensitive to algorithm options in general, high aspect ratio tetrahedral elements complicate the simulation of high Reynolds number, viscous flow as compared to locally structured meshes aligned with the flow.
Author
Unstructured Grids (Mathematics); Physical Chemistry; Ideal Gas; Tvd Schemes; Algorithms; Eigenvalues; Aerodynamic Heating

20040082534 NASA Langley Research Center, Hampton, VA, USA
Wall Interference Study of the NTF Slotted Tunnel Using Bodies of Revolution Wall Signature Data
Iyer, Venkit; Kuhl, David D.; Walker, Eric L.; [2004]; 18 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): NAS1-00135; 23-090-80-10
Report No.(s): AIAA Paper 2004-2306; Copyright; Avail: CASI; A03, Hardcopy

This paper is a description of the analysis of blockage corrections for bodies of revolution for the slotted-wall configuration of the National Transonic Facility (NTF) at the NASA Langley Research Center (LaRC). A wall correction method based on the measured wall signature is used. Test data from three different-sized blockage bodies and four wall

ventilation settings were analyzed at various Mach numbers and unit Reynolds numbers. The results indicate that with the proper selection of the boundary condition parameters, the wall correction method can predict blockage corrections consistent with the wall measurements for Mach numbers as high as 0.95.
Author
Aerodynamic Interference; Bodies of Revolution; Wall Flow; Slotted Wind Tunnels; Wind Tunnel Walls; Mathematical Models

20040082644 Texas Univ., Austin, TX
Suction Side Roughness Effects on Film Cooling Heat Transfer on a Turbine Vane
Rutledge, James L.; May 2004; 231 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423603; CI04-361; No Copyright; Avail: CASI; A11, Hardcopy

An experimental study was conducted in a simulated three vane linear cascade to determine the effects of surface roughness and film cooling on the heat transfer coefficient distribution in the region downstream of the first row of suction side coolant holes. Suction side film cooling was operated in the range 0 less than M less than 1.4. The showerhead was tested at M(sub sh) = 1.6. In addition to the completely smooth condition, simulated airfoil roughness was used upstream of the coolant holes, downstream of the coolant holes, and both upstream and downstream of the coolant holes. Two levels of mainstream turbulence intensity were tested. The heat transfer measurements were conducted by application of a uniform heat flux in the region downstream of the coolant holes. The resulting surface temperature distributions were measured with infrared thermography. Because the upstream region was unheated, the influence of film cooling on the heat transfer coefficient was due to only to hydrodynamic effects and not thermal effects. The coolant to mainstream density ratio of the majority of the experiments was unity; however, a single experiment was conducted at a density ratio of DR = 1.6 to determine how the coolant to mainstream density ratio affects heat transfer. Net heat flux reduction calculations were performed by combining the heat transfer coefficient measurements of the present study with adiabatic effectiveness measurements of a separate study. In order to gain insight into the hydrodynamics that affect the heat transfer, boundary layer measurements were conducted using hot-wire anemometry.
DTIC
Film Cooling; Gas Turbines; Heat Pipes; Heat Transfer; Suction; Surface Roughness; Turbines; Vanes

20040082774 Massachusetts Inst. of Tech., Cambridge, MA
Research and Development on Aspirated Compressors
Kerrebrock, Jack; Epstein, A.; Adamczyk, J.; Braunscheidel, E.; Merchant, A.; Apr. 2003; 33 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0493
Report No.(s): AD-A423903; AFRL-SR-AR-TR-04-0285; No Copyright; Avail: CASI; A03, Hardcopy

This program consisted of three primary objectives: (1) the development of a computational design system for the design of aspirated compressors; (2) the design, construction, and testing of a low-tip speed fan stage incorporating aspiration in the rotor fan stator; and (3) the design, construction, and testing of a high-tip speed, high-pressure ratio fan stage. In summary, the program has succeeded in achieving all three objectives, yielding a compressor design that incorporates boundary layer control by aspiration and delivers approximately double the work of conventional stages with competitive through-flow efficiency. This has been demonstrated experimentally via a low-tip speed stage with a pressure ratio of 1.6 at a tip speed of 750 feet per second and via a high-tip speed stage with a pressure ratio of 3.2 at a tip speed of 1500 feet per second. The low-tip speed stage was demonstrated in the MIT Blowdown Compressor Facility. The high-tip speed stage was demonstrated in a compressor facility at the NASA Glenn Research Center at full-simulated engine conditions, so that although its primary objective was an aerodynamic verification, it also constituted a proof of feasibility of at least one structural concept for aspirated compressors. (23 figures, 7 refs.)
DTIC
Aerodynamic Characteristics; Compressor Blades; Compressor Rotors; Compressors; Gas Turbines; High Pressure

20040082777 Academy of Sciences (USSR), Novosibirsk
Kinetic Theory and Rarefied Gas Dynamics: Book of Abstracts of All Russia Seminar
Rebrov, A. K.; Rudyak, V. Ya; Belkin, A. A.; Mar. 11, 2003; 64 pp.; In English
Contract(s)/Grant(s): FA8655-03-1-5006
Report No.(s): AD-A423906; CSP-03-5006; No Copyright; Avail: CASI; A04, Hardcopy

This book contains the abstracts of papers presented at the All-Russia Seminar Kinetic Theory and Rarefied Gas Dynamics″ 2-6 December, 2002. The results of theoretical and experimental investigations on the following topics are given

in the papers: kinetic theory, non- equilibrium statistical mechanics, irreversibility and dynamic chaos, transport processes and relaxation phenomena in gases and liquids, gas-surface interaction, methods of solving the kinetic equations, gas and liquid simulation methods, rarefied gas dynamics, physics and dynamics of clusters and aerosols. The issue is meant for specialists in the field of kinetic theory, continuum mechanics, non-equilibrium processes physics, as well as for students and post-graduate students of the corresponding specialties.
DTIC
Abstracts; Kinetic Theory; Rarefied Gas Dynamics; Rarefied Gases; Russian Federation

20040084038 Minnesota Mining and Mfg. Co., Saint Paul, MN, USA
Novec(tm) Engineered Fluids
Hesselroth, David A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A02, Hardcopy

Novec(TM) Engineered Fluids are useful as cleaning solvents, carrier solvents, heat transfer liquids, Halon replacements and machining lubricant fluids. Currently there are twelve commercial Novec (TM) products. Four pure segregated hydrofluoroether (HFE) products, five segregated hydrofluoroether azeotropic blended products, two segregated hydrofluoroether machining blends and one perfluoroketone. The physical and Environmental, Health, Safety and Regulatory (EHS&R) properties with discussion about the advantages of using blends of HFEs in cleaning applications will be the major focus of this paper.
Derived from text
Fluids; Ethers; Fluoro Compounds; Hydrocarbons; Chemical Properties

20040084074 NASA Langley Research Center, Hampton, VA, USA
A Separation Control CFD Validation Test Case, Part 1, Baseline and Steady Suction
Greenblatt, David; Paschal, Keith B.; Yao, Chung-Sheng; Harris, jerome; Schaeffler, Norman W.; Washburn, Anthony E.; June 24, 2004; 17 pp.; In English; 2nd AIAA Flow Control Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-762-55-MC
Report No.(s): AIAA Paper 2004-2220; No Copyright; Avail: CASI; A03, Hardcopy

Low speed flow separation over a wall-mounted hump, and its control using steady suction, were studied experimentally in order to generate a data set for a workshop aimed at validating CFD turbulence models. The baseline and controlled data sets comprised static and dynamic surface pressure measurements, flow field measurements using Particle Image Velocimetry (PIV) and wall shear stress obtained via oil-film interferometry. In addition to the specific test cases studied, surface pressures for a wide variety of conditions were reported for different Reynolds numbers and suction rates. Stereoscopic PIV and oil-film flow visualization indicated that the baseline separated flow field was mainly two-dimensional. With the application of control, some three-dimensionality was evident in the spanwise variation of pressure recovery, reattachment location and spanwise pressure fluctuations. Part 2 of this paper, under preparation for the AIAA Meeting in Reno 2005, considers separation control by means of zero-efflux oscillatory blowing.
Author
Computational Fluid Dynamics; Separated Flow; Wind Tunnel Tests; Suction; Turbulence Models; Low Speed; Control Theory

20040084089 NASA Langley Research Center, Hampton, VA, USA
Analysis Tools for CFD Multigrid Solvers
Mineck, Raymond E.; Thomas, James L.; Diskin, Boris; [2004]; 14 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 23-762-45-CA
Report No.(s): AIAA Paper 2004-2531; No Copyright; Avail: CASI; A03, Hardcopy

Analysis tools are needed to guide the development and evaluate the performance of multigrid solvers for the fluid flow equations. Classical analysis tools, such as local mode analysis, often fail to accurately predict performance. Two-grid analysis tools, herein referred to as Idealized Coarse Grid and Idealized Relaxation iterations, have been developed and evaluated within a pilot multigrid solver. These new tools are applicable to general systems of equations and/or discretizations and point to problem areas within an existing multigrid solver. Idealized Relaxation and Idealized Coarse Grid are applied in developing

textbook-efficient multigrid solvers for incompressible stagnation flow problems.
Author
Computational Fluid Dynamics; Flow Equations; Multigrid Methods

20040084103 Maritime Research Inst. Netherlands, Wageningen, Netherlands
Computational Analysis of the Flow Around the Propeller Blade Root with a Viscous Flow Solver
Bosschers, J.; March 2004; 82 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): A02/KM/138; MARIN Proj. 15353-255
Report No.(s): TD-2003-0177; Rept-15353-4-SP; Copyright; Avail: Other Sources

Past experiments from full-scale observations indicate that the inception of blade root cavitation might not be well predicted in the Depressurized Towing Tank. Besides possible geometrical differences between model scale and full-scale propeller fillet geometries, Reynolds number effects and nuclei might be important. To investigate the flow around the blade root in detail and the influence of possible Reynolds number effects on the flow a computational study has been carried out for a propeller in open water conditions. The propeller has a large loading at the blade root and the blade root inception values have been measured in the Cavitation Tunnel in 1999. The computations have been carried out using CFX-TASCFLOW by CFX-UK while the analysis of the data was done by MARIN. The computed minimum pressure showed a good correspondence with measured values. The Reynolds number variation study was carried out using a modified computational domain and hub geometry. The computations showed a very small influence of the Reynolds number on the minimum pressure in the blade root region. Surprising is the absence of a horseshoe vortex. Instead vorticity is generated in the fillet area with a sign opposite to that of a horseshoe vortex.
Author
Analysis (Mathematics); Cavitation Flow; Propeller Blades; Viscous Flow; Scale Models

20040084121 NASA Langley Research Center, Hampton, VA, USA
Emerging CFD Capabilities and Outlook: A NASA Langley Perspective
Biedron, Robert T.; Pao, S. Paul; Thomas, James L.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 48-68; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

COMSAC goals include increasing the acceptance of CFD as a viable tool for S&C predictions, as well as to focus CFD development and improvement towards the needs of the S&C community. We view this as a symbiotic relationship, with increasing improvement of CFD promoting increasing acceptance by the S&C community, and increasing acceptance spurring further improvements. In this presentation we want to provide an overview for the non CFD expert of current CFD strengths and weaknesses, as well as to highlight a few emerging capabilities that we feel will lead toward increased usefulness in S&C applications.
Derived from text
Computational Fluid Dynamics; NASA Programs; General Overviews

20040084128 NASA Langley Research Center, Hampton, VA, USA
Introduction to Computational Methods for Stability and Control (COMSAC)
Hall, Robert M.; Fremaux, C. Michael; Chambers, Joseph R.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 7-27; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

This Symposium is intended to bring together the often distinct cultures of the Stability and Control (S&C) community and the Computational Fluid Dynamics (CFD) community. The COMSAC program is itself a new effort by NASA Langley to accelerate the application of high end CFD methodologies to the demanding job of predicting stability and control characteristics of aircraft. This talk is intended to set the stage for needing a program like COMSAC. It is not intended to give details of the program itself. The topics include: 1) S&C Challenges; 2) Aero prediction methodology; 3) CFD applications; 4) NASA COMSAC planning; 5) Objectives of symposium; and 6) Closing remarks.
Derived from text
Computational Fluid Dynamics; Control Stability; Conferences; NASA Programs

20040084131 Naval Air Systems Command, Prince Frederick, MD, USA
NAVAIR S and C Issues for CFD
Donaldson, Steve A.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 239-247; In English; See also 20040084120; No Copyright; Avail: CASI; A02, Hardcopy

CFD can be a useful tool for Stability and Control (S & C) engineers, however: Its use has been limited to point designs. Primarily used for flow visualization. Has not been used to predict aerodynamics across the usage spectrum. The amount of data required for S & C analysis so far requires the use of extensive wind tunnel testing as the most efficient method of collecting aerodynamic data.
Author
Computational Fluid Dynamics; Wind Tunnel Tests; Aerodynamics

20040084141 West Virginia Univ., Morgantown, WV, USA
Positioning of Simulated Vapor Bubbles in Microgravity by the Kelvin Force
Kuhlman, John; Gray, Donald D.; Glaspell, Shannon; Kreitzer, Paul; Battleson, Charlie; Lechliter, Michelle; Campanelli, Michael; Fredrick, Nicholas; Sunderlin, Christopher; Williams, Brianne; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 99-100; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Experiments were performed in July 2003 in the NASA Weightless Wonder KC-135 aircraft through the Reduced Gravity Student Flight Opportunities Program, to study the influence of the magnetic Kelvin force on the behavior of air bubbles in a paramagnetic liquid in microgravity (micro -g). This aircraft, which flies through a series of parabolic arcs providing about 20 seconds of micro-g per parabola, allowed a unique environment in which to study the resultant phenomena. The experiment was conceived, designed, constructed, and performed by the WVU student team and their advisors. When there is no dominant body force such as gravity to produce a buoyant force, vapor bubbles that form may remain adjacent to heat rejection surfaces, rather than be driven away due to buoyancy. This reduces the heat exchange rates and can cause burnout or damage the surface that needs to be cooled. The experiment modeled one possible method for repelling the vapor bubbles on a heat rejection surface in micro-g. In the presence of a non-uniform magnetic field, a body force, known as the Kelvin force, is exerted on all magnetically permeable materials. Diamagnetic and paramagnetic fluids are repelled from and attracted to magnetic fields, respectively. The Kelvin force is approximately three orders of magnitude larger for liquids than for gases, leading to a magnetic buoyancy force on bubbles in a liquid.
Author
Diamagnetism; Microgravity; Nonuniform Magnetic Fields; Weightlessness; Buoyancy

20040084142 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Visualization of Electric Field Effects on Nucleate and Film Boiling
Sankaran, Subramanian; Allen, Jeffrey S.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 149; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Film boiling is the phenomena whereby a layer of vapor completely covers a heated surface resulting in extreme surface temperatures; a potentially catastrophic condition. Film boiling can easily occur in microgravity and in microscale systems because the characteristic dimension of the vapor bubble is much larger than that of the heater. Electric fields may be employed to provide an effective means to bring liquid into contact with the heater surface thereby maintaining low surface temperatures at high heat fluxes. Nucleate and film boiling of PF-5060 over a 127 micrometer diameter electrically heated wire are observed. High resolution, high speed imaging show the nature of nucleate and film boiling and the enhancement to heat transfer afforded by the use of electric fields. Preliminary experiments conducted at 12 C and 27 C subcooling levels showed increases in the q_max and q_min heat flux levels by up to 50% when using 2kv across the heater and the screen, compared to the heat fluxes without electric fields. Using electric fields 1) we can enhance the nucleate boiling heat transfer (increase q_max), 2) make the transition, from nucleate boiling to film boiling at the critical heat flux, a slower and controllable process, and 3) destabilize the vapor film earlier and achieve nucleate boiling (increased q_min is a desirable safety/recovery characteristic).
Author
Electric Fields; Film Boiling; Heat Transfer; Heat Flux; Microgravity; Surface Temperature; Nucleate Boiling

20040084146 Michigan Univ., Ann Arbor, MI, USA
Microfluidic and Dielectric Processing of DNA
Larson, Ronald G.; Fang, Lin; Li, Lei; Namasivayam, Vijay; Burns, Mark A.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 27-28; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The manipulation of DNA parameters for genomics, health monitoring, and other applications can in principle be carried

out in microfluidic devices. Using single-molecule experiments and Brownian dynamics simulations we have considered isolated DNA molecules near absorbing and non-absorbing walls in the presence of a simple shearing flow and in an evaporating droplet. We have also used electric fields to stretch DNA molecules and adhere them to surfaces, where we might eventually study their interactions with proteins, including proteins that repair or protect DNA from radiation or other damage.
Author
Deoxyribonucleic Acid; Microfluidic Devices; Dielectrics; Brownian Movements; Drops (Liquids)

20040084148 Rensselaer Polytechnic Inst., Troy, NY, USA
Constrained Vapor Bubble
Plawsky, Joel L.; Wayner, Peter C., Jr.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 37-38; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The use of interfacial free energy gradients to control liquid and vapor flows naturally leads to simpler and lighter change-of-phase heat transfer systems because of the absence of mechanical pumps. These 'passive' engineering (PE) systems are ideal candidates for the thermal control of spacecraft. The non-isothermal constrained vapor bubble (CVB) is a generic PE system without porous material. A common example is a heat pipe without porous material. The particular CVB system being studied is in the shape of a heat pipe fin. The dynamic thermophysical principles underlying these heat transfer systems, especially under equivalent microgravity conditions, are not well understood and its uses have not been optimized. Within this project, the CVB is being studied under both earth and microgravity flight conditions to remedy this undesirable situation. The study is multi-faceted: 1) It is a study of a passive heat exchanger; 2) It is a basic engineering study of thermal transport; 3) It is a basic scientific study of interfacial phenomena, physics, and thermodynamics. Although the basic engineering Facets (1) and (2) are emphasized for heat exchanger development, the research is also naturally a basic scientific study in interfacial phenomena, microgravity physics, and thermodynamics.
Author (revised)
Vapors; Bubbles; Interfacial Energy; Free Energy

20040084149 Purdue Univ., West Lafayette, IN, USA
Two-fluid Model and Interfacial Area Transport in Microgravity Condition
Ishii, Mamoru; Sun, Xiandong; Vasavada, Shilp; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 85-86; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the present study is to develop a two-fluid model formulation with interfacial area transport equation applicable for microgravity conditions. The new model is expected to make a leapfrog improvement by furnishing the constitutive relations for the interfacial interaction terms with the interfacial area transport equation, which can dynamically model the changes of the interfacial structures. In the first year of this three-year project supported by the U.S. NASA, Office of Biological and Physics Research, the primary focus is to design and construct a ground-based, microgravity two-phase flow simulation facility, in which two immiscible fluids with close density will be used.
Author
Two Fluid Models; Liquid-Liquid Interfaces; Transport Theory; Microgravity

20040084151 Duke Univ., Durham, NC, USA
Gravity and Granular Materials
Behringer, Bob; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 5; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Phase transitions in 3D granular materials are greatly influenced by gravity, particularly in the compaction gas- and fluid-like phases. We are presently working with the NASA microgravity program to prepare low-G experiments for the space station, and concurrently conducting earth-bound laboratory experiments. Our setup consists of an annular shear cell which is vibrationally fluidized from below. This provides two separate means of injecting energy into the system, and we are able to study the interaction of the two effects in the formation of shear bands. We are presently investigating the statistical properties of this flow by quantifying velocities, granular temperatures, local density, and clustering. A parallel aspect of these studies are Molecular Dynamics (MD) simulations in 2D and 3D. These simulations provide insight into the expected behavior of a flight experiment, and provides insight inot new ways of modelling granular systems.
Author (revised)
Granular Materials; Microgravity; Flow Velocity; Fluid-Solid Interactions

20040084152 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA

Dynamic Wetting of Room Temperature Polymer Melts: Deviation from Newtonian Behavior

Rame, Enrique; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 139; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We examine the dynamic wetting of two simple, room temperature polymer melts, polystyrene and polyisobutylene, by observing the liquid-vapor interface formed on the outside of a silica surface forced into a bath of the test fluid at controlled rates. The dynamic interface shapes of these fluids deviate from the prediction of models that include only Newtonian flow behavior. Specifically, near the contact line the fluid interface curvature is enhanced compared to the Newtonian fluid having the same shear viscosity and static wetting behavior. This observation is surprising because neither elasticity nor any other non-Newtonian behavior is detected for these materials using standard rotational rheometry. To probe the cause of the deviation further, we observe the interface shape of analogous model fluids having measurable elasticity in the rheometer and show that elasticity causes qualitatively similar, although larger, deviations from Newtonian behavior. This study demonstrates that fluids which appear Newtonian in standard rheometric characterization may have wetting behavior which deviates from purely Newtonian. We may expect these deviations to appear not only in the interface shape near the moving contact line but also in such key properties as spontaneous spreading times and in flows which control coating processes.

Author

Nonnewtonian Flow; Polystyrene; Polyisobutylene; Liquid-Vapor Interfaces; Room Temperature

20040084154 Illinois Univ., Chicago, IL, USA

The Effect of Gravity Modulation on Filtration Convection in a Horizontal Layer

Popova, Natalya; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 131-132; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The present paper examines the effect of vertical (transverse) harmonic oscillations of the frequency and the amplitude A on the onset of convection in an infinite horizontal layer of fluid saturating a porous medium. Constant temperature distribution is assigned on the rigid impermeable boundaries, so that there exists a vertical temperature gradient. The mathematical model is described by equations of filtrational convection in the Darcy-Oberbeck-Boussinesq approximation, introduced in the coordinate system inflexibly fixed to the oscillating horizontal layer.

Author (revised)

Gravitational Effects; Convection; Filtration; Harmonic Oscillation; Transverse Oscillation

20040084162 California Univ., Berkeley, CA, USA

Transition from Forward Smoldering to Flaming in Small Polyurethane Foam Samples

Bar-Ilan, A.; Putzeys, O.; Rein, G.; Fernandez-Pello, A. C.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 53; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Experimental observations are presented of the effect of the flow velocity and oxygen concentration, and of a thermal radiant flux, on the transition from smoldering to flaming in forward smoldering of small samples of polyurethane foam with a gas/solid interface. The experiments are part of a project studying the transition from smolder to flaming under conditions encountered in spacecraft facilities, i.e., microgravity, low velocity variable oxygen concentration flows. Because the microgravity experiments are planned for the International Space Station, the foam samples had to be limited in size for safety and launch mass reasons. The feasible sample size is too small for smolder to self propagate because of heat losses to the surrounding environment. Thus, the smolder propagation and the transition to flaming had to be assisted by reducing the heat losses to the surroundings and increasing the oxygen concentration. The experiments are conducted with small parallelepiped samples vertically placed in a wind tunnel. Three of the sample lateral-sides are maintained at elevated temperature and the fourth side is exposed to an upward flow and to a radiant flux. It is found that decreasing the flow velocity and increasing its oxygen concentration, and/or increasing the radiant flux enhances the transition to flaming, and reduces the delay time to transition. Limiting external ambient conditions for the transition to flaming are reported for the present experimental set-up. The results show that smolder propagation and the transition to flaming can occur in relatively small fuel samples if the external conditions are appropriate. The results also indicate that transition to flaming occurs in the char left behind by the smolder reaction, and it has the characteristics of a gas-phase ignition induced by the smolder reaction, which acts as the source of both gaseous fuel and heat.

Derived from text

Smoldering; Polyurethane Foam; Gravitational Effects; Heat Flux; Flow Velocity

20040084177 Notre Dame Univ., IN, USA

Convective Instabilities in Liquid Foams

Veretennikov, Igor; Glazier, James A.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 181-182; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The main goal of this work is to better understand foam behavior both on the Earth and in microgravity conditions and to determine the relation between a foam s structure and wetness and its rheological properties. Our experiments focused on the effects of the bubble size distribution (BSD) on the foam behavior under gradual or stepwise in the liquid flow rate and on the onset of the convective instability. We were able to show experimentally, that the BSD affects foam rheology very strongly so any theory must take foam texture into account.

Author

Foams; Bubbles; Size Distribution; Moisture Content; Liquid Flow; Microgravity

20040084179 Washington State Univ., Pullman, WA, USA

Enhanced Damping for Capillary Bridge Oscillation Using Velocity Feedback

Wei, Wei; Thiessen, David B.; Marston, Philip L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 185; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The stability of cylindrical liquid bridges in reduced gravity is affected by ambient vibrations of the spacecraft. Such vibrations are expected to excite capillary modes of the bridge. The lowest-order unstable mode is particularly susceptible to vibration as the length of the bridge approaches the stability limit. This low-order mode is known as the (2,0) mode and is an axisymmetric varicose mode of one wavelength in the axial direction. In this work, an optical system is used to detect the (2,0)-mode amplitude. The derivative of the error signal produced by this detector is used to produce the appropriate voltages on a pair of ring electrodes which are concentric with the bridge. A mode-coupled Maxwell stress profile is thus generated in proportional to the modal velocity. Depending on the sign of the gain, the damping of the capillary oscillation can be either increased or decreased. This effect has been demonstrated in Plateau-tank experiments. Increasing the damping of the capillary modes on free liquid surfaces in space could be beneficial for containerless processing and other novel technologies. [work supported by NASA]

Author

Damping; Liquid Bridges; Oscillations; Microgravity; Space Processing

20040084180 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA

Droplet-surface Impingement Dynamics for Intelligent Spray Design

VanderWal, Randy L.; Kizito, John P.; Tryggvason, Gretar; Berger, Gordon M.; Mozes, Steven D.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 179-180; In English; See also 20040084137

Contract(s)/Grant(s): NRA-01-HEDs-03; NCC3-975; No Copyright; Avail: CASI; A01, Hardcopy

Spray cooling has high potential in thermal management and life support systems by overcoming the deleterious effect of microgravity upon two-phase heat transfer. In particular spray cooling offers several advantages in heat flux removal that include the following: 1. By maintaining a wetted surface, spray droplets impinge upon a thin fluid film rather than a dry solid surface 2. Most heat transfer surfaces will not be smooth but rough. Roughness can enhance conductive cooling, aid liquid removal by flow channeling. 3. Spray momentum can be used to a) substitute for gravity delivering fluid to the surface, b) prevent local dryout and potential thermal runaway and c) facilitate liquid and vapor removal. Yet high momentum results in high We and Re numbers characterizing the individual spray droplets. Beyond an impingement threshold, droplets splash rather than spread. Heat flux declines and spray cooling efficiency can markedly decrease. Accordingly we are investigating droplet impingement upon a) dry solid surfaces, b) fluid films, c) rough surfaces and determining splashing thresholds and relationships for both dry surfaces and those covered by fluid films. We are presently developing engineering correlations delineating the boundary between splashing and non-splashing regions.

Author

Drops (Liquids); Sprayers; Life Support Systems; Cooling; Fluid Films; Liquid Flow; Temperature Control

20040084183 Stanford Univ., Stanford, CA, USA

Fluid Physics and Transport Phenomena in a Simulated Reduced Gravity Environment

Lipa, John; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 109; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We describe a ground-based apparatus that allows the cancellation of gravity on a fluid using magnetic forces. The present system was designed for liquid oxygen studies over the range 0.001 - 5 g's. This fluid is an essential component of any flight mission using substantial amounts of liquid propellant, especially manned missions. The apparatus has been used to reduce the hydrostatic compression near the oxygen critical point and to demonstrate inverted phase separation. It could also be used to study pool boiling and two phase heat transfer in Martian, Lunar or near-zero gravity, as well as phenomena such as Marangoni flow and convective instabilities. These studies would contribute directly to the reliability and optimization of the Moon and Mars flight programs.
Author
Fluid Dynamics; Microgravity; Transport Properties; Computerized Simulation

20040084185 Drexel Univ., Philadelphia, PA, USA
Thermoacoustic Convection and Transport in Gases and Near-critical Fluids under Normal and Micro-gravity Conditions
Lin, Yi-Qiang; Lei, Zhi-Heng; Farouk, Bakhtier; Oran, Elaine S.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 107-108; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The recently initiated research project is aimed at studying thermoacoustic and buoyancy-driven transport in gases and near-critical fluids at normal and reduced gravity environments. Large-scale detailed computational models are being developed to simulate and understand the complex phenomena, and thereby analyze the heat and mass transport in gases and near-critical fluids under both microgravity and normal gravity conditions. Normal and reduced gravity experiments are being designed where careful measurements and visualization studies will be carried out to characterize thermoacoustic waves in gases and near-critical fluids. Ground-based reduced gravity experiments will be carried out in the 2.2 s drop tower at the Glenn Research Center. When a compressible fluid is suddenly exposed to a localized heat flux, part of the fluid in the immediate vicinity of the boundary expands. This gives rise to a rapid increase in the local pressure, leading to the production of pressure waves called thermoacoustic waves. Thermal convection induced or augmented by acoustic waves is termed as thermoacoustic convection. In real gases, the heat transfer and fluid dynamic effects of thermoacoustic waves are only significant when the heat addition is rapid and the gravitational effects are reduced. We shall investigate the thermoacoustic wave characteristics in different real gases in normal and reduced gravity environments.
Author
Gravitational Effects; Convection; Buoyancy; Working Fluids; Sound Waves; Real Gases; Microgravity; Heat Transfer; Heat Flux

20040084186 NASA Glenn Research Center, Cleveland, OH, USA
Transition from Forward Smoldering to Flaming in Small Polyurethane Foam Samples
Bar-Ilan, A.; Putzeys, O.; Rein, G.; Fernandez-Pello, A. C.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 53; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Experimental observations are presented of the effect of the flow velocity and oxygen concentration, and of a thermal radiant flux, on the transition from smoldering to flaming in forward smoldering of small samples of polyurethane foam with a gas/solid interface. The experiments are part of a project studying the transition from smolder to flaming under conditions encountered in spacecraft facilities, i.e., microgravity, low velocity variable oxygen concentration flows. Because the microgravity experiments are planned for the International Space Station, the foam samples had to be limited in size for safety and launch mass reasons. The feasible sample size is too small for smolder to self propagate because of heat losses to the surrounding environment. Thus, the smolder propagation and the transition to flaming had to be assisted by reducing the heat losses to the surroundings and increasing the oxygen concentration. The experiments are conducted with small parallelepiped samples vertically placed in a wind tunnel. Three of the sample lateral-sides are maintained at elevated temperature and the fourth side is exposed to an upward flow and to a radiant flux. It is found that decreasing the flow velocity and increasing its oxygen concentration, and/or increasing the radiant flux enhances the transition to flaming, and reduces the delay time to transition. Limiting external ambient conditions for the transition to flaming are reported for the present experimental set-up. The results show that smolder propagation and the transition to flaming can occur in relatively small fuel samples if the external conditions are appropriate. The results also indicate that transition to flaming occurs in the char left behind by the smolder reaction, and it has the characteristics of a gas-phase ignition induced by the smolder reaction, which acts as the source of both gaseous fuel and heat.
Author
Flow Velocity; Polyurethane Foam; Smoldering; Wind Tunnel Tests; Flames

20040084188 Cornell Univ., NY, USA

The Fluid Mechanics of Liquid Jet Impingement: The Hydraulic Jump in Microgravity

Avedisian, C. T.; Chandra, S.; Mostaghimi, J.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 47-49; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Liquid jet impingement is an important process for thermal management to dissipate very high heat fluxes [1] and for coating solid surfaces with a liquid (e.g., applying thin films on paper to produce a high-gloss finish). Rapid cooling is achieved by taking advantage of the high liquid velocity in the thin film flowing away from the stagnation point. If a hydraulic jump forms (figure 1a for a circular hydraulic jump) the physical extent of cooling, or uniformity of a film coating, degrades because the film thickness increases substantially downstream of the jump. The discovery of steady noncircular jump shapes in normal gravity experimentation ([2- 4]; figure 1b illustrates an example at G=1 for polygonal jumps) shows unusual patterns in the flow near to the jump boundary and downstream of it (figure 1c [3] which shows fluid ejection at the corners) that are poorly understood, yet which could hold some promise for heat transfer. This project is the first phase of an anticipated two-part effort to understand the mechanisms of heat transfer from impinging liquid jets at reduced gravity. The first part focuses on the fluid mechanics of isothermal flows and the conditions under which hydraulic jumps form. An emphasis is on the formation of noncircular jumps and the conditions and flow patterns associated with them at reduced gravity. As we have just begun the research in 2004, we describe briefly some of the objectives and methods we will pursue during the first phase. Author

Fluid Jets; Jet Impingement; Heat Flux; Heat Transfer; Microgravity; Flow Distribution

20040084189 Michigan Univ., Ann Arbor, MI, USA

Light Scattering and Direct Visualization Studies of Anisometric Colloidal Aggregates and Gels

Mohraz, Ali; Solomon, Michael J.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 115; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Suspensions of anisometric colloids find widespread technological applications in areas such as the manufacturing of ceramics and the production of polymer/clay nanocomposites. Although often the functional properties of the final products rely on the anisometric shape of the colloids, the fundamental role of this parameter in mediating the microstructure and rheology of aggregated structures such as colloidal gels is poorly understood. To experimentally assess the effect of particle geometry on the morphology of such amorphous structures, colloidal boehmite rods of approximately monodisperse dimensions and aspect ratios in the range 5-30 have been synthesized. Aggregation is induced by the addition of electrolytes to aqueous suspensions and the structure of fractal aggregates in both the DLCA and RLCA regimes is characterized over three decades of the scattering vector by combined ultra-small, small, and wide-angle light scattering. The microstructure of rod aggregates in the DLCA regime shows an unexpected dependence on the geometry of primary particles, in contrast with the universal behavior of colloidal spheres. Monte Carlo simulations of rod aggregation corroborate this finding and the underlying mechanism for this unforeseen deviation is understood in light of the interaction of Brownian motion and anisotropic excluded volume of primary particles. Furthermore, as the rod aspect ratio is increased, the structural distinction between the DLCA and RLCA aggregates is diminished. The implication of these structural anomalies in the internal dynamics of fractal networks is investigated by photon correlation spectroscopy. Direct visualization of three-dimensional structure by confocal laser scanning microscopy (CLSM) provides a powerful means for investigating the effect of particle shape and orientation of the structure and dynamics of colloidal suspensions. Stable suspensions of fluorescent colloidal spherocylinders and ellipsoids in organic solvents have been prepared by the adaptation of literature methods. The sterically-stabilized polymeric colloids have been dispersed in density and refractive-index matching mixed organic solvents suitable for CLSM studies. Image processing algorithms for location of the centroid position and orientation angle of individual particles have been developed. By means of these methods, we investigate the distribution of rod orientations in suspensions and gels. Derived from text

Light Scattering; Anisotropy; Colloids; Aggregates; Gels; Flow Visualization

20040084192 Purdue Univ., West Lafayette, IN, USA

Study of Co-current and Counter-current Gas-liquid Two-phase Flow Through Packed Bed in Microgravity

Revankar, Shripad T.; Kong, Xiangcheng; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 141-142; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The main goal of the project was to develop experiments to obtain data and develop models on the co-current and counter-current gas-liquid two-phase flow through a packed bed in microgravity and characterize the flow regime transition, pressure drop, void and interfacial area distribution, and liquid hold up. An experimental and analytical modeling program for

the study of co-current air-water two-phase down flow in a packed column was developed. A detailed survey of the literature was performed on two-phase flow in packed columns. The literature shows only one set of study from Glenn Research Center NASA is available on two-phase flow in packed bed under microgravity conditions. A large amount of effort was put in the development of instrumentation for the local and global measurement in the packed bed. A two point conductivity probe for the measurement of void fraction in the bed at pore level, a film thickness probe for the measurement of film thickness and drying characteristics of the packing, and a bed wise impedance meter for bed wise void measurement were developed. These probes were calibrated and plans were made for the installation of these probes in the packed bed. A packed bed test facility was designed and constructed. The bed is a cylindrical pipe of diameter 69 mm and height of 1.52m. the bed particles were glass spheres of diameter 6 mm. The bed porosity was 0.377. Single phase flow characterization of the test loop was performed by flowing air and water in the bed and measuring bed pressure drop. From these measurements single phase constants in Ergun pressure drop equations were calculated. Two Phase co-current down flow of air-water test were conducted. The flow regime in the bed was observed and recorded with high speed video camera. Flow regime map was developed. Five flow regimes were identified, trickling, wavy, transitional, pulsing and bubble flow. Pressure drop in the bed were also obtained for various flow regimes in the bed. An analytical model was developed for predicting flow regime transition from trickle to pulse mode using two-phase film model. Packed bed reactors have potential space-based applications in bioregenerative food production, waste treatment, watering and nutrient transport in plant root systems, waste recovery, and extraction from planetary materials. The present research addresses the most important topic of HEDS-specific microgravity fluid physics research identified by NASA s one of the strategic enterprises, OBPR Enterprise. The first two years are devoted to ground based flight definition experimental and modeling program. During the next two years microgravity flight tests are carried out using the ground-based parabolic flight research aircraft.
Author
Experiment Design; Data Acquisition; Mathematical Models; Liquid-Gas Mixtures; Fluid Dynamics; Two Phase Flow; Microgravity; Pressure Measurement

20040084196 California Univ., Davis, CA, USA
Bi-component Droplet Combustion in Reduced Gravity
Shaw, Benjamin D.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 155-156; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

This research deals with reduced-gravity combustion of bi-component droplets initially in the mm size range or larger. The primary objectives of the research are to study the effects of droplet internal flows, thermal and solutal Marangoni stresses, and species volatility differences on liquid species transport and overall combustion phenomena (e.g., gas-phase unsteadiness, burning rates, sooting, radiation, and extinction). The research program utilizes a reduced-gravity environment so that buoyancy effects are rendered negligible. Use of large droplets also facilitates visualization of droplet internal flows, which is important for this research. In the experiments, droplets composed of low- and high-volatility species are burned. The low-volatility components are initially present in small amounts. As combustion of a droplet proceeds, the liquid surface mass fraction of the low-volatility component will increase with time, resulting in a sudden and temporary decrease in droplet burning rates as the droplet rapidly heats to temperatures close to the boiling point of the low-volatility component. This decrease in burning rates causes a sudden and temporary contraction of the flame. The decrease in burning rates and the flame contraction can be observed experimentally. Measurements of burning rates as well as the onset time for flame contraction allow effective liquid-phase species diffusivities to be calculated, e.g., using asymptotic theory [1]. It is planned that droplet internal flows will be visualized in flight and ground-based experiments. In this way, effective liquid species diffusivities can be related to droplet internal flow characteristics.
Author
Drops (Liquids); Marangoni Convection; Flow Characteristics; Combustion; Vapor Phases; Volatility; Size Distribution; Microgravity

20040084197 California Univ., Davis, CA, USA
Reduced Gravity Studies of Soret Transport Effects in Liquid Fuel Combustion
Shaw, Benjamin D.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 157-158; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Soret transport, which is mass transport driven by thermal gradients, can be important in practical flames as well as laboratory flames by influencing transport of low molecular weight species (e.g., monatomic and diatomic hydrogen). In addition, gas-phase Soret transport of high molecular weight fuel species that are present in practical liquid fuels (e.g., octane or methanol) can be significant in practical flames and in high-pressure droplet evaporation, and it has also been shown that

Soret transport effects can be important in determining oxygen diffusion rates in certain classes of microgravity droplet combustion experiments. It is thus useful to obtain information on flames under conditions where Soret effects can be clearly observed. This research is concerned with investigating effects of Soret transport on combustion of liquid fuels, in particular liquid fuel droplets. Reduced-gravity is employed to provide an ideal (spherically-symmetrical) experimental model with which to investigate effects of Soret transport on combustion. The research will involve performing reduced-gravity experiments on combustion of liquid fuel droplets in environments where Soret effects significantly influence transport of fuel and oxygen to flame zones. Experiments will also be performed where Soret effects are not expected to be important. Droplets initially in the 0.5 to 1 mm size range will be burned. Data will be obtained on influences of Soret transport on combustion characteristics (e.g., droplet burning rates, droplet lifetimes, gas-phase extinction, and transient flame behaviors) under simplified geometrical conditions that are most amenable to theoretical modeling (i.e., spherical symmetry). The experiments will be compared with existing theoretical models as well as new models that will be developed. Normal gravity experiments will also be performed. Experimental research will involve performing reduced-gravity droplet combustion experiments in a NASA Glenn drop tower (the 2.2 s tower). Use will be made of an existing droplet combustion rig. Digital images of the drop rig are shown. This rig will be used to provide results on Soret effects for droplets initially from about 0.5 mm to 1 mm in diameter. The pressure will range from subatmospheric to as high as about 1.2 MPa (and possibly higher). The drop rig has a pressure vessel mounted on a NASA-supplied drop frame with associated control electronics and gas and liquid handling systems. Orthogonal views are used with the drop rig; one view is used to image droplets and the other view is used to image flames. The flame view is not backlit, and a Xybion intensified-array CCD camera can be used to image OH emissions in this view (CH emissions can also be imaged).
Derived from text
Gravitational Effects; Combustion; Liquid Fuels; Mathematical Models

20040084201 Cornell Univ., Ithaca, NY, USA
Dynamics and Stability of Capillary Surfaces: Liquid Switches at Small Scales
Steen, Paul H.; Bhandar, Anand; Vogel, Michael J.; Hirsa, Amir H.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 163; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The dynamics and stability of systems of interfaces is central to a range of technologies related to the Human Exploration and Development of Space (HEDS). Our premise is that dramatic shape changes can be manipulated to advantage with minimal input, if the system is near instability. The primary objective is to develop the science base to allow novel approaches to liquid management in low-gravity based on this premise. HEDS requires efficient, reliable and lightweight technologies. Our poster will highlight our progress toward this goal using the capillary switch as an example. A capillary surface is a liquid/liquid or liquid/gas interface whose shape is determined by surface tension. For typical liquids (e.g., water) against gas on earth, capillary surfaces occur on the millimeter-scale and smaller where shape deformation due to gravity is unimportant. In low gravity, they can occur on the centimeter scale. Capillary surfaces can be combined to make a switch a system with multiple stable states. A capillary switch can generate motion or effect force. To be practical, the energy barriers of such a switch must be tunable, its switching time (kinetics) short and its triggering mechanism reliable. We illustrate these features with a capillary switch that consists of two droplets, coupled by common pressure. As long as contact lines remained pinned, motions are inviscid, even at sub-millimeter scales, with consequent promise of low-power consumption at the device level. Predictions of theory are compared to experiment on i) a soap-film prototype at centimeter scale and ii) a liquid droplet switch at millimeter-scale.
Author
Gas-Liquid Interactions; Liquid-Vapor Interfaces; Millimeter Waves; Drops (Liquids); Microgravity

20040084203 NASA Glenn Research Center, Cleveland, OH, USA
Fixed Packed Bed Reactors in Reduced Gravity
Motil, Brian J.; Balakotaiah, Vemuri; Kamotani, Yasuhiro; McCready, Mark J.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 35; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We present experimental data on flow pattern transitions, pressure drop and flow characteristics for cocurrent gas-liquid flow through packed columns in microgravity. The flow pattern transition data indicates that the pulse flow regime exists over a wider range of gas and liquid flow rates under microgravity conditions compared to 1-g and the widely used Talmor map in 1-g is not applicable for predicting the transition boundaries. A new transition criterion between bubble and pulse flow in microgravity is proposed and tested using the data. Since there is no static head in microgravity, the pressure drop measured

is the true frictional pressure drop. The pressure drop data, which has much smaller scatter than most reported 1-g data clearly shows that capillary effects can enhance the pressure drop (especially in the bubble flow regime) as much as 200% compared to that predicted by the single phase Ergun equation. The pressure drop data are correlated in terms of a two-phase friction factor and its dependence on the gas and liquid Reynolds numbers and the Suratman number. The influence of gravity on the pulse amplitude and frequency is also discussed and compared to that under normal gravity conditions. Experimental work is planned to determine the gas-liquid mass transfer coefficients. Because of enhanced interfacial effects, we expect the gas-liquid transfer coefficients k(L)a and k(G)a (where a is the gas-liquid interfacial area) to be higher in microgravity than in normal gravity at the same flow conditions. This will be verified by gas absorption experiments, with and without reaction in the liquid phase, using oxygen, carbon dioxide, water and dilute aqueous amine solutions. The liquid-solid mass transfer coefficient will also be determined in the bubble as well as the pulse flow regimes using solid benzoic acid particles in the packing and measuring their rate of dissolution. The mass transfer coefficients in microgravity will be compared to those in normal gravity cocurrent flow to determine the mass transfer enhancement and propose new mass transfer correlations for two-phase gas-liquid flows through packed beds in microgravity.
Author (revised)
Microgravity; Flow Distribution; Pressure Gradients; Two Phase Flow

20040084209 Florida Univ., Gainesville, FL, USA
Comparison of the Stability of an Elliptical Liquid Bridge with a Companion Circular Liquid Bridge
Uguz, A. Kerem; Narayanan, R.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 175; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Liquid bridges have applications in microgravity contexts in connection to human health as well as materials processing. The small airways of the lungs are covered with a thin viscous film. The surface tension between the film and the air may induce the formation of a liquid bridge blocking the airflow and which might even damage the airway walls because of the pressure build-up. This disease is mostly seen in newborn premature babies who lack enough surfactant. Another application of the liquid bridges is seen in the float-zone crystal growth, which is a crucible-free technique to grow especially silicone. In this technique, in zero gravity, even if the strong thermocapillary flows are neglected, the melt zone, which can be represented by liquid bridge configuration, collapses at what is known as the Plateau limit. In most of the liquid bridge studies, the end disks are considered to be circular. In this presentation, the effect of distortion of the circular end plates to the nearby elliptical ones is studied wherein the volume of the companion cylindrical bridge is conserved. Also, the end plates are deviated from the companion circular plates by keeping either the area or the perimeter of the circular disks constant. We conclude that elliptical liquid bridge is more stable than its nearby circular bridge. A movie of the break-up of an elliptical liquid bridge is also provided.
Author
Liquid Bridges; Fluid Boundaries; End Plates

20040084213 Pittsburgh Univ., Pittsburgh, PA, USA
Two Dimensional Turbulence in Presence of Polymer
Jun, Yonggun; Zhang, Jie; Wu, Xiao-Lun; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 89; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The phenomenon of drag reduction by adding a small amount of long-chain polymers to turbulent flow has been studied for a long time but is not fully understood. We investigated the effect of the dilute polymer concentration and the energy injection rate upon the drag reduction and the turbulent structures in fully-developed 2D turbulent flow. Our measurements were performed in a freely suspended soap film. The Particle Imaging Velocimetry (PIV) is used to determine the velocity field and the local topological structures.We found that large coherent structures were suppressed by polymers and the energy dissipation due to polymer suddenly increased around polymer concentration 10 wppm. The shape of the PDF of the local topology P(delta) is changed for higher polymer concentrations.
Author
Drag Reduction; Energy Dissipation

20040084217 Cornell Univ., NY, USA

MOBI: Microgravity Observations of Bubble Interactions

Koch, Donald L.; Sangani, Ashok; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 25; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the greatest uncertainties affecting the design of multiphase flow technologies for space exploration is the spatial distribution of phases that will arise in microgravity or reduced gravity. On Earth, buoyancy-driven motion predominates whereas the shearing of the bubble suspension controls its behavior in microgravity. We are conducting a series of ground-based experiments and a flight experiment spanning the full range of ratios of buoyancy to shear. These include: (1) bubbles rising in a quiescent liquid in a vertical channel; (2) weak shear flow induced by slightly inclining the channel; (3) moderate shear flow in a terrestrial vertical pipe flow; and (4) shearing of a bubble suspension in a cylindrical Couette cell in microgravity. We consider nearly monodisperse suspensions of 1 to 1.8 mm diameter bubbles in aqueous electrolyte solutions. The liquid velocity disturbance produced by bubbles in this size range can often be described using an inviscid analysis. Electrolytic solutions lead to hydrophilic repulsion forces that stabilize the bubble suspension without causing Marangoni stresses. We will discuss the mechanisms that control the flow behavior and phase distribution in the ground-based experiments and speculate on the factors that may influence the suspension flow and bubble volume fraction distribution in the flight experiment.

Author

Bubbles; Microgravity; Technology Utilization; Two Phase Flow

20040084218 Pittsburgh Univ., Pittsburgh, PA, USA

The Study of Topological Structure Distributions in Stratified Soap Film Convections

Zhang, Jie; Jun, Yong-Gun; Wu, X. L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 187; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The statistical properties of local topological structures (centers and saddles) are studied using a vertically suspended soap film. The turbulent convection of the film is created by a vertical temperature gradient ((Delta)T)). The quantitative description of local topology is given by Lambda(x,y) triple bonds 1/4((omega(sup 2)-Sigma(sup 2)), where omega is the local vorticity and sigma is the local strain rate. The PDFs of Lambda were measured within a broad range of (Delta)Ts. After normalizing Lambda by its Lambda(sub rms), one found that the PDFs of Lambda were collapsed to two different curves at low and high (Delta)T regimes. Interestingly, the non-dimensional compressibility C triple bond \h(V-bar central dot v-bar)(sup 2)\g (sup 1/2)/\h (V-bar(v-bar))(sup 2)\g(sup 1/2)\g was found to have two different constant values at these low and high (Delta)T regimes within experimental uncertainties. At low (Delta)T, C was found 0.32, and at high (Delta)T was 0.24. We believe the two different behaviors of Lambda PDFs and C at low and high (Delta)Ts are closely related and are result of the vertical stratifications of the soap film.

Author

Topology; Soaps; Thin Films; Convection

20040084219 Bremen Univ., Germany

Critical Velocities in Open Capillary Channel Flows (CCF)

Dreyer, Michael E.; Rosendahl, Uwe; Ohlhoff, Antje; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 69-70; In English; See also 20040084137

Contract(s)/Grant(s): BMFT-50-WM-0241; No Copyright; Avail: CASI; A01, Hardcopy

We consider a forced liquid flow in an open capillary channel with free liquid surfaces under low gravity conditions. The channel consists of two parallel plates is shown. The gap distance, the width of the plates and the length of the channel are denoted with a, b and l, respectively. The liquid flows along the x-axis and forms free surfaces at the sides between the plates. The flow is maintained by external pumps and the free surface deforms according to the pressure along the flow path. In case of steady flow the capillary pressure of the free surface balances the differential pressure between the liquid and the ambient constant pressure gas phase. A maximum flow rate is achieved when the adjusted volumetric flow rate exceeds a certain limit leading to a collapse of the free surfaces. The aim of the considerations is to determine the profile of the gas/liquid interface, the maximum flow rate of the steady flow and the corresponding critical flow velocity. The maximum flow rate depends on the geometry of the channel and the properties of the liquid, specified by three dimensionless parameters.

Derived from text

Critical Flow; Capillary Flow; Microgravity; Steady Flow; Critical Velocity

20040084222 Cornell Univ., Ithaca, NY, USA
Solids Interacting with a Gas in a Microgravity Apparatus
Louge, Michael Y.; Jenkins, James T.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 29-30; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Gravity complicates the interpretation of Earth-bound experiments involving gas-solid flows. Because terrestrial gas-solid suspensions require sufficient drag to balance the weight of solids, they generally involve particles that are too small to control surface forces. In flows of larger granular solids, gravity creates condensed regions where particles engage in long-lasting contacts that are not collisional. Finally, gravity makes it difficult to control granular agitation at small flow speeds. To avoid these difficulties, we have designed the axisymmetric shear cell sketched in Fig. 1. We will use this apparatus to study gas-solid interactions in a project called SiGMA (Solids Interacting with a Gas in a Microgravity Apparatus), which will first fly in the Microgravity Science Glovebox on the International Space Station as early as 2003, and later in a Granular Flow Module under development. The apparatus consists of two counter-rotating cylindrical boundaries and two flat stationary side walls forming a rectangular flow channel. Shear flows are observed through windows on one of the flat side walls. In this talk we will illustrate the convenience of a long-lasting microgravity environment for studying flows of granular materials with and without gas interaction. We consider collisional greanular flows of nearly elastic spheres featuring a single consituent or binary mixtures in various bounded geometries.
Author (revised)
Microgravity; Granular Materials; Binary Mixtures; Gas-Solid Interactions

20040084227 Maryland Univ., College Park, MD, USA
Boiling Heat Transfer Mechanisms in Earth and Low Gravity Boundary Condition and Heater Aspect Ratio Effects
Kim, Jungho; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 21-22; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Boiling is a complex phenomenon where hydrodynamics, heat transfer, mass transfer, and interfacial phenomena are tightly interwoven. An understanding of boiling and critical heat flux in microgravity environments is of importance to space based hardware and processes such as heat exchange, cryogenic fuel storage and transportation, electronic cooling, and material processing due to the large amounts of heat that can be removed with relatively little increase in temperature. Although research in this area has been performed in the past four decades, the mechanisms by which heat is removed from surfaces in microgravity are still unclear. Recently, time and space resolved heat transfer data were obtained in both earth and low gravity environments using an array of microheaters varying in size between 100 microns and 700 microns. These heaters were operated in both constant temperature as well as constant heat flux mode.
Author
Boiling; Heat Flux; Heat Transfer; Mass Transfer; Hydrodynamics; Cooling; Heaters; Microgravity

35
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*.

20040079785 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Simple, Scalable, Script-based Science Processor
Lynnes, Christopher; [2004]; 1 pp.; In English; Workshop for Earth Science Satellite Remote Sensing, Summer 2003, Fairfax, VA, USA; No Copyright; Avail: Other Sources; Abstract Only

The production of Earth Science data from orbiting spacecraft is an activity that takes place 24 hours a day, 7 days a week. At the Goddard Earth Sciences Distributed Active Archive Center (GES DAAC), this results in as many as 16,000 program executions each day, far too many to be run by human operators. In fact, when the Moderate Resolution Imaging Spectroradiometer (MODIS) was launched aboard the Terra spacecraft in 1999, the automated commercial system for running science processing was able to manage no more than 4,000 executions per day. Consequently, the GES DAAC developed a lightweight system based on the popular Per1 scripting language, named the Simple, Scalable, Script-based Science Processor (S4P). S4P automates science processing, allowing operators to focus on the rare problems occurring from anomalies in data

or algorithms. S4P has been reused in several systems ranging from routine processing of MODIS data to data mining and is publicly available from NASA.
Author
Data Mining; Imaging Spectrometers; Imaging Techniques; MODIS (Radiometry)

20040081078 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Satellite Hyperspectral Imaging Simulation
Zanoni, Vicki; Stanley, Tom; Blonski, Slawomir; Cao, Changyong; Gasser, Jerry; Ryan, Robert; Zanoni, Vicki; Stanley, Tom; April 1, 1999; 2 pp.; In English; International Symposium on Spectral Sensing Research, 31 Oct. - 4 Nov. 1999, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-05-00039-SSC; No Copyright; Avail: Other Sources; Abstract Only

Simulations of generic pushbroom satellite hyperspetral sensors have been performed to evaluate the potential performance and validation techniques for satellite systems such as COIS (NEMO), Warfighter-1 (OrbView-4), and Hyperion (EO-1). The simulaitons start with a generation of synthetic scenes form material maps of studied terrain. Scene-reflected radiance is corrected for atmospheric effects and convolved with sensor spectral response uwing MODTRAN 4 radiance and transmission calculations. Scene images are further convolved with point spread functions derived from Optical Transfer Functions (OTF's) of the sensor system. Photon noise and detector/electronics noise are added to the simulated images, which are also finally quantized to the sensor bit resolution. Studied scenes include bridges and straight roads used for evaluation of sensor spatial resolution, as well as fields of minerals, vegetation, and manmade materials used for evaluation of sensor radiometric response and sensitivity. The scenes are simulated with various seasons and weather conditions. Signal-to-noise ratos and expected performance are estimated for typica satellite system specifications and are discussed for all the scenes.
Author
Imaging Techniques; Satellite Instruments; Simulation; Spectra; Sensors

20040081406 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Gas Chromatograph Mass Spectrometer for the Huygens Probe
Niemann, H. B.; Atreya, S. K.; Bauer, S. J.; Biemann, K.; Carignan, G. R.; Donahue, T. M.; Gautier, D.; Hunten, D. M.; Israel, G.; Lunine, J. I., et al.; [2004]; 1 pp.; In English; International Conference on the Occaision of the 375th Birthday of Christiaan Huygens, 13-17 Apr. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Titan is unique in the solar system, the only moon that has a dense atmosphere. The major constituents of the atmosphere, nitrogen and methane, are continuously broken apart by a combination of solar UV, impinging electrons from Saturn's magnetosphere, and a steady flow of cosmic rays. The resulting molecular fragments recombine and form a variety of new species, many of which were detected for the first time by Voyager 1. The ubiquitous, surface-hiding aerosol blanket manifests the existence of still more complex compounds. In addition to hydrocarbons and nitriles, the atmosphere is known to contain CO, CO2 and externally delivered H2O. The Gas Chromatograph Mass Spectrometer (GCMS) on the Huygens Probe will measure the chemical composition of the atmosphere of Titan from 170 km altitude (approximately lhPa) to the surface (approximately 1500hPa) and determine the isotope ratios of the major constituents. The GCMS will also analyze gas samples from the Aerosol Collector Pyrolyser (ACP) and may be able to obtain compositional information of several surface materials. The GCMS consists of a quadrupole mass spectrometer (QP) with a secondary electron multiplier ion detector, a three-column gas chromatograph (GC) and an elaborate gas sampling system. The gas sampling system will provide atmospheric samples to the QP for nearly continuous analysis during the Probe descent and batch samples at several altitudes for GC analysis. It also contains a chemical scrubber for noble gas analysis and an enrichment cell for trace constituent enhancement. In addition to the sampling of the atmosphere periodic gas samples, derived from the pyrolysis of aerosols, will be transferred from the ACP to the GCMS for direct QP and full GCMS analysis. The QP can analyze molecular masses from 2 to 14lDalton. The nominal detection threshold is at a mixing ratio of 10E-8. Data rate is 885 bits/sec. The mass of the instrument is 17.3 kg and the energy required for operation during the descent is 110 Watt-hours.
Author
Gas Chromatography; Huygens Probe; Mass Spectrometers; Gas Analysis

20040081505 Space and Naval Warfare Systems Command, San Diego, CA, USA, Naval Surface Warfare Center, USA
Interactive Multisensor Analysis Training
Wulfeck, Wallace H., II; Wetzel-Smith, Sandra K.; Dickierson, Janet L.; Advanced Technologies for Military Training; April 2004; 14 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Interactive Multisensor Analysis Training (IMAT) project is aimed at improving the preparation of operational users of undersea-warfare sensor systems. The effort has focused on training at all levels from initial individual training ashore through team, platform, and collective training at-sea, at all skill levels from apprentice sensor operators to senior tactical commanders. Operators and tacticians at all levels need a deep and scientifically accurate, but not necessarily formal, understanding of the physical principles that underlie tactical employment of their sensors. IMAT systems use model-based scientific visualizations, including three-dimensional graphics and animations, to illustrate complex physical interactions in mission-relevant contexts, and to provide interactive virtual laboratories in which the principles can be explored. Concepts in instruction include radiated acoustic characteristics, propagation in range-dependent environments, and sensor properties. Training systems provide exploratory environments in which operators and tacticians can examine the effects of change in any of the variables involved in the end-to-end sequence of emission, transmission, reflection and detection. Sensor settings, environmental conditions, and target characteristics can all be modified through a 'what-if' simulation approach. These technologies have been applied effectively in basic and advanced sensor operations/employment courses; in individual and team training simulators, and in on-board training. At the battle-group and theater level, new-technology systems are used for decision support during at-sea exercises and operations, and for post-event reconstruction and performance analysis. This paper describes the IMAT training philosophy and approach, the design of training systems, and training effectiveness.
Author
Multisensor Fusion; Training Simulators; Military Personnel; Antisubmarine Warfare

20040082056 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status and Performance of HST/Wide Field Camera 3
Kimble, Randy; 2004; 1 pp.; In English; AAS Conference, 4-8 Jan. 2004, Atlanta, GA, USA; No Copyright; Avail: Other Sources; Abstract Only

The HST Wide Field Camera 3 is a panchromatic UV-visible-near infrared camera whose development is currently nearing completion, for a planned installation into the Hubble Space Telescope during Servicing Mission 4. WFC3 provides two imaging channels. The UVIS channel features a 4096 x 4096 pixel CCD focal plane with sensitivity from 200 to 1000 nm and a 160 x 160 arcsec field of view. The UVIS channel provides unprecedented sensitivity and field of view in the near ultraviolet for HST. The IR channel features a 1014 x 1014 pixel HgCdTe focal plane covering 850 to 1700 nm with a 135 x 135 arcsec field of view, providing an order of magnitude increase in J+H band surveying efficiency for HST. WFC3 offers a rich complement of filters and grisms in each channel. The construction of WFC3 is nearly complete, and the instrument is well into its integration and test program. We present the current status of the instrument and its projected scientific performance.
Author
Hubble Space Telescope; Cameras; Imaging Techniques; Near Infrared Radiation; Ultraviolet Radiation

20040082132 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GLAST: GeV Astronomy in a Multiwavelength Context
Thompson, David J.; New Astronomy Reviews; April 2004; ISSN 1387-6473; Volume 48, No. 5-6, pp. 543-549; In English; Copyright; Avail: Other Sources

The GLAST Large Area Telescope (LAT), successor to Energetic Gamma-ray Experiment Telescope (EGRET) on the Compton Observatory, will play an important role in multiwavelength studies during the second half of this decade. Operating at energies between 20 MeV and greater than 300 GeV with sensitivity 30 or more times greater than that of EGRET, the Large Area Telescope (LAT) will offer good spatial and time resolution over a large (less than 2 sr) field of view. The LAT will bring insight to the whole range of high-energy gamma-ray phenomena, including bursts, active galactic nuclei, pulsars, supernova remnants, diffuse emission and unidentified sources. In essentially all cases, the maximum scientific return will come from coordinated (although not necessarily simultaneous) multiwavelength observations. Particularly with its planned scanning mode of operation, GLAST will have full sky coverage on relatively short time scales. The LAT team looks forward to cooperating with observers at other wavelengths.
Author
Gamma Ray Telescopes; Spatial Resolution; Gamma Rays; Active Galactic Nuclei

20040082141 NASA Goddard Space Flight Center, Greenbelt, MD, USA
JWST ISIM Distortion Analysis Challenge
Cifie, Emmanuel; Matzinger, Liz; Kuhn, Jonathan; Fan, Terry; 2004; 19 pp.; In English; NASA/GSFC FEMCI Workshop, 6-6 May 2004, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

Very tight distortion requirements are imposed on the JWST's ISM structure due to the sensitivity of the telescope's mirror segment and science instrument positioning. The ISIM structure is a three dimensional truss with asymmetric gusseting and metal fittings. One of the primary challenges for ISIM's analysis team is predicting the thermal distortion of the structure both from the bulk cooldown from ambient to cryo, and the smaller temperature changes within the cryogenic operating environment. As a first cut to estimate thermal distortions, a finite element model of bar elements was created. Elements representing joint areas and metal fittings use effective properties that match the behavior of the stack-up of the composite tube, gusset and adhesive under mechanical and thermal loads. These properties were derived by matching tip deflections of a solid model simplified T-joint. Because of the structure s asymmetric gusseting, this effective property model is a first attempt at predicting rotations that cannot be captured with a smeared CTE approach. In addition to the finite element analysis, several first order calculations have been performed to gauge the feasibility of the material design. Because of the stringent thermal distortion requirements at cryogenic temperatures, a composite tube material with near zero or negative CTE is required. A preliminary hand analysis of the contribution of the various components along the distortion path between FGS and the other instruments, neglecting second order effects were examined. A plot of bounding tube longitudinal and transverse CTEs for thermal stability requirements was generated to help determine the feasibility of meeting these requirements. This analysis is a work in progress en route to a large degree of freedom hi-fidelity FEA model for distortion analysis. Methods of model reduction, such as superelements, are currently being investigated.
Author
Telescopes; Mirrors; Cryogenic Temperature; Degrees of Freedom; Distortion

20040082154 NASA Goddard Space Flight Center, Greenbelt, MD, USA
LISA Propulsion Module Separation Study
Merkowitz, Stephen; 2004; 1 pp.; In English; 5th International LISA Symposium, 12-16 Jul. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission is a space-borne gravitational wave detector consisting of three spacecraft in heliocentric orbit. Each spacecraft is delivered to it operational orbit by a propulsion module. Because of the strict thermal and mass balancing requirements of LISA, the baseline mission concept requires that the propulsion module separate from the sciencecraft after delivery. The only propulsion system currently baselined for the sciencecraft are micronewton level thrusters, such as FEEP or colloid thrusters, that are used to balance the 30-40 microN of solar radiation pressure and provide the drag-free and attitude control of the spacecraft. Due to these thrusters limited authority, the separation of the propulsion module from the sciencecraft must be well controlled to not induce a large tip-off rotation of the sciencecraft. We present here the results of a design study of the propulsion module separation system that is shown to safely deliver the LISA sciencecraft to its final operational orbit.
Author
Lisa (Observatory); Gravitational Waves; Solar Radiation; Radiation Pressure

20040082163 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radiation-Induced Transient Effects in Near Infrared Focal Plane Arrays
Reed, Robert A.; Pickel, J.; Marshall, P.; Waczynski, A.; McMurray, R.; Gee, G.; Polidan, E.; Johnson, S.; McKeivey, M.; Ennico, K.; Johnson, R.; 2004; 12 pp.; In English; SPIE Europe International Symposium Astronomical Telescopes, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation describes a test simulate the transient effects of cosmic ray impacts on near infrared focal plane arrays. The objectives of the test are to: 1) Characterize proton single events as function of energy and angle of incidence; 2) Measure charge spread (crosstalk) to adjacent pixels; 3) Assess transient recovery time.
CASI
Near Infrared Radiation; Focal Plane Devices; Radiation Effects; Cosmic Rays

20040082175 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Remote Sensing Capabilities to Detect Maritime Vessels in Distress
Larsen, Rudolph K.; Green, John M.; Huxtable, Barton D.; Rais, Houra; [2004]; 1 pp.; In English; Alliance for Maritime Remote Sensing Conference 2004, 16-19 Mar. 2004, London, UK
Contract(s)/Grant(s): NAS5-33229; NAS5-99124; Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration (NASA) has the responsibility for conducting research and development for search and rescue as charged under the National Search and Rescue Plan. For over two decades this task has

been undertaken by the Search and Rescue Mission Office at the NASA Goddard Space Flight Center (GSFC). The technology used by the highly successful beacon locating satellite system, Cospas-Sarsat, was conceived and developed at GSFC and is managed by the National Oceanographic and Atmospheric Administration (NOAA). Using beacon-less remote sensing to find people and vessels in distress complements the demonstrated life saving capabilities of this satellite system. The Search and Rescue Mission Office has been investigating the use of fully polarimetric synthetic aperture radar to locate crashed aircraft. An overview of this effort and potential maritime applications of Search and Rescue Synthetic Aperture Radar (SAR) will be presented. The Mission Office has also developed a Laser search and rescue system called L-SAR. The prototype instrument was designed and built by SenSyTech Inc. It specifically targets the location of novel retro-reflective material easily applied to rescue equipment and vessels in distress. An overview of this effort will also be presented.
Author
Remote Sensing; Rescue Operations; Targets

20040082193 NASA Goddard Space Flight Center, Greenbelt, MD, USA
4H-SiC UV Photo Detector with Large Area and Very High Specific Detectivity
Yan, Feng; Shahid, Aslam; Franz, David; Xin, Xiaobin; Zhao, Jian H.; Zhao, Yuegang; Winer, Maurice; 2004; 21 pp.; In English
Contract(s)/Grant(s): NE-EK000-2-00302; Copyright; Avail: CASI; A03, Hardcopy

Pt/4H-SiC Schottky photodiodes have been fabricated with the device areas up to 1 sq cm. The I-V characteristics and photo-response spectra have been measured and analyzed. For a 5 mm x 5 mm area device leakage current of 1 x 10(exp 15)A at zero bias and 1.2 x 10(exp 14)A at -IV have been established. The quantum efficiency is over 30% from 240nm to 320nm. The specific detectivity, D(sup *), has been calculated from the directly measured leakage current and quantum efficiency data and are shown to be higher than 10(exp 15) cmHz(sup 1/2)/W from 210nm to 350nm with a peak D(sup *) of 3.6 x 10(exp 15)cmH(sup 1/2)/W at 300nm.
Author
Ultraviolet Detectors; Silicon Carbides; Photodiodes; Spectral Resolution

20040082195 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Self-Gravity Modeling for LISA
Merkowitz, Stephen; 2004; 1 pp.; In English; 5th International LISA Symposium, 12=16 Jul. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission, a space based gravitational wave detector, uses laser metrology to measure distance fluctuations between proof masses aboard three spacecraft. The total acceleration disturbance to each proof mass is required to be below 3 x 10(exp 15) m/sq square root of Hz. Self-gravity noise due to spacecraft distortion and spacecraft motion is expected to be a significant contributor to the acceleration noise budget. To minimize these effects, the gravitational field at each proof mass must be kept as small, flat, and constant as possible. It is estimated that the static field must be kept below 5 x 10(exp -10) m/sq s with a gradient below 3 x 10(exp -8)/sq s in order to meet the required noise levels. Most likely it will not be possible to directly verify by measurements that the LISA spacecraft meets these requirements; they must be verified by models. The LISA Integrated Modeling team developed a new self-gravity tool that calculates the gravitational forces and moments on the proof masses to aid in the design and verification of the LISA spacecraft. We present here an overview of&e tool and the latest self-gravity results calculated using the current baseline design of LISA. We also present results of a self-gravity analysis of the ST-7 DRS package that will fly on the LISA Pathfinder mission.
Author
Lisa (Observatory); Gravitational Waves; Noise Intensity; Metrology

20040082206 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
IKONOS Spatial Resolution and Image Interpretability Characterization
Ryan, Robert; Baldridge, Braxton; Schowengerdt, Robert A.; Choi, Taeyoung; Helder, Dennis L.; Blonski, Slawomir; July 29, 2003; 50 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-05-00042-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This paper contains research from five individual projects to characterize the spatial performance of the IKONOS commercial imaging sensor. The end result of the projects is determination of the spatial image quality of IKONOS data prodicts in terms of the National Imagery Interpretability Rating Scale (NIIRS), the system Modulation Transfer Function

(MTF), the system stability over the first year, the characteristics of the Space Imaging MTF Compensation (MTFC) procedure, and the application-specific capabilities of IKONOS imagery. Both panchromatic and multispectral imagery were evaluated. Major conclusions of this work are that the system was stable im imaging performance during the first year of operation, tha its MTF meets the specification for the NASA Scientific Data Purchase program, that the initial MTFC processing appears to be transposed in the in-track and the cross-track directions, that the MTFC results in a noise amplification of 2x to 4x in addition to sharpening the imagery, and that IKONOS panchromatic imagery achieves an average NIIRS rating of 4.5.
Author
Spatial Resolution; Imaging Techniques; Sensors; Characterization; Photointerpretation

20040082211 NASA Langley Research Center, Hampton, VA, USA
A Rotary Flow Channel for Shear Stress Sensor Calibration
Zuckerwar, Allan J.; Scott, Michael A.; April 19, 2004; 12 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 762-55-MA; No Copyright; Avail: CASI; A03, Hardcopy

A proposed shear sensor calibrator consists of a rotating wheel with the sensor mounted tangential to the rim and positioned in close proximity to the rim. The shear stress generated by the flow at the sensor position is simply tau(sub omega) = (mu)r(omega)/h, where mu is the viscosity of the ambient gas, r the wheel radius, omega the angular velocity of the wheel, and h the width of the gap between the wheel rim and the sensor. With numerical values of mu = 31 (mu)Pa s (neon at room temperature), r = 0.5 m, omega = 754 /s (7200 rpm), and h = 50.8 m, a shear stress of tau(sub omega) = 231 Pa can be generated. An analysis based on one-dimensional flow, with the flow velocity having only an angular component as a function of the axial and radial coordinates, yields corrections to the above simple formula for the curvature of the wheel, flatness of the sensor, and finite width of the wheel. It is assumed that the sensor mount contains a trough (sidewalls) to render a velocity release boundary condition at the edges of the rim. The Taylor number under maximum flow conditions is found to be 62.3, sufficiently low to obviate flow instability. The fact that the parameters entering into the evaluation of the shear stress can be measured to high accuracy with well-defined uncertainties makes the proposed calibrator suitable for a physical standard for shear stress calibration.
Author
Calibrating; Sensors; Shear Stress; Angular Velocity

20040082221 BAE Systems, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
X-ray Microscopic Characterization of Protein Crystals
Hu, Z. W.; Holmes, A.; Thomas, B.R.; Chernov, a. A.; Chu, Y. S.; Lai, B.; [2004]; 1 pp.; In English; 10th International Conference on the Crystallization of Biological Maromolecules (ICCBM), 5-8 Jun. 2004, Beijing, China
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

The microscopic mapping of the variation in degree of perfection and in type of defects in entire protein crystals by x-rays may well be a prerequisite for better understanding causes of lattice imperfections, the growth history, and properties of protein crystals. However, x-ray microscopic characterization of bulk protein crystals, in the as-grown state, is frequently more challenging than that of small molecular crystals due to the experimental difficulties arising largely from the unique features possessed by protein crystals. In this presentation, we will illustrate ssme recent activities in employing coherence-based phase contrast x-ray imaging and high-angular-resolution diffraction techniques for mapping microdefects and the degree of perfection of protein crystals, and demonstrate a correlation between crystal perfection, diffraction phenomena., and crystallization conditions. The observed features and phenomena will be discussed in context to gain insight into the nature of defects, nucleation and growth, and the properties of protein crystals.
Author
Crystal Defects; Defects; Diffraction; Protein Crystal Growth; Microscopes

20040082250 NASA Langley Research Center, Hampton, VA, USA
Membrane Vibration Analysis Above the Nyquist Limit with Fluorescence Videogrammetry
Dorrington, Adrian A.; Jones, Thomas W.; Danehy, Paul M.; Pappa, Richard S.; [2004]; 9 pp.; In English; SEM X International Congress and Exposition on Experimental and Applied Mechanics, 7-10 Jun. 2004, Costa Mesa, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-090-20-15; No Copyright; Avail: CASI; A02, Hardcopy

A new method for generating photogrammetric targets by projecting an array of laser beams onto a membrane doped with fluorescent laser dye has recently been developed. In this paper we review this new fluorescence based technique, then proceed to show how it can be used for dynamic measurements, and how a short pulsed (10 ns) laser allows the measurement of vibration modes at frequencies several times the sampling frequency. In addition, we present experimental results showing the determination of fundamental and harmonic vibration modes of a drum style dye-doped polymer membrane tautly mounted on a 12-inch circular hoop and excited with 30 Hz and 62 Hz sinusoidal acoustic waves. The projected laser dot pattern was generated by passing the beam from a pulsed Nd:YAG laser though a diffractive optical element, and the resulting fluorescence was imaged with three digital video cameras, all of which were synchronized with a pulse and delay generator. Although the video cameras are capable of 240 Hz frame rates, the laser s output was limited to 30 Hz and below. Consequently, aliasing techniques were used to allow the measurement of vibration modes up to 186 Hz with a Nyquist limit of less than 15 Hz.
Derived from text
Dynamic Structural Analysis; Photogrammetry; Lasers; Vibration Mode; Cameras

20040082318 National Space Science and Technology Center, Huntsville, AL, USA
The Marshall Space Flight Center Solar Utraviolet Magnetograph
West, E. A.; Porter, J. G.; Davis, J. M.; Gary, G. A.; Noble, M.; [2004]; 1 pp.; In English; SPIE Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

This paper will describe the objectives of the Marshall Space Flight Center (MSFC) Solar Ultraviolet Magnetograph Investigation (SUMI) and the optical components that have been developed to meet those objectives. In order to test the scientific feasibility of measuring magnetic fields in the W, a sounding rocket payload is being developed. This paper will discuss: (1) the scientific measurements that will be made by the SUMI sounding rocket program, (2) how the optics have been optimized for simultaneous measurements of two magnetic lines CIV (1550 Angstroms) and MgII (2800 Angstroms), and (3) the optical, reflectance, transmission and polarization measurements that have been made on the SUMI telescope mirrors and polarimeter.
Author
Magnetometers; Solar Instruments; Ultraviolet Radiation; Telescopes

20040082328 NASA Marshall Space Flight Center, Huntsville, AL, USA
Incoming Metrology of Segmented X-Ray Mandrels at MSFC
Gubarev, Mikhail; ODell, Steve; Kester, Thomas; Lehner, David; Jones, William; Smithers, Martin; [2004]; 1 pp.; In English; SPIE Astronomical Telescope and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources

The Constellation-X Spectroscopy X-ray telescope (SXT) is designed to be built from X-ray optic segments. The X-ray segments will be fabricated from the segmented mandrels using a replication process. The purpose of the incoming metrology is to map the surface of the mandrels, so the performance of the X-ray optics produced can be predicted. Three Constellation-X segmented mandrels have been delivered to MSFC for incoming metrology. The segmented mandrels are 30-degree sections of a cylindrical surface and have diameters of 1.0 m, 1.2 m and 1.6 m. The maximum dimensions of the optical surface are 1.0 m axial length and 0.5 m azimuthal segment length. The metrology of the mandrels consists of the measurement of their slope differences, roundness, absolute radius, axial profile and microroughness. Accuracy goals for each type of measurement and the accuracy of the instruments used for the measurements will be discussed. The results of the mandrel metrology together with the performance predictions will be presented.
Author
Metrology; X Ray Optics; X Ray Telescopes; Fabrication; Mandrels; Spectroscopy

20040082627 Harvard Medical School, Boston, MA
Sub 50nm Critical Dimension Lithography Using Surface Plasmon Enhanced Illumination
Apr. 30, 2004; 10 pp.; In English
Report No.(s): AD-A423578; F49620-02-1-0422; AFRL-SR-AR-TR-04-0276; No Copyright; Avail: CASI; A02, Hardcopy

Surface plasmon enhanced illumination Is a photonics device that creates a nanometric source of bright propagating light. This light source serves as the basis for a direct write maskless photolithography system. The key progress made on this project is the demonstration of lateral resolution less than 50nm. The lateral resolution corresponds directly to feature size when patterning a photoresist.
DTIC
Lithography; Plasmons

20040082647 FGAN-FOM Research Inst. for Optronics and Pattern Recognition, Ettlingen
Navigation Sensor Accuracy Requirements for Emerging Laser Radar Applications
Armbruster, Walter; Oct. 2002; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423607; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Accuracy; Classifications; Detection; Inertial Navigation; Navigation Instruments; Optical Radar; Target Acquisition; Target Recognition; Targets; Terrain Analysis; Warning Systems

20040082688 Texas Univ., Austin, TX
User Configurable Incident Response Monitor
Anderson, Chris; Barber, Suzanne K.; Graser, Thomas J.; Park, Jisun; Swenholt, Mark; May 31, 2004; 80 pp.; In English
Contract(s)/Grant(s): F49620-02-C-0032
Report No.(s): AD-A423716; AFRL-SR-AR-TR-04-0294; No Copyright; Avail: CASI; A05, Hardcopy
This document is the final report for contract F49620-02-C-0032. The contractual requirement for this report is defined in Exhibit A, Reporting Requirements Under Contracts Issued by AFOSR, as cited by contract line item 0002 of the contract. This report covers the work performed over the period from June 1, 2002 (the date of contract award) through May 31, 2004 (the date of the contract termination). Its contents cover the highlights of the research and implementation effort related to the User Configurable Incident Response Monitor (UCIRM) application defined in the contractor's Technical Proposal. The UCIRM, designed and implemented jointly by ScenPro, Inc. and the Laboratory for Intelligent Processes and Systems at the University of Texas at Austin (UT:LIPS) , provides decision support for military personnel responsible for monitoring military installations to determine if designated zones (i.e. predefined regions) have been subject to chemical/biological attack. Specifically, the UCIRM supports personnel with respect to the following two decision-making tasks: (i) Estimating how zone contamination will affect the tempo of base operations; and (ii) Determining zone contamination with an assigned confidence level based on the trustworthiness of sensor readings and the sensors providing those readings.
DTIC
Chemical Warfare; Military Operations; Warfare

20040082709 Arcon Corp., Waltham, MA
UHF Strip - SAR and ISAR Images of a Tank: Application of Scale - Model Measurements
Poirier, J. L.; Emstmeyer, James; Franch, Peter; Ouch, Chet; Schindler, John K.; Oct. 16, 2003; 34 pp.; In English
Contract(s)/Grant(s): Proj-4916
Report No.(s): AD-A423762; AFRL-SN-HS-TR-2004-026; No Copyright; Avail: CASI; A03, Hardcopy
UHF images of a tank on the ground were obtained by measuring a scale model of the tank on a ground plane. With a scale factor of 35, the laboratory radar range frequencies of 6 to 18 GHz scale to 171.4 to 514.3 MHz. The dielectric constant of the ground plane material was matched to that of the real ground to insure that the images of the full-scale tank matched those of a full. scale tank. We found that the correlation between images at the same aspect falls off rapidly even for differences in grazing angle of a few degrees. We converted the measured ISAR images to strip-SAR format as would be obtained by an airborne UHF SAR. The correlation between the ISAR and strip-SAR images is high. The correlation, however, falls off as the grazing angle and synthetic aperture length increase. Scale model measurements offer an approach to obtaining multi-aspect images of military targets that are quick and cost effective compared to full scale airborne or turntable measurements. Scale models of a wide array of military vehicles are readily available. Nonmetallic objects such as the ground and vegetation are fabricated from materials that have the same dielectric properties as a function of the scaled X-band laboratory measurement frequency as do the full-scale objects at UHF. This insures that the measurement yield accurate representations of the RCS and images of the full-scale objects.
DTIC
Images; Radar Imagery; Scale Models; Sonar; Synthetic Aperture Radar; Synthetic Apertures; Ultrahigh Frequencies

20040082715 Syracuse Research Corp., NY
Space-Time Adaptive Processing (STAP) for Low Sample Support Applications
Schuman, Harvey K.; Li, Ping; May 2004; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-02-C-0218; Proj-762R
Report No.(s): AD-A423770; AFRL-SN-RS-TR-2004-124; No Copyright; Avail: CASI; A04, Hardcopy
Airborne radar Space-Time Adaptive Processing (STAP) in a heterogeneous, target-rich environment is addressed. An

efficient Kalman Filter implementation of the normalized form of the Parametric Adaptive Matched Filter (NPAMF) is introduced and shown to perform well against a detailed simulation of a site-specific, dense-target environment, Ground Moving Target Indication (GMTI) scenario. The number of secondary data range cells in a Coherent Processing Interval (CPI) required by NPAMF is much smaller than the product of spatial channels and pulses and, thus, NPAMF is attractive for low sample support applications. Other promising methods for low sample support applications are introduced and studied, as well. These include a Generalized Likelihood Ratio Test (GLRT)-based PAMF (ParaGLRT) shown to perform about as well as the matched filter when used in combination with Multiple Pass Processing (MPP), Sub-OP I smoothing and a GLRT variant called Severely Non homogeneous Interference Processing (SNIP). These methods are shown also to perform much better than conventional STAP methods such as Joint Domain Localized (JDL). An optimized variant of MPP called T-SNIP (the ″T″ is for ″target-rich environment″) is introduced, as well. Beam space variants of the above methods also are evaluated and found to require less processing time than element space counterparts while performing at least as well.
DTIC
Adaptation; Radar Equipment; Space-Time Adaptive Processing

20040082756 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD
Tests on a Low Volume Mail Screening System (LVMSS)
Kesavan, Jana; Bottiger, Jerold; Hottell, K. A.; Apr. 2004; 17 pp.; In English
Report No.(s): AD-A423854; ECBC-TN-018; No Copyright; Avail: CASI; A03, Hardcopy

A Low Volume Mail Screening System (LVMSS) was developed by Smiths Detection - Edgewood, Inc., to screen letters and packages delivered to a facility. The LVMSS was tested at the U.S. Army Edgewood Chemical Biological Center August 6- 13, 2003. This was a quick test where a known amount of Bacillus globigii (BG) was placed in a letter (0.1 mg) or package (1 mg) before processing by the LVMSS. Each BG test was preceded by a control test without BG. Based on four letter and five package tests, the LVMSS correctly identified the tests with BG. The independent laboratory verification of the LVMSS's SpinCon(Registered) samples using the R.A.P.I.D. and Bio-Seeq(Registered) PCR methods showed positive for the tests with BG and negative for tests without BG. Reference filter samples indicated that there was no detectable BG exposure outside the LVMSS cabinet during BG letter and package processing. The nine tests conducted were not enough tests to estimate false positive and false negative statistics with good confidence.
DTIC
Spores

20040082763 Florida Univ., Gainesville, FL
Robust Decision Making: Addressing Uncertainties in Distributions
Uryasev, Stanislav; Pardalos, Panos; Mar. 10, 2004; 98 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0338
Report No.(s): AD-A423866; AFRL-SR-AR-TR-04-0313; No Copyright; Avail: CASI; A05, Hardcopy

The project was concentrated on development of new methodologies for decision making in uncertain environment and relevant applications. The first part of the project was focused on analytical and discrete optimization approaches for routing an aircraft in threat environment. The model considered aircraft trajectory in three-dimensional space. Several threats were studied, including risk of aircraft detection by radars, sensors, and the risk of being killed by surface to air missiles. The problem of finding aircraft optimal risk trajectory subject to a constraint on the trajectory length,was solved by analytical and discrete optimization approaches. The second part of the project resulted in general approach to risk management for the case with uncertainties in distributions. The risk of loss, damage, or failure was measured by the Conditional Value-at-Risk (CVaR) measure. As a function of decision variables, CVaR is convex, and therefore can be efficiently controlled/optimized using convex or linear programming. The methodology was tested on two Weapon-Target Assignment (WTA) problems. The total cost of a mission was minimized, while satisfying the operational constraints and ensuring destruction of targets with high probability. The risk of a failure of the mission is controlled by CVaR constraints. The case studies showed that there were significant qualitative and quantitative differences in solutions of deterministic and stochastic WTA problems. The third part of the project studied the Multiple Traveling Salesmen Problem (Multiple-TSP) in several variations. The research was focused on MIN-MAX 2-TSP which cannot be solved by standard methods. The relation between this class of problems and a subclass of the self-dual monotonic Boolean functions was established. This resulted in new efficient optimization algorithms.
DTIC
Aircraft Detection; Decision Making

20040082816 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Cross Range Smear Characterization in Xpatch ISAR Images
Muend, Peter E.; Mar. 2004; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423979; AFIT/GE/ENG/04-18; No Copyright; Avail: CASI; A06, Hardcopy

This thesis investigates a cross range smear phenomenon seen in far field, frequency domain Xpatch calculations. The phenomenon is very subtle, manifesting itself in 2-D ISAR images as a low-level scatterer response smeared in the cross range direction. This cross range smear occurs only using complex target models with certain characteristics. It is also a mathematical construct, not occurring in physical SAR systems. Using a carefully constructed scattering target set, Xpatch-generated ISAR images are used to characterize cross range smear in terms of its input parameters. The characterization is done as a DOE- based polynomial approximation to the observed smear levels. Frequency extent and bandwidth have the highest effect on cross range smear, consistently increasing smear with parameter value. Ray density is slightly less important, having primarily squared and second order influence. The choice of diffraction and first bounce algorithm has very little effect on cross range smear. In addition, the performance of a proposed smear reduction technique is analyzed against Xpatch-generated ISAR images. The algorithm generally reduces smear, but the smear reduction magnitude is not a linear function of smear value.
DTIC
Characterization; Radar Imagery; Smear; Synthetic Aperture Radar

20040082834 Alameda Applied Science Corp., San Leandro, CA
Radiation Imaging Diagnostic for Plasma Radiation Sources
Parasad, Rahul R.; Crisman, Alexander C.; Gensler, Steven; Qi, Niansheng; Krishnan, Mahadevan; May 2004; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DSWA01-96-C-0171; Proj-AB
Report No.(s): AD-A423998; DTRA-TR-99-42; No Copyright; Avail: CASI; A05, Hardcopy

This report describes a two-dimensional, time- resolved, x-ray imaging camera. This camera has a detector face that consists of a pixilated, 6xl2 array of 72, lxlxO.Smm discrete diamond detectors. The camera captured x-ray images of Argon z-pinches produced by the Defense Threat Reduction Agency's Double-EAGLE flash x-ray accelerator, located in San Leandro, CA. The Argon z-pinch was imaged on to this array through a pinhole with a 1:1 magnification. A portion of the pinch that was 6x 1 2rnm in area was imaged on to the camera faceplate, with spatial resolution of 1 rnm. The coverage of the pinch may easily be altered by altering the magnification of the pinhole camera. Magnifications \g2:1 further improve the spatial resolution, but at the expense of field of coverage. The temporal resolution of the diamonds is \h1 ns. Images of K-shell emission (3.1-4 keV) from Argon z-pinches that were resolved to 400 Ps, show bright spots of emission that wax and wane along the pinch length. This level of imaging detail in such z-pinches is unprecedented. The diamond detectors are sensitive to radiation down to 5 eV, hence by use of suitable filters, the softer, L-shell emissions from the Argon z-pinch (50-800 eV) may also be imaged.
DTIC
Imaging Techniques; Plasma Radiation; Radiation Absorption; Radiation Sources

20040082950 Naval Facilities Engineering Service Center, Port Hueneme, CA
Aboveground Storage Tank (AST) Leak Detection and Monitoring
Mar. 2004; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423569; NFESC-TR-2242-ENV; No Copyright; Avail: CASI; A05, Hardcopy

The Naval Facilities Engineering Service Center (NFESC), Port Hueneme, California, and its industrial partners, Vista Engineering Technologies, L.L.C., and Vista Research, Inc., have demonstrated and validated (DEM/VAL) an innovative mass-based leak detection system for aboveground storage tanks (ASTs) . The Low-Range Differential Pressure (LRDP) system is a computer-controlled system that can reliably detect small leaks in ASTs, which range in size from 50,000 gal to ASTs with diameters of over 260 ft and containing over 10,000,000 gal of petroleum fuel. While no specific national regulatory requirements presently exist for ASTs, stringent state requirements are forcing Department of Defense (DoD) facilities to take their tanks out of service to install double bottoms and perform interstitial monitoring. With a validated, high-performance, in-tank leak-detection system for ASTs, like the LRDP, an alternative strategy is now available that is cost effective and does not necessitate taking the tank out of service. The results of the evaluation showed that the LRDP has the performance to meet the monthly monitoring and annual precision (tightness) test regulatory compliance requirements set for bulk underground storage tanks (USTs) using a test that takes less than 24 h to conduct. This project was performed under the Environmental Security Technology Certification Program (TNTCP). The objective of the ESTCP is to demonstrate and

validate innovative environmental technologies that are needed to address the environmental objectives of the DoD, that are cost effective, and that will be ready for the development of commercial products and services at the completion of the DEM/VALs. All of the objectives of the project have been met, and the LRDP is ready for and is currently in commercial use.
DTIC
Detection; Leakage; Storage Tanks

20040083989 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ammonia Analysis by Gas Chromatograph/Infrared Detector (GC/IRD)
Scott, Joseph P.; Whitfield, Steve W.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 2 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A01, Hardcopy

Methods are being developed at Marshall Space Flight Center's Toxicity Lab on a CG/IRD System that will be used to detect ammonia in low part per million (ppm) levels. These methods will allow analysis of gas samples by syringe injections. The GC is equipped with a unique cryogenic-cooled inlet system that will enable our lab to make large injections of a gas sample. Although the initial focus of the work will be analysis of ammonia, this instrument could identify other compounds on a molecular level. If proper methods can be developed, the IRD could work as a powerful addition to our offgassing capabilities.
Author
Gas Chromatography; Infrared Detectors; Ammonia

20040084009 Idaho National Engineering and Environmental Lab., Idaho Falls, ID, USA
Quantitative Remaining Life Assessments for Aerospace Components Using Photon Induced Position Annihilation (PIPA)
Akers, D. W.; Rideout, Curt; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 12 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A new patented technology, Photon Induced Positron Annihilation (PIPA) has been developed that can be used to measure bulk fatigue and embrittlement characteristics of aerospace components beginning at less than 1% of fatigue life. This technology can accurately predict remaining life to within 5% based upon PIPA measurements performed on components at any stage of their fatigue life. Minimized maintenance and surveillance requirements will be possible along with highly accurate planning for system replacements. Positron Systems PIPA technology utilizes a patented technology for implanting positrons in bulk materials and measuring the concentration and type of defects within the material. Quantitative analyses can be performed for nano-defect concentrations, defect type and following the formation of cracks, crack growth projections for various components. This technology has numerous applications in the aerospace industry from the assessment of lap splice joints on pressure hull panels to fatigue and compressive stress release assessment on aircraft jet engine fan disks and turbine blades. Portable systems can be used for in-situ NDE measurements during aircraft maintenance periods or facility-based systems can be used to assess components already removed from service for damage assessment and research.
Author
Quantitative Analysis; Life (Durability); Technology Assessment; Photons; Fatigue Life

20040084047 Oak Ridge Y-12 Plant, TN, USA
A Study of Stains on Metals using Infrared Hyperspectral Imaging
Powell, G. L.; Cox, R. L.; Beecroft, M.; Dombrowski, M.; Mattison, P.; Szczesniak, M. M.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 48 pp.; In English; See also 20040083973
Contract(s)/Grant(s): DE-AC05-00-OR-22800; No Copyright; Avail: CASI; A03, Hardcopy

Diffuse Reflectance Infrared Fourier Transform (DRIFT) spectroscopy is well suited to surface inspection with portable instruments. This viewgraph presentation demonstrates how the SOC 400 infrared reflectometer can be used for the visualization of spreading and interacting oil drops on a sand blasted gold surface.
CASI
Imaging Techniques; Infrared Spectrometers; Infrared Inspection; Fluid Mechanics; Oils; Gold; Reflectometers

20040084159 Johns Hopkins Univ., Laurel, MD, USA
Miniature Time of Flight Mass Spectrometer
Potember, Richard S.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 133-134; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

We are developing and testing a small, efficient time-of-flight mass spectrometer to rapidly identify important biomarkers and countermeasures for human space exploration. We are using the time-of-flight mass spectrometer to evaluate critical biomarkers and countermeasures that are indicators of bone loss and repair associated with space travel. This miniature instrument will provide new capabilities in the area of sampling, sample preparation, rapid quantitation of biomarkers and it will allow us to apply our technology to other space based problems such as monitoring the spacecraft environment for chemical and biological contaminants. Mass spectrometry is a technique for determining the masses of molecules and specific fragmentation products formed during vaporization and ionization. From detailed analysis of the mass distribution of the molecule and its fragments, molecular identification is accomplished. These molecular measurements can be carried out at the attomole (10-18 mole) level of material using specialized laboratory-based instruments. The combination of specific molecular identification and extreme sensitivity makes mass spectrometry one of the most powerful analytical laboratory tools yet developed for detection and identification of chemical and biological substances.
Derived from text
Mass Spectrometers; Time of Flight Spectrometers; Spacecraft Environments; Ionization; Space Exploration

20040084194 Combustion Science and Engineering, Inc., Columbia, MD, USA
The Integration of a Smoke Detector Model with Large Eddy Simulation Fire Modeling for Predicting Smoke Detector Activation in Microgravity
Roby, Richard; Zhang, Wei; Gaines, Glenn; Olenick, Stephen; Klassen, Michael; Torero, Jose L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 145-146; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Fire safety on spacecraft, space stations, and in potential non-terrestrial environments (e.g. Mars) is an important consideration for any mission. Safety of the crews and spacecraft or space station, as well as continuation of the mission is dependent on adequate prevention, detection and suppression of fires in low- and micro-gravity environments. Early detection of fires relies on quickly identifying a fire signature by a detection device placed in an optimum location. Fire signatures and fire flows have been shown to be vastly different on spacecraft and in low-gravity environments; therefore, studies aimed at determining proper detector locations are necessary to provide adequate fire protection in low-gravity environments. Since it is not practical to perform the large number of experiments necessary to determine optimal placement of detectors in the various low-gravity environments (e.g. the shuttle or varying racks and modules in ISS), a methodology must be developed which will allow for effective detector placement using a minimal number of experiments and a well-validated computational scheme. This study aims to integrate an algorithm that describes the response characteristics of the smoke detectors used in the ISS and the shuttle into a Large Eddy Simulation fire model (FDS). The algorithm is restricted to two parameters, a dwell time and a mixing time, which was originally proposed by Cleary et al. A full scale room test with convective flows similar to the International Space Station is currently being conducted. Hence initially, experimental data from a multi-room compartment fire was used for validation. Overall, reasonable results were obtained when comparing the predictions to the experimental results. This result shows great potential of the smoke detector modeling combined with CFD (Computational Fluid Dynamics) fire modeling.
Derived from text
Smoke Detectors; Microgravity; Modules; Large Eddy Simulation; Computational Fluid Dynamics

20040084224 Michigan Univ., Ann Arbor, MI, USA
Nanomolecular Biosensors and Therapeutics
Baker, James R., Jr.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 3; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are developing nanoscale biosensors and bioactuators for use in astronaut health and safety monitoring. The involves nanoscale polymer structures less than 20nm in diameter as the basis of the sensor/actuators. The structures would be designed to target into specific cells of an astronaut and be able to monitor health issues as the exposure to radiation or infectious agents. These molecules would also be able to administer therapeutics in response to the need of the astronaut, and act as actuators to remotely manipulate an astronaut as necessary to ensure their safety. A multidisciplinary team, involving disciplines including nanotechnology-based materials science, bioengineering, bioinformatics and medical sciences, performs these studies. We will use these different disciplines to converge on the design and manipulation of the nanosensors, and the development of non-invasive system to interact with the sensors through multi-spectral fluorescence analysis. Because of these broad requirements, the research involves a multi-disciplinare team from the Medical, Engineering and LS&A schools at the

University of Michigan, and is funded to train multidisciplinary scientists at the pre-graduate level.
Author
Bioinstrumentation; Safety; Radiation Dosage; Actuators; Measuring Instruments

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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*.

20040082153 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Selection of Optical Cavity Surface Coatings for 1micron Laser Based Missions
Hedgeland, Randy J.; Straka, Sharon; Matsumura, Mark; Hammerbacher, Joseph; 2004; 8 pp.; In English; 2004 IEE Aerospace Conference, 6 Mar. 2003 - 14 Mar. 2004, Big Sky, MT, USA; No Copyright; Avail: CASI; A02, Hardcopy

The particulate surface cleanliness level on several coatings for aluminum and beryllium substrates were examined for use in the optical cavities of high pulse energy Nd:YAG Q-switched, diode-pumped lasers for space flight applications. Because of the high intensity of the lasers, any contaminants in the laser beam path could damage optical coatings and limit the instrument mission objectives at the operating wavelength of 1 micron (micrometer). Our goal was to achieve an EST-STD-CC1246D Level 100 particulate distribution or better to ensure particulate redistribution during launch would not adversely affect the performance objectives. Tapelifts were performed to quantify the amount of particles using in-house developed procedures. The primary candidate coatings included chromate conversion coating aluminum (Al), uncoated Al electroless Nickel (Ni) on Al, Ni-gold (Au) on Al, anodized Al, and gold (Au)/Ni on Beryllium (Be). The results indicate that there were advantages in Ni and Au coating applications for the two major substrates, Al and Be, when considering applications that need to meet launch environments.
Author
Optical Resonators; Cavities; Surface Treatment; Laser Beams; Antireflection Coatings

20040082194 NASA Goddard Space Flight Center, Greenbelt, MD, USA
LISA Thermal Design
Merkowitz, Stephen; 2004; 1 pp.; In English; 5th International LISA Symposium, 12-16 Jul. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The Laser Interferometer Space Antenna (LISA) mission, a space based gravitational wave detector, uses laser metrology to measure distance fluctuations between proof masses aboard three spacecraft. The total acceleration disturbance to each proof mass is required to be below 3 x 10(exp -15) meters per second squared per the square root of Hertz. Optical path length variations on each optical bench must be kept below about 3 pm per the square root of Hertz. Noise due to spacecraft thermal distortions, temperature difference variations across proof mass housing, and other thermal effects are expected to be a significant contributors to these noise budgets. The LISA Integrated Modeling team developed a detailed thermal model that is currently being used to drive the design of LISA. Several new thermal analysis techniques are also being developed in order to achieve model accuracies to LISA levels. We present here an overview of the LISA thermal design and modeling efforts. The latest thermal results calculated using the current baseline design of LISA are also discussed.
Author
Lisa (Observatory); Thermal Analysis; Antenna Design; Space Missions

20040082625 Air Force Research Lab., Hanscom AFB, MA
Impacts of Numerical Weather Prediction Spatial Resolution on an Atmospheric Decision Aid for Directed Energy Weapon Systems
Lefevre, Randy J.; Ruggiero, Frank H.; Roe, Kevin P.; Apr. 2004; 8 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423573; AFRL-VS-HA-TR-2004-1114; No Copyright; Avail: CASI; A02, Hardcopy

The Airborne Laser (ABL) is being developed as one element of our nation's Ballistic Missile Defense System. The ABL Element Office is developing an Atmospheric Decision Aid (ADA) to diagnose and forecast the location and magnitude of optical turbulence in the upper troposphere and lower stratosphere. Development of the ADA relies on an understanding about the strengths and weaknesses of numerical weather prediction (NwP) models, plus the sensitivity of the optical turbulence

algorithms to the NWP spatial and temporal resolution. This case study compared the accuracy and precision of the ADA optical turbulence algorithms to several horizontal and vertical NWP resolutions. Results indicate that for a given vertical resolution using a finer horizontal resolution does not significantly improve the accuracy of the forecast, but for a given horizontal resolution increasing the vertical resolution does improve the forecast accuracy.
DTIC
Decision Support Systems; Numerical Weather Forecasting; Spatial Resolution; Weapon Systems

20040082754 Tubitak Marmara Research Center, Kocaeli
Polarization Effects in Optical Properties of GaSe Crystal Bulk and Surfaces
Allahverdi, Kerim; Dec. 2002; 54 pp.; In English
Contract(s)/Grant(s): F61775-02-WE008
Report No.(s): AD-A423852; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking TUBITAK, Marmara Research Center as follows: The contractor will investigate the anisotropy of the optical properties of quasi two-dimensional crystals, specifically of GaSe, using IR absorption and exciton photoluminescence spectroscopy over a wide frequency range. The results obtained will be used to determine the mechanism of free carrier scattering and its anisotropy; to identify the nature of peaks observed in the anisotropy of IR absorption spectra; and to construct the equations describing the spectral dependence of the absorption coefficients for two polarization in the spectral range of 1- 25 mm.
DTIC
Anisotropy; Crystal Surfaces; Gases; Laser Materials; Optical Properties

20040082762 Civil Aeromedical Inst., Oklahoma City, OK
Effects of Laser Illumination on Operational and Visual Performance of Pilots Conducting Terminal Operations
Nakagawara, Van B.; Montgomery, Ron W.; Dillard, Archie; McLin, Leon; Connor, C. W.; Aug. 2003; 13 pp.; In English
Report No.(s): AD-A423865; DOT/FAA/AM-03-12; No Copyright; Avail: CASI; A03, Hardcopy

Several hundred incidents involving the illumination of aircrew members by laser light have been reported in recent years. Consequently, FAA Order 7400.2 was revised to establish new guidelines for Flight Safe Exposure Limits (FSEL) in specific zones of navigable airspace. The purpose of this study was to evaluate the performance of test subjects exposed to laser radiation while performing approach and departure maneuvers in the Critical Flight Zone (CFZ). Pilot performance was assessed in a Boeing 727-200, Level C, flight simulator using four levels of laser illumination (0, 0. 5, 5, and 50 muW/cm2) and three operational maneuvers (takeoff and departure, visual approach, and instrument landing system ILS approach). Subjective responses were solicited after each trial and during an exit interview. The pilots were asked to rate on a scale from 1 to 5 (1 = none, 2 = slight, 3 = moderate, 4 = great, and 5 = very great) the affect each laser exposure had on their ability to operate the aircraft and on their visual performance. Average subjective ratings were calculated for each exposure level and flight maneuver, and an analysis of variance (ANOVA) was performed. Thirty-four pilots served as test subjects for this study. Average subjective ratings for operational and visual performance were 1.57 and 1. 74, 1. 89 and 2.15, 2.43 and 2.76, for the 0.5, 5 (i.e., CFZ), and 50 muW/cm2 laser exposure levels, respectively. ANOVA found a significant difference (p \h 0.05) between the subjective ratings for each exposure level. No significant differences were found between the types of flight maneuvers or between the ratings for operational and visual performance themselves for a given maneuver or exposure level. The FSEL of 5 muW/cm2 was validated for pilots illuminated by laser light while conducting terminal operations in the CFZ.
DTIC
Lasers; Visual Perception

20040082975 Aerospace Corp., El Segundo, CA
Adaptation of the Aerospace Near-Infrared Imaging Spectrograph for Observation of Rocket Launches
Rudy, R. J.; Fujino, R. H.; Mazuk, S. M.; Skinner, W. J.; Venturini, C. C.; May 20, 2004; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8802-04-C-0001
Report No.(s): AD-A423789; TR-2004(8570)-3; SMC/EL-TR-04-16; No Copyright; Avail: CASI; A03, Hardcopy

This document describes the auxiliary equipment used to adapt the Aerospace Near-Infrared Imaging Spectrograph (NIRIS) for remote sensing and the specific configuration used for launch observations at Vandenberg AFB. This equipment enables NIRIS's considerable capability for hyperspectral imaging and absolute spectrophotometry (including instantaneous wavelength coverage from 0.8-2.5 micrometers at spectral resolutions from 56-1200) to be applied to a number of remote

sensing observations, but most specifically the spatially resolved spectroscopy of rocket plumes. Equipment includes a small telescope that provides a 9 degrees field of view in the spatial dimension (along the slit), digital cameras for both slit viewing and direct imaging of the field, a fast shutter and filterwheel outfitted with neutral density filters for brightness control and saturation avoidance, and an electrically isolating interface plate that allows mounting the entire 400+ lb pack- age to a large alt-azimuth tracking mount.
DTIC
Imagery; Imaging Techniques; Rocket Launching; Spectrographs

20040084231 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Boresight Adjusment Mechanism For Use in Laser Altimeters
Hakun, Claef; Budinoff, Jason; Brown, Gary; Parong, Fil; Morell, Armando; [2004]; 14 pp.; In English; 38th Aerospace Mechanisms Symposium, 19-21 May 2004, Galveston, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the development of the Boresight Adjustment Mechanism (BAM) for the Geoscience Laser Altimeter System (GLAS) Instrument. The BAM was developed late in the integration and test phase of the GLAS instrument flight program. Thermal vacuum tests of the GLAS instrument indicated that the instrument-boresight alignment stability over temperature may be marginal. To reduce the risk that GLAS may not be able to meet the boresight alignment requirements an intensive effort was started to develop a BAM. Observatory-level testing and further evaluation of the boresight alignment data indicated that sufficient margin could be obtained utilizing existing instrument resources and therefore the BAM was never integrated onto the GLAS Instrument. However, the BAM was designed fabricated and fully qualified over a 4 month timeframe to be capable of precisely steering (less than 2 arcsec over plus or minus 300 arcsec) the output of three independent lasers to ensure the alignment between the transmit and receive paths of the GLAS instrument. The short timeline for the development of the mechanism resulted in several interesting design solutions. This paper discusses the requirement definition design, and testing processes of the BAM development effort how the design was affected by the extremely tight development schedule and the lessons learned throughout the process.
Author
Boresights; Geophysics; Laser Altimeters; Adjusting; Fabrication

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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*.

20040081319 Environmental Protection Agency, Washington, DC, USA
Highway Diesel Progress Review, Report 2
Mar. 2004; In English
Report No.(s): PB2004-103782; EPA/420/R/04-004; No Copyright; Avail: National Technical Information Service (NTIS)

The Environmental Protection Agency (EPA or the Agency) established in 2000 new far reaching emission standards beginning in 2007 for heavy-duty diesel vehicles and the fuel used in them. These standards were premised on the introduction of new catalyst based emission controls for diesel engines and the removal of a catalyst poison, sulfur, from diesel fuel. This report is the second in a series of technical progress reviews by EPA to document the status of engine and vehicle technology development to meet the 2007 standards. The first report, published in June of 2002, concluded that progress to that time had been substantial and was in keeping with the expected progress necessary for successful implementation of the new standards in 2007. This second report also considers the continuing progress in the research laboratory but, more importantly, the transition of these technologies from research into business plans, product development programs, engines and vehicles for field testing, and finally into real products for sale in the marketplace in 2007. Thus, while we continue to be impressed by the amount of technical progress shown in the laboratory, it is the concrete steps that manufacturers have taken in their new product development programs that gives us great confidence for 2007.
NTIS
Diesel Fuels; Diesel Engines; Environment Protection; Exhaust Emission

20040081350 Helsinki Univ. of Technology, Espoo, Finland
Piston Ring Tribology. A Literature Survey
Anderson, P.; Tamminen, J.; Sandstrom, C. E.; 2002; 112 pp.; In English
Report No.(s): PB2004-106103; VTT/RN-2178; No Copyright; Avail: CASI; A06, Hardcopy

The tribological considerations in the contacts formed by the piston skirt, piston rings and cylinder liner have attracted much attention over several decades, not least indicated by the large number of articles published on this topic in recent years. Recent studies include modelling, miniaturised experimental work and full-scale engine testing. This literature survey, covering over 150 references, aims to shed new light on the tribological issues related to the piston assembly. The work is intended as a compact reference volume for internal combustion engines in general, with particular emphasis on diesel engines. Central topics discussed in this work are the basic functions of the piston and the piston rings, the design and the materials of the components, mechanical and thermal loads on the rings, the contact pressure between ring and liner, the sealing action, blow-by leakage, hot gas erosion damage, exhaust emissions, the lubrication conditions and the influence of combustion products, the coefficient of friction and the friction force, the wear of the sliding surfaces and surface technology for wear reduction.
NTIS
Internal Combustion Engines; Tribology; Pistons; Exhaust Emission; Loads (Forces)

20040081422 Oak Ridge National Lab., TN, USA
A Remote Metallographic Specimen Grinder
Long, E. L., Jr.; Richt, A. E.; Holcomb, D. L.; Gray, R. J.; Technical Papers of the Fifteenth Metallographic Group Meeting; 1 May 1964, pp. 157-162; In English; See also 20040081421; No Copyright; Avail: CASI; A02, Hardcopy

An investigation is currently under way to evaluate potential methods of remotely grinding metallographic specimens and to select optimum equipment. During this investigation several commercial grinders have been considered, none of which could be placed in-cell as purchased. As a result, one grinder was selected and modified for remote grinding.
Author
Metallography; Grinding Machines

20040082618 National Center for Competitiveness, Dayton, OH
Brake-By-Wire Program
Bowman, Robert J.; Flanagan, Paul F.; Baumgartner, Ernst S.; Sep. 30, 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-01-2-5804; Proj-3946
Report No.(s): AD-A423564; AFRL-ML-WP-TM-2004-4064; No Copyright; Avail: CASI; A03, Hardcopy

Two design iterations for electric calipers and two systems (full brake by wire and hybrid brakes) were developed for use on a ground vehicle. The program demonstrated a fully integrated-rated electric caliper and full brake-by-wire system on a sports utility vehicle (GM Envoy). A variety of full brake-by-wire design options were investigated. Specific areas that were explored and developed included high temperature electronics, electro-mechanical acuation technologies, reconfigurable controls, robust and low cost sensors, fault-tolerant systems, and high reliability wiring and connectors. Significant technical challenges remain before brake-by-wire technology will be available on vehicles in production; however, a significant step toward producibility was made in this effort.
DTIC
Wire

20040083978 International Trade Bridge, Inc., Cocoa Beach, FL, USA
Lead-Free Solder Project
Greene, Brian; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 26 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Uses of Lead in Electronic Components:Provides final surface finish to printed circuit boards. Applied to component leads for compatibility with solderable surfaces. Used to attach electronics components on printed circuit board - Manual soldering - Automated soldering (wave & reflow).
Derived from text
Lead (Metal); Solders; Surface Finishing

20040083988 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Evaluation of the Oxygen Compatibility of Composite Materials

Richardson, Erin H.; Hall, Joylene; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 2 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A01, Hardcopy

Three tests are described which evaluate the oxygen compatibility characteristics of multiple composite materials: 1) Mechanical Impact Bruceton 'Up and Down' Method; 2) Promoted Combustion; 3) Electrostatic Discharge.

CASI

Composite Materials; Oxidation; Oxygen

20040084011 NASA Marshall Space Flight Center, Huntsville, AL, USA

Friction Stir Welding of Tapered Thickness Welds Using an Adjustable Pin Tool

Adams, Glynn; Venable, Richard; Lawless, Kirby; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Friction stir welding (FSW) can be used for joining weld lands that vary in thickness along the length of the weld. An adjustable pin tool mechanism can be used to accomplish this in a single-pass, full-penetration weld by providing for precise changes in the pin length relative to the shoulder face during the weld process. The difficulty with this approach is in accurately adjusting the pin length to provide a consistent penetration ligament throughout the weld. The weld technique, control system, and instrumentation must account for mechanical and thermal compliances of the tooling system to conduct tapered welds successfully. In this study, a combination of static and in-situ measurements, as well as active control, is used to locate the pin accurately and maintain the desired penetration ligament. Frictional forces at the pin/shoulder interface were a source of error that affected accurate pin position. A traditional FSW pin tool design that requires a lead angle was used to join butt weld configurations that included both constant thickness and tapered sections. The pitch axis of the tooling was fixed throughout the weld; therefore, the effective lead angle in the tapered sections was restricted to within the tolerances allowed by the pin tool design. The sensitivity of the FSW process to factors such as thickness offset, joint gap, centerline offset, and taper transition offset were also studied. The joint gap and the thickness offset demonstrated the most adverse affects on the weld quality. Two separate tooling configurations were used to conduct tapered thickness welds successfully. The weld configurations included sections in which the thickness decreased along the weld, as well as sections in which the thickness increased along the weld. The data presented here include weld metallography, strength data, and process load data.

Author

Adjusting; Friction Stir Welding; Pins; Tapering; Thickness; Tooling

20040084012 Tennessee Technological Univ., Cookeville, TN, USA

High Temperature Thermographic Phosphor Coatings Development

Goedeke, Shawn; Allison, S. W.; Beshears, D. L.; Bencic, T.; Cates, M. R.; Hollerman, W. A.; Guidry, R.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For many years, phosphor thermometry has been used for non-contact temperature measurements. A large number of applications have been associated with high temperatures, especially for aerospace systems where blackbody radiation backgrounds are large and in challenging environments, such as vibration, rotation, flame, or noise. These environments restrict the use of more common thermocouples or infrared thermometric techniques. In particular, temperature measurements inside jet turbines, rocket engines, or similar devices are especially amenable to phosphor techniques. Often the fluorescent materials are used as powders, either suspended in binders and applied like paint or applied as high-temperature sprays. Thin coatings that are less than 50 m thick are used on the surfaces of interest. These coatings will quickly assume the same temperature as the surface to which they are applied. The temperature dependence of fluorescent materials is a function of the base matrix atoms and a small quantity of added activator or dopant ions. Often for high temperature applications, the selected materials are refractory and include rare earth ions. Phosphors like Y3Al5O12 (YAG) doped with Eu, Dy, or Tm, Y2O3 doped with Eu, or similar rare earth compounds, will survive high temperatures and can be configured to emit light that changes rapidly in lifetime and intensity. For example, researchers at Oak Ridge National Laboratory recently observed fluorescence from YAG:Dy and YAG:Tm at temperatures above 1400 C. One of the biggest challenges is to locate a binder material that can withstand tremendous variations in temperature in an adverse aerospace environment. This poster will provide an overview into our attempt to utilize phosphors for thermometry purposes. Emphasis will be placed on the use of selected

binder materials that can withstand high temperatures. This research was completed for the National Aeronautics and Space Administration's Glenn Research Center in Cleveland, Ohio.
Author
Phosphors; Thermography; Coatings; High Temperature; Aerospace Systems

20040084013 NASA Marshall Space Flight Center, Huntsville, AL, USA
SLI Complex Curvature Friction Stir Weld Risk Reduction Program
Hartley, Paula J.; Schneider, Jules; Jones, Chip; Lawless, Kirby; Russell, Carolyn; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Space Launch Initiative Program (SLI) in conjunction with the National Center for Advanced Manufacturing (NCAM) will demonstrate the ability to produce large-scale complex curvature hardware using the self-reacting friction stir welding process. This multi-phased risk reduction program includes friction stir welding process development and manufacture of a 22-ft diameter quarter dome using a conventional tooling approach; it culminates in a 27.5-ft diameter quarter dome demonstration performed on a 5-axis Universal Weld System. The design, fabrication, and installation of the Universal Weld System is made possible through a collaboration between the State of Louisiana, NASA, and the University of New Orleans. The Universal Weld System, manufactured by MTS Systems Corporation, will be installed at the Michoud Assembly Facility in New Orleans, Louisiana, and will be capable of manufacturing domes up to 30 ft in diameter. All welding will be accomplished using the Adaptable Adjustable Pin Tool (AdAPT) weld head and controller manufactured by MTS. Weld parameters will be developed for an aluminum alloy in gauges ranging from 0.320 to 0.400 in. thick. Weld quality will be verified through radiography, mechanical property testing at ambient and LN2 temperatures, and metallurgical analysis. The AdAPT weld head will then be mounted on a 22-ft diameter dome tool, which will be modified to include a welding track and drive system for moving the AdAPT weld head along the weld joint. This tool will then be used to manufacture a 22-ft diameter dome of an aluminum alloy, with 0.320-in. constant thickness joints, consisting of three individual gore panels. Finally, the 27.5-ft diameter quarter dome will be welded on the Universal Weld System. The quarter dome will consist of three individual gore panels with weld lands tapering from 0.320 to 0.360 in. in thickness. With the demonstration of these welds, the ability to manufacture large diameter domes using the friction stir weld process in conjunction with a universal weld system provides a low risk approach to the fabrication of aluminum tanks for future launch vehicle applications.
Author
Curvature; Friction Stir Welding; Manufacturing; Spacecraft Launching; Fabrication; Risk

20040084018 Wolverine Tube, Inc., Huntsville, AL, USA
MicroDeformation Technology
Kukowski, Rob; Ng, C. M.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

MicroDeformation Technology is the newest patented material-forming technology developed by Wolverine Tube. Originally developed to fin copper tubes, Wolverine has advanced the technology to process a variety of materials, including special alloys such as Titanium, Silver, Gold, Teflon, Rubber, Plastic, etc. MD Technology can be applied to form OD material as large as a drive shaft for a ship, or as small as mesh with hole size of 5-8 micron. There are almost unlimited applications in materials forming needs for aerospace, shipbuilding, filtration, electronics and other industries. The first major advantage of MD material forming technology is that existing shop equipment can be utilized. No special equipment is required to apply the technology. The second major advantage of the DC forming technology is clean operation. There is no yield loss, no scrap nor lubricant to create disposal issues. The forming technique does not generate enough heat to change the properties of the material to be formed, so no special treatment of the material is required after the forming process. Additional advantages include: 1) Multifunctional process to create a variety of products; 2) Large material base from which to choose; 3) Can be applied to standard metal cutting equipment; 4) No machining chips / no removal of base metal. Potential applications for MD forming technology includes the following: 1) Reconditioning dimensions and quality of worn surfaces; 2) Filtration : mesh from precious material not currently available as wire or sintered powder (Ti, zirconium, palladium); 3) Surface hardening; 4) Heat transfer; 5) Capillary structures; 6) Miniature heat pipes / heat exchangers; 7) Cooling for electronics; 8) Surface treatment to increase strength to the base metal. Wolverine Tube is interested to further explore applications and expand the horizon of MD Technology. We are interested to discuss applications with potential users of this unique technology.
Author
Forming Techniques; Micromachining

20040084019 Lockheed Martin Manned Space Systems, New Orleans, LA, USA
NDE of Friction Stir Welds in Aerospace Applications
Kinchen, David G.; Aldahir, Esma; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Friction Stir Welding (FSW) is a solid state joining process, which utilizes a cylindrical, shouldered pin tool with a radiused tip that is rotated and plunged into the weld joint. Frictional heating beneath the shoulder, and surrounding the pin tip causes the material to plasticize, intermix and consolidate into a weldment without melting the parent material. FSW in aluminum alloys has many advantages such as low distortion and shrinkage, excellent mechanical properties, and no porosity. However, the propensity of the FSW process to create detrimental defects does exist, and is dependent on FSW parameter limits and controls. Inspection processes for FSW must also be selected and implemented concurrent with the new weld process. This paper describes the efforts by Lockheed Martin and NASA to find proper NDE techniques for detecting and characterizing the anomalies that may be caused by operating outside the envelope of optimized FSW parameters. Potential defects are identified and the results of the exploration of numerous NDE techniques including visual, liquid penetrant, multiple ultrasonic methods, eddy current and conductivity are discussed.
Author
Aluminum Alloys; Cylindrical Bodies; Friction Stir Welding; Welded Joints

20040084031 Tennessee Technological Univ., Cookeville, TN, USA
Solid-State Friction Stir Welding
Buchanan, G. R.; Peddieson, J.; Ramirez, G. R.; Idem, S. A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this paper is to report progress on mathematical modeling of the friction stir welding process supported by NCAM. The friction stir welding mechanism is described in numerous publications and will be briefly described here. Two pieces of aluminum sheet are to be edge-joined using a weld and are placed with edges fitted together. A tool, referred to as a pintool, actually creates the weld. A retractable pintool, developed at Marshall Space Flight Center, consists of a mechanism that can be compared to a plunge router. The shoulder of the tool houses the pin and is placed at the intersection of the edge-joined materials. The shoulder applies pressure and rotates to create frictional heat as it is pressed against the material joint. The frictional heat must reach a temperature that allows the aluminum to flow plastically. The pin is inserted into the material and as it rotates the material is actually stirred, meaning that the material from one plate actually replaces a corresponding amount of material in the second plate. The pintool moves with sufficient speed along the joint to continue to heat new material that can be stirred into the weld. Cooling occurs as the tool moves away from the welded material and the aluminum solidifies to become solidly welded. The retractable pintool enables a weld strip that can end without leaving a hole in the workpiece. The mechanism of the actual placement of the flowable material in front of the pintool to a position behind the pintool is the primary topic of research.
Derived from text
Mathematical Models; Friction Stir Welding; Solid State; Aluminum

20040084032 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Non-Autoclave Processing of Large Re-Usable Aerospace Structures
Loos, Al; Batra, Romesh; Sturges, Robert H.; Vieland, Dwight D.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

High-specific strength and stiffness make composite materials ideal for aerospace applications; however, widespread use of composite materials for these applications has been limited by high manufacturing costs. Current autoclave methods for manufacturing reusable aerospace structures are time-consuming, expensive, and unreliable. Additionally, these methods are not conducive to the manufacturing of new ″smart″ composite materials with embedded sensors. Non-autoclave processes that reduce material and assembly labor costs must be developed for composites to compete effectively with traditional materials. The overall objective is to investigate the use of cost effective, non-autoclave manufacturing techniques for fabricating large, reusable composite structures for aerospace applications. Over the course of this 3-year initiative, three parallel tasks will be integrated to achieve the project objective: First, develop non-autoclave processes for manufacturing composite materials. Second, realize an intelligent manufacturing system for composite materials and structures. Third, develop innovative manufacturing methods for nondestructive evaluation (NDE) and enhanced reliability. Composite fabrication is a complex

process with numerous physical phenomena occurring simultaneously, including heat transfer, resin flow, ply compaction, resin cure kinetics, and void growth and collapse. The Virginia Tech interdisciplinary research team will develop comprehensive models for composite manufacturing and develop new sensor materials for NDE of composite systems.
Author
Aerospace Engineering; Aircraft Structures; Autoclaves; Reuse; Nondestructive Tests

20040084055 NASA Marshall Space Flight Center, Huntsville, AL, USA
Friction Stir Process Mapping Methodology
Bjorkman, Gerry; Kooney, Alex; Russell, Carolyn; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 25 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The weld process performance for a given weld joint configuration and tool setup is summarized on a 2-D plot of RPM vs. IPM. A process envelope is drawn within the map to identify the range of acceptable welds. The sweet spot is selected as the nominal weld schedule The nominal weld schedule is characterized in the expected manufacturing environment. The nominal weld schedule in conjunction with process control ensures a consistent and predictable weld performance.
Derived from text
Friction Stir Welding; Performance Prediction; Mapping

20040084187 Rhode Island Univ., Kingston, RI, USA
Melting and Solidification in a Rectangular Cavity Under Electromagnetically Simulated Low Gravity
Faghri, M.; Charmchi, M.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 73; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A low gravity environment has been simulated numerically and experimentally, via an electromagnetic field, by studying the transport phenomena associated with the melting and solidification of an electrically conducting phase change material (gallium) inside a three-dimensional rectangular enclosure. Both transverse electric and magnetic fields are used to generate a Lorentz force, which is used to counteract the effects of gravity and thus simulate low-gravity environment. The problem is formulated as one domain by employing an enthalpy-based transformation of the energy equation. The governing equations are then discretized using a control-volume-based finite difference scheme. Experimentally, the solid thickness is measured via ultrasonic techniques and the solid/melt interface is mapped using fluorescent light shadowgraphy through a transparent window. The experimental data consist of temperature history, ultrasonic detection of the interface, florescent light shadowgraphy and solid phase volume fraction. The experimental results show the presence of the magnetic filed had a marked effect on melting and natural convection whereas phase change convection was noticeable in the solidification. The numerical results show that the application of an electromagnetic filed can be used to simulate key melting characteristics found for actual low gravity. However, the resulting three-dimensional flow field in the melted region differs from actual low gravity. The application of an electromagnetic field creates a flow reversal phenomenon not found in actual low gravity. Flow distortions exist when an electromagnetic field is applied but their intensity is significantly lower than the distortions found when only a magnetic filed is applied.
Author
Cavities; Electromagnetic Fields; Microgravity; Solidification; Melting; Computerized Simulation

20040084190 Colorado School of Mines, Golden, CO, USA
Mechanical Properties of Fine Particle Assemblies
Nakagawa, Masami; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 117; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We will present two in-house projects which will have direct relevance to in-situ space resources utilization. One of the aims of the first project is to measure mechanical properties of packed particles of different sizes and materials by measuring the wave velocity using piezoelectric sensors. Our results include preliminary measurements under microgravity environment using the NASA GRC drop tower facility. The second project is the feasibility study of mechanical properties of small scale assemblies of wet/cohesive granular materials by using micromanipulators. One of the driving questions for the second project is how to define mechanical properties of an assembly containing only a small number of particles but still behave as a collective solid. We can test the validity of extending our results of mesoscopic systems to predictions about macroscopic

behavior, and so provide an alternative to bulk testing of precious extraterrestrial samples.
Author
Mechanical Properties; Granular Materials; Microgravity; Piezoelectricity

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QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20040082164 NASA Goddard Space Flight Center, Greenbelt, MD, USA
COTS Ceramic Chip Capacitors: An Evaluation of the Parts and Assurance Methodologies
Sampson, Michael J.; January 08, 2004; 31 pp.; In English; Commercialization of Military and Space Electronics Conference, 9-12 Feb. 2004, Los Angeles, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation profiles an experiment to evaluate the suitability of commercial off-the-shelf (COTS) ceramic chip capacitors for NASA spaceflight applications. The experiment included: 1) Voltage Conditioning ('Burn-In'); 2) Highly Accelerated Life Test (HALT); 3) Destructive Physical Analysis (DPA); 4) Ultimate Voltage Breakdown Strength. The presentation includes results for each of the capacitors used in the experiment.
CASI
Commercial Off-the-Shelf Products; Capacitors; Ceramics

20040082357 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Fracture Panel 2004: Post-Proof NDE
Gregg, M. Wayne; [2004]; 7 pp.; In English; Southwest Research Inst. Conference, 1-4 Jun. 2004, San Antonio, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph presentation addresses the fracture control requirements for space station habitable modules. The presentation puts an emphasis on the welding of panels on module pressure shells, and recommends an inspection plan for these components.
CASI
Space Station Modules; Nondestructive Tests; Fracturing

20040082372 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Fracture Panel 2004: Fasteners
Gregg, M. Wayne; [2004]; 4 pp.; In English; Southwest Research Inst. Conference, 1-4 Jun. 2004, San Antonio, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy

This viewgraph presentation addresses fatigue tests on fasteners, the fracture requirements for fasteners, and quality control for fasteners.
CASI
Fasteners; Fracturing; Fatigue Tests

20040082424 Technical Research Centre of Finland, Espoo, Finland
FINNUS: The Finnish Research Programme on Nuclear Power Plant Safety 1999-2002. Executive Summary
Kyrki-Rajamaki, R.; 2002; In English
Report No.(s): PB2004-106093; No Copyright; Avail: National Technical Information Service (NTIS)

FINNUS (1999-2002) is the Finnish public research program on nuclear power plant safety, launched by the Ministry of Trade and Industry (KTM). The program has concentrated on the themes of aging, accidents, and risks. This executive summary gives a brief description of the goals and results of the program.
NTIS
Nuclear Power Plants; Safety; Finland

20040084014 Assembly Guidance Systems, Inc., Chelmsford, MA, USA
Automatic Ply Verification
Blake, Scott; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For a composite part to perform as required, all manufacturing processes must be performed correctly. Many complex composite parts are fabricated manually, taking advantage of assembler flexibility and tactile and visual senses. Manual manufacturing is also characterized by weaknesses in the areas of meticulousness, speed, and precision. The Automatic Ply Verification (APV) Poster shows a new system that supplements the hand-laid composite manufacturing process, utilizing existing CAD data, laser projection, optics, and networking. The APV System provides the assembler/manufacturer with an economical, automatic, in-process quality monitoring capability. The assembler wears a small, wireless camera-illumination-referencing system that is manually placed at locations on the part as pointed out by the laser projector. Images are captured and analyzed under the guidance of CAD data. Fully traceable data are available for each ply in the laminate. Ply presence, location, fiber orientation, and material type are verified as required by the process planner. The poster displays system components in operation, input data, captured and processed images, and output data from a Sikorsky Aircraft rotor blade component. Sikorsky Aircraft and Assembly Guidance are in the process of implementing APV for production of the RAH-66 Comanche at Sikorsky s new manufacturing facility in Bridgeport, Connecticut.
Author
Laminates; Ply Orientation; Quality Control

20040084035 Superior Coatings, Inc., Chilicothe, MO, USA
Fluorescent Cleaning Process
Deardorff, Jim; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In recent years, the tremendous growth in available technology and the resulting trend toward component miniaturization and increased product reliability has challenged many companies to upgrade their current cleaning operations to satisfy the higher quality standards required by new product designs. A new, integrated process that combines cleaning methods with fluorescence-based monitoring promises to increase operational efficiency significantly and to provide low-cost quality assurance to a greater range of cleaning operations. Fluorescent (FP) cleaning makes use of modified cleaning agents containing an internal fluorescent/phosphorescent dye that produces a highly visible response when exposed to ultraviolet or visible illumination. FP cleaning offers many performance advantages over traditional cleaning operations. Uniform coverage of all surface areas and complete saturation of available contaminants can be easily monitored by suitable light inspection. Small parts or parts with complicated surfaces are also uniformly covered and complete saturated by FP cleaning. Cleanliness quality is verified, after the removal of the FP cleaner and suspended contaminants, by the total absence of visible fluorescence. Fluorescent inspections can be performed at virtually any point during the assembly phase or at future intervals to support on-going contamination control maintenance.
Author
Cleaning; Quality Control; Fluorescence

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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*.

20040082044 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Quantifying Square Membrane Wrinkle Behavior Using MITC Shell Elements
Jacobson, Mindy B.; Iwasa, Takashi; Natori, M. C.; 2004; 9 pp.; In English; 45th AIAA Structural Dynamics and Materials Conference, 19 Apr. 2004, Palm Springs, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

For future membrane based structures, quantified predictions of membrane wrinkling behavior in terms of amplitude, angle and wavelength are needed to optimize the efficiency and integrity of such structures, as well as their associated control systems. For numerical analyses performed in the past, limitations on the accuracy of membrane distortion simulations have often been related to the assumptions made while using finite elements. Specifically, this work demonstrates that critical assumptions include: effects of gravity. supposed initial or boundary conditions, and the type of element used to model the membrane. In this work, a 0.2 square meter membrane is treated as a structural material with non-negligible bending stiffness. Mixed Interpolation of Tensorial Components (MTTC) shell elements are used to simulate wrinkling behavior due to a constant applied in-plane shear load. Membrane thickness, gravity effects, and initial imperfections with respect to flatness

were varied in numerous nonlinear analysis cases. Significant findings include notable variations in wrinkle modes for thickness in the range of 50 microns to 1000 microns, which also depend on the presence of an applied gravity field. However, it is revealed that relationships between overall strain energy density for cases with differing initial conditions are independent of assumed initial con&tions. In addition, analysis results indicate that the relationship between amplitude scale (W/t) and structural scale (L/t) is linear in the presence of a gravity field.
Author
Membrane Structures; Stress Tensors; Interpolation; Wrinkling; Thin Walled Shells; Mechanical Properties

20040082241 NASA Langley Research Center, Hampton, VA, USA
Investigating and Analyzing Applied Loads Higher Than Limit Loads
Karkehabadi, R.; Rhew, R. D.; March 30, 2004; 11 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Contract(s)/Grant(s): 090-80-40
Report No.(s): AIAA Paper 2004-2197; No Copyright; Avail: CASI; A03, Hardcopy

The results of the analysis for Balance 1621 indicate that the stresses are high near sharp corners. It is important to increase the size of the fillets to relieve some of the high stresses for the balances that will be designed. For the existing balances, the stresses are high and do not satisfy the established criteria. Two options are considered here. One is a possible modification of the existing balances, and two is to consider other load options. Redesigning a balance can be done in order to enhance the structural integrity of the balance. Because an existing balance needs to be modified, it is not possible to increase the fillet sizes without some further modifications to the balance. It is required that some materials be extracted from the balance in order to have larger fillet sizes. Researchers are interested in being able to apply some components of the load on the balance above the limit loads assigned. Is it possible to enhance the load on the same balance and maintain the factor of safety required? Some loads were increased above their limit loads and analyzed here.
Derived from text
Loads (Forces); Structural Failure; Stresses

20040082336 NASA Glenn Research Center, Cleveland, OH, USA
Investigation of Gear and Bearing Fatigue Damage Using Debris Particle Distributions
Dempsey, Paula J.; Lewicki, David G.; Decker, Harry J.; May 2004; 18 pp.; In English; 60th Annual Forum and Technology Display, 7-10 Jun. 2004, Baltimore, MD, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-704-01-03; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-212883; ARL-TR-3133; E-14297; No Copyright; Avail: CASI; A03, Hardcopy

A diagnostic tool was developed for detecting fatigue damage to spur gears, spiral bevel gears, and rolling element bearings. This diagnostic tool was developed and evaluated experimentally by collecting oil debris data from fatigue tests performed in the NASA Glenn Spur Gear Fatigue Rig, Spiral Bevel Gear Test Facility, and the 500hp Helicopter Transmission Test Stand. During each test, data from an online, in-line, inductance type oil debris sensor was monitored and recorded for the occurrence of pitting damage. Results indicate oil debris alone cannot discriminate between bearing and gear fatigue damage.
Derived from text
Debris; Helicopter Propeller Drive; Test Stands; Transmissions (Machine Elements); Spiral Bevel Gears; Fatigue Tests

20040082466 NASA Glenn Research Center, Cleveland, OH, USA
Design and Control of a Proof-of-Concept Active Jet Engine Intake Using Shape Memory Alloy Actuators
Song, Gangbing; Ma, Ning; Penney, Nicholas; Barr, Todd; Lee, Ho-Jun; Arnold, Steven M.; June 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2827; NSF 00-93737; WBS 22-708-01-15
Report No.(s): NASA/TM-2004-213124; E-14618; No Copyright; Avail: CASI; A03, Hardcopy

The design and control of a novel proof-of-concept active jet engine intake using Nickel-Titanium (Ni-Ti or Nitinol) shape memory alloy (SMA) wire actuators is used to demonstrate the potential of an adaptive intake to improve the fuel efficiency of a jet engine. The Nitinol SMA material is selected for this research due to the material's ability to generate large strains of up to 5 percent for repeated operations, a high power-to-weight ratio, electrical resistive actuation, and easy fabrication into a variety of shapes. The proof-of-concept engine intake employs an overlapping leaf design arranged in a concentric configuration. Each leaf is mounted on a supporting bar that rotates upon actuation by SMA wires electrical resistive heating.

Feedback control is enabled through the use of a laser range sensor to detect the movement of a leaf and determine the radius of the intake area. Due to the hysteresis behavior inherent in SMAs, a nonlinear robust controller is used to direct the SMA wire actuation. The controller design utilizes the sliding-mode approach to compensate for the nonlinearities associated with the SMA actuator. Feedback control experiments conducted on a fabricated proof-of-concept model have demonstrated the capability to precisely control the intake area and achieve up to a 25 percent reduction in intake area. The experiments demonstrate the feasibility of engine intake area control using the proposed design.
Author
Actuators; Fabrication; Jet Engines; Shape Memory Alloys; Control Systems Design; Engine Inlets

20040082497 NASA Langley Research Center, Hampton, VA, USA
Model Update of a Micro Air Vehicle (MAV) Flexible Wing Frame with Uncertainty Quantification
Reaves, Mercedes C.; Horta, Lucas G.; Waszak, Martin R.; Morgan, Benjamin G.; July 2004; 18 pp.; In English
Contract(s)/Grant(s): WU 23-762-45-T6
Report No.(s): NASA/TM-2004-213232; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a procedure to update parameters in the finite element model of a Micro Air Vehicle (MAV) to improve displacement predictions under aerodynamics loads. Because of fabrication, materials, and geometric uncertainties, a statistical approach combined with Multidisciplinary Design Optimization (MDO) is used to modify key model parameters. Static test data collected using photogrammetry are used to correlate with model predictions. Results show significant improvements in model predictions after parameters are updated; however, computed probabilities values indicate low confidence in updated values and/or model structure errors. Lessons learned in the areas of wing design, test procedures, modeling approaches with geometric nonlinearities, and uncertainties quantification are all documented.
Author
Fabrication; Mathematical Models; Statistical Analysis; Flexible Wings; Aerodynamics; Aircraft Design

20040083993 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermo-Optical and Mechanical Property Testing of Candidate Solar Sail Materials
Hollerman, WIlliam A.; Stanaland, T. L.; Womack, F.; Edwards, David; Hubbs, Whitney; Semmel, Charles; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Solar sailing is a unique form of propulsion where a spacecraft gains momentum from incident photons. Since sails are not limited by reaction mass, they provide continual acceleration, reduced only by the lifetime of the lightweight film in the space environment and the distance to the Sun. Practical solar sails can expand the number of possible missions, enabling new concepts that are difficult by conventional means. The National Aeronautics and Space Administration's Marshall Space Flight Center (MSFC) is concentrating research into the utilization of ultra-lightweight materials for spacecraft propulsion. Solar sails are generally composed of a highly reflective metallic front layer, a thin polymeric substrate, and occasionally a highly emissive back surface. The Space Environmental Effects Team at MSFC is actively characterizing candidate sails to evaluate the thermo-optical and mechanical properties after exposure to electrons. This poster will discuss the preliminary results of this research.
Author
Mechanical Properties; Solar Sails; Aerospace Environments; Optics; Thermal Analysis

20040084028 Dayton Univ. Research Inst., OH, USA
Corrosion Prevention Compound Evaluation Method
Kuhlman, Sarah J. H.; Abfalter, Garry H.; Dante, Jim; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 9 pp.; In English; See also 20040083973
Contract(s)/Grant(s): F42620-00-D-0039; No Copyright; Avail: CASI; A02, Hardcopy

Many high-strength aluminum alloys employed in aircraft structures are subject to stress corrosion cracking and corrosion fatigue cracking. If a crack is initiated by stress corrosion, the crack may propagate under fatigue loading. Significant fatigue data exists on the effects of environment on the fatigue life of these materials. Corrosion prevention compounds (CPCs) are used as a fast, inexpensive method to reduce corrosion related damage. Environmental exposure studies have demonstrated that CPCs improve the corrosion resistance of high strength aluminum alloys. In a study by F. Gui and R. Kelly of the University of Virginia, it was stated that all the CPCs tested improved the corrosion resistance, but that the CPCs were application sensitive. Such studies demonstrate the need for tests that simulate the both the chemistry and geometry in which

the CPC will be applied. New CPCs are continually being developed in response to environmental concerns and advances in technology. These CPCs need to be screened for their effectiveness and to confirm that the CPCs do not have an adverse effect on fatigue crack growth. The University of Dayton Research Institute (UDRI) developed a simple, cost-effective test method to screen and evaluate the performance of CPCs during fatigue crack growth. Due to the complexity and number of variables involved, this effort was limited to developing a test method and verifying its effectiveness to screen a few CPCs. This paper describes the test method, procedures used, and the results.
Derived from text
Corrosion Prevention; Mechanical Properties; Stress Corrosion Cracking; Fatigue Testing Machines

20040084037 NASA White Sands Test Facility, NM, USA
Effect of Molding and Machining on Neoflon CTFE M400H Polychlorotrifluoroethylene Rod Stock and Valve Seat Properties
Waller, Jess M.; Newton, Barry E.; Beeson, Harold D.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 11 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Since 1997 numerous fires have been reported to the Food and Drug Administration involving cylinder valves installed on medical use oxygen cylinders sold and operated within the USA. All of the cylinder valves in question had polychlorotrifluoroethylene (PCTFE) valve seats. Subsequent failure analysis showed that the main seat was the primary source of ignition. A review of the incidents involving cylinder valve fires indicated three possible ignition mechanisms: contaminant promotion, flow friction, and resonance. However, gas purity analysis showed that uncombusted, residual oxygen was within specification. Infrared and energy dispersive spectroscopy further showed that no contaminants or organic compounds were present in the remaining, uncombusted valve seat material or on seat plug surfaces. Therefore, contaminant-promoted ignition did not appear to be responsible for the failures. Observations of extruded material along the outer edge of the coined or loaded seat area produced by cylinder overuse or poppet overload led to concerns that accelerated gas flow across a deformed seat surface could generate enough localized heating to ignite the polymeric seat. Low molecular weight or highly amorphous quick-quenched PCTFE grades might be expected to be especially prone to this type of deformation. Such a failure mechanism has been described as flow friction; however, the corresponding mechanistic parameters are poorly understood. Subsequent revelation of low-temperature dimensional instability by thermomechanical analysis (TMA) in a variety of PCTFE sheet and rod stock samples led to new concerns that PCTFE valve seats could undergo excessive expansion or contraction during service. During expansion, additional extrusion and accompanying flow friction could occur. During contraction, a gap between the seal and adjacent metal surfaces could form. Gas flowing past the gap could, in turn, lead to resonance heating and subsequent ignition as described in ASTM Guide for Evaluation Nonmetallic Materials for Oxygen Service (G 63). Attempts to uncover the origins of the observed dimensional instability were hindered by uncertainties about resin grade, process history, and post-process heat history introduced by machining, annealing, and sample preparation. An approach was therefore taken to monitor property changes before and after processing and machining using a single, well-characterized lot of Neoflon CTFE.1 M400H resin. A task group consisting of the current PCTFE resin supplier, two molders, and four valve seat manufacturers was formed, and phased testing on raw resin, intermediate rod stock, and finished valve seats initiated. The effect of processing and machining on the properties of PCTFE rod stock and oxygen gas cylinder valve seats was then determined. Testing focused on two types of extruded rod stock and one type of compression-molded rod stock. To accommodate valve seat manufacturer preferences for certain rod stock diameters, two representative diameters were used (4.8 mm (0.1875 in.) and 19.1 mm (0.75 in.)). To encompass a variety of possible sealing configurations, seven different valve seat types with unique geometries or machining histories were tested. The properties investigated were dimensional stability as determined by TMA, specific gravity, differential scanning calorimetry (DSC), compressive strength, zero strength time, and intrinsic viscosity. Findings are discussed in the context of polymer structure-process-property relationships whenever possible.
Author
Machining; Molds; Seats; Polymers; Manufacturing; Mechanical Properties; Gas Valves

20040084084 Building and Construction Research TNO, Delft, Netherlands
Analyses of Tested Steel-GRP Joints and COVOCO Panel using the DYCOSS Failure Prediction Tool
Trouwborst, W.; October 2003; 275 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): A02/KM/128; TNO Proj. 006.38121
Report No.(s): Rept-2003-CMC-R071; TD-2003-0198; Copyright; Avail: Other Sources

New possibilities for sensor performance and signature reduction of naval vessels lead to a growing interest in composite

superstructures and composite integrated mast designs. Therefore, in previous years a design for an integrated mast has been developed consisting of a space frame of steel girders with sandwich panels. The (bonded) joint connection between steel girder and sandwich panels is critical with respect to underwater shock loading transferred to the superstructure. A scaled so-called COVOCO panel with joint has been produced and tested on the shock table in 2001. In 2002 a number of material tests have been carried out and reported to obtain material failure parameters for the adhesives and bondlines as applied in the joint. This report discusses analyses results as calculated with the failure prediction tool as developed within the DYCOSS project, both for the material tests as for the quite complicated COVOCO panel with joint. The main conclusion is that both material tests and COVOCO panel can be analysed quite well with the failure prediction tool, giving results corresponding well with the experimental results. This holds for different aspects as force displacement curves, the onset of failure, the progress of failure and the final damage pattern.
Author
Steels; Failure Analysis; Ships; Sensors; Panels; Mechanical Properties

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*.

20040082319 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Comparison of Local Variance, Fractal Dimension, and Moran's I as Aids to Multispectral Image Classification
Emerson, Charles W.; Sig-NganLam, Nina; Quattrochi, Dale A.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The accuracy of traditional multispectral maximum-likelihood image classification is limited by the skewed statistical distributions of reflectances from the complex heterogenous mixture of land cover types in urban areas. This work examines the utility of local variance, fractal dimension and Moran's I index of spatial autocorrelation in segmenting multispectral satellite imagery. Tools available in the Image Characterization and Modeling System (ICAMS) were used to analyze Landsat 7 imagery of Atlanta, Georgia. Although segmentation of panchromatic images is possible using indicators of spatial complexity, different land covers often yield similar values of these indices. Better results are obtained when a surface of local fractal dimension or spatial autocorrelation is combined as an additional layer in a supervised maximum-likelihood multispectral classification. The addition of fractal dimension measures is particularly effective at resolving land cover classes within urbanized areas, as compared to per-pixel spectral classification techniques.
Author
Maximum Likelihood Estimates; Fractals; Accuracy; Satellite Imagery; Autocorrelation; Statistical Distributions; Spectrum Analysis

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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*.

20040081367 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EOS Aqua AMSR-E Arctic Sea Ice Validation Program: Intercomparison Between Modeled and Measured Sea Ice Brightness Temperatures
Stroeve, J.; Markus, T.; Cavalieri, D. J.; Maslanik, J.; Sturm, M.; Henrichs, J.; Gasiewski, A.; Klein, M.; 2004; 1 pp.; In English; IGARSS 04, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

During March 2003, an extensive field campaign was conducted near Barrow, Alaska to validate AQUA Advanced Microwave Scanning Radiometer (AMSR) sea ice products. Field, airborne and satellite data were collected over three different types of sea ice: 1) first year ice with little deformation, 2) first year ice with various amounts of deformation and 3) mixed first year ice and multi-year ice with various degrees of deformation. The validation plan relies primarily on comparisons between satellite, aircraft flights and ground-based measurements. Although these efforts are important, key aspects such as the effects of atmospheric conditions, snow properties, surface roughness, melt processes, etc on the sea ice algorithms are not sufficiently well understood or documented. To improve our understanding of these effects, we combined

the detailed, in-situ data collection from the 2003 field campaign with radiance modeling using a radiative transfer model to simulate the top of the atmosphere AMSR brightness temperatures. This study reports on the results of the simulations for a variety of snow and ice types and compares the results with the National Oceanographic and Atmospheric Administration Environmental Technology Laboratory Polarimetric Scanning Radiometer (NOAA) (ETL) (PSR) microwave radiometer that was flown on the NASA P-3.
Author
Earth Observing System (Eos); Microwave Radiometers; Arctic Ocean; Sea Ice; Brightness Temperature; Atmospheric Models

20040081408 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Formation Control for the Maxim Mission.
Luquette, Richard J.; Leitner, Jesse; Gendreau, Keith; Sanner, Robert M.; January 2004; 3 pp.; In English; 2nd International Symposium on Formation Flying Missions and Technologies, 14-16 Sep. 2004, Washington, DC, USA; Copyright; Avail: CASI; A01, Hardcopy

Over the next twenty years, a wave of change is occurring in the spacebased scientific remote sensing community. While the fundamental limits in the spatial and angular resolution achievable in spacecraft have been reached, based on today's technology, an expansive new technology base has appeared over the past decade in the area of Distributed Space Systems (DSS). A key subset of the DSS technology area is that which covers precision formation flying of space vehicles. Through precision formation flying, the baselines, previously defined by the largest monolithic structure which could fit in the largest launch vehicle fairing, are now virtually unlimited. Several missions including the Micro-Arcsecond X-ray Imaging Mission (MAXIM), and the Stellar Imager will drive the formation flying challenges to achieve unprecedented baselines for high resolution, extended-scene, interferometry in the ultraviolet and X-ray regimes. This paper focuses on establishing the feasibility for the formation control of the MAXIM mission. The Stellar Imager mission requirements are on the same order of those for MAXIM. This paper specifically addresses: (1) high-level science requirements for these missions and how they evolve into engineering requirements; (2) the formation control architecture devised for such missions; (3) the design of the formation control laws to maintain very high precision relative positions; and (4) the levels of fuel usage required in the duration of these missions. Specific preliminary results are presented for two spacecraft within the MAXIM mission.
Author
Formation Flying; Space Missions; X Ray Imagery; Control Systems Design; Remote Sensing

20040081410 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Metadata Authoring with Versatility and Extensibility
Pollack, Janine; Olsen, Lola; 2004; 1 pp.; In English; AAG Conference, 14-19 Mar. 2004, Philadelphia, PA, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's Global Change Master Directory (GCMD) assists the scientific community in the discovery of and linkage to Earth science data sets and related services. The GCMD holds over 13,800 data set descriptions in Directory Interchange Format (DIF) and 700 data service descriptions in Service Entry Resource Format (SERF), encompassing the disciplines of geology, hydrology, oceanography, meteorology, and ecology. Data descriptions also contain geographic coverage information and direct links to the data, thus allowing researchers to discover data pertaining to a geographic location of interest, then quickly acquire those data. The GCMD strives to be the preferred data locator for world-wide directory-level metadata. In this vein, scientists and data providers must have access to intuitive and efficient metadata authoring tools. Existing GCMD tools are attracting widespread usage; however, a need for tools that are portable, customizable and versatile still exists. With tool usage directly influencing metadata population, it has become apparent that new tools are needed to fill these voids. As a result, the GCMD has released a new authoring tool allowing for both web-based and stand-alone authoring of descriptions. Furthermore, this tool incorporates the ability to plug-and-play the metadata format of choice, offering users options of DIF, SERF, FGDC, ISO or any other defined standard. Allowing data holders to work with their preferred format, as well as an option of a stand-alone application or web-based environment, docBUlLDER will assist the scientific community in efficiently creating quality data and services metadata.
Author
Earth Sciences; Metadata; Versatility; NASA Programs

20040082017 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Measurement Based Assessment of Aerosol Radiative Forcing at the Top and Bottom of the Atmosphere
Kaufman, Yoram; [2004]; 1 pp.; In English; AeroCom Workshop, 10-12 Mar. 2004, Ispra, Italy; No Copyright; Avail: Other Sources; Abstract Only

I shall review current efforts on measurement based assessment of the aerosol radiative effects at the top of the atmosphere using MODIS, CERES and VIRS instruments, and radiative effects at the surface using AERONET. I shall also discuss use of the MODIS derived fine aerosol fraction for assess the anthropogenic component.
Author
Aerosols; Atmospheric Effects

20040082065 Michigan Technological Univ., Houghton, MI, USA
Development of a Miniature L-band Radiometer for Education Outreach in Remote Sensing
King, Lyon B.; 2004; 20 pp.; In English
Contract(s)/Grant(s): NAG5-12770; No Copyright; Avail: CASI; A03, Hardcopy

Work performed under this grant developed a 1.4-Mhz radiometer for use in soil moisture remote sensing from space. The resulting instrument was integrated onto HuskySat. HuskySat is a 30-kg nanosatellite built under sponsorship from the Air Force Research Laboratory and NASA. This report consists of the interface document for the radiometer (the Science Payload of HuskySat) as detailed in the vehicle design report.
Author
Soil Moisture; Remote Sensing; Military Technology; Radiometers

20040082080 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA Data for Water Resources Applications
Toll, David; Houser, Paul; Arsenault, Kristi; Entin, Jared; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Water Management Applications is one of twelve elements in the Earth Science Enterprise National Applications Program. NASA Goddard Space Flight Center is supporting the Applications Program through partnering with other organizations to use NASA project results, such as from satellite instruments and Earth system models to enhance the organizations critical needs. The focus thus far has been: 1) estimating water storage including snowpack and soil moisture, 2) modeling and predicting water fluxes such as evapotranspiration (ET), precipitation and river runoff, and 3) remote sensing of water quality, including both point source (e.g., turbidity and productivity) and non-point source (e.g., land cover conversion such as forest to agriculture yielding higher nutrient runoff). The objectives of the partnering cover three steps of: 1) Evaluation, 2) Verification and Validation, and 3) Benchmark Report. We are working with the U.S. federal agencies including the Environmental Protection Agency (EPA), the Bureau of Reclamation (USBR) and the Department of Agriculture (USDA). We are using several of their Decision Support Systems (DSS) tools. This includes the DSS support tools BASINS used by EPA, Riverware and AWARDS ET ToolBox by USBR and SWAT by USDA and EPA. Regional application sites using NASA data across the US. are currently being eliminated for the DSS tools. The current NASA data emphasized thus far are from the Land Data Assimilation Systems WAS) and MODIS satellite products. We are currently in the first two steps of evaluation and verification validation. Water Management Applications is one of twelve elements in the Earth Science Enterprise s National Applications Program. NASA Goddard Space Flight Center is supporting the Applications Program through partnering with other organizations to use NASA project results, such as from satellite instruments and Earth system models to enhance the organizations critical needs. The focus thus far has been: 1) estimating water storage including snowpack and soil moisture, 2) modeling and predicting water fluxes such as evapotranspiration (ET), precipitation and river runoff, and 3) remote sensing of water quality, including both point source (e.g., turbidity and productivity) and non-point source (e.g., land cover conversion such as forest to agriculture yielding higher nutrient runoff). The objectives of the partnering cover three steps of 1) Evaluation, 2) Verification and Validation, and 3) Benchmark Report. We are working with the U.S. federal agencies the Environmental Protection Agency (EPA), the Bureau of Reclamation (USBR) and the Department of Agriculture (USDA). We are using several of their Decision Support Systems (DSS) tools. T us includes the DSS support tools BASINS used by EPA, Riverware and AWARDS ET ToolBox by USBR and SWAT by USDA and EPA. Regional application sites using NASA data across the US. are currently being evaluated for the DSS tools. The current NASA data emphasized thus far are from the Land Data Assimilation Systems (LDAS) and MODIS satellite products. We are currently in the first two steps of evaluation and verification and validation.
Derived from text
Water Management; MODIS (Radiometry); Resources Management; Earth Sciences; Agriculture; Point Sources

20040082114 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Initial Validation of NDVI time seriesfrom AVHRR, VEGETATION, and MODIS

Morisette, Jeffrey T.; Pinzon, Jorge E.; Brown, Molly E.; Tucker, Jim; Justice, Christopher O.; [2004]; 9 pp.; In English; Second VEGETATION International Users Conference, 23-26 Mar. 2004, Antwerpen, Belgium; Copyright; Avail: CASI; A02, Hardcopy

The paper will address Theme 7: Multi-sensor opportunities for VEGETATION. We present analysis of a long-term vegetation record derived from three moderate resolution sensors: AVHRR, VEGETATION, and MODIS. While empirically based manipulation can ensure agreement between the three data sets, there is a need to validate the series. This paper uses atmospherically corrected ETM+ data available over the EOS Land Validation Core Sites as an independent data set with which to compare the time series. We use ETM+ data from 15 globally distributed sites, 7 of which contain repeat coverage in time. These high-resolution data are compared to the values of each sensor by spatially aggregating the ETM+ to each specific sensors' spatial coverage. The aggregated ETM+ value provides a point estimate for a specific site on a specific date. The standard deviation of that point estimate is used to construct a confidence interval for that point estimate. The values from each moderate resolution sensor are then evaluated with respect to that confident interval. Result show that AVHRR, VEGETATION, and MODIS data can be combined to assess temporal uncertainties and address data continuity issues and that the atmospherically corrected ETM+ data provide an independent source with which to compare that record. The final product is a consistent time series climate record that links historical observations to current and future measurements.
Author

Normalized Difference Vegetation Index; Data Processing; High Resolution; Comparison

20040082118 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Communications: Mosquito Habitats, Land Use, and Malaria Risk in Belize from Satellite Imagery

Pope, Kevin; Masuoka, Penny; Rejmankova, Eliska; Grieco, John; Johnson, Sarah; Roberts, Donald; [2004]; 23 pp.; In English

Contract(s)/Grant(s): NAG5-12593; NIAID-R01-AI49726; Copyright; Avail: CASI; A03, Hardcopy

Satellite imagery of northern Belize is used to examine the distribution of land use and breeding habitats of the malaria vector the Anopheles mosquito. A land cover classification based on multispectral SPOT and multitemporal Radarsat images identified eleven land cover classes, including agricultural, forest, and marsh types. Two of the land cover types, Typha domingensis marsh and flooded forest, are Anopheles vestitipennis larval habitats, and one, Eleocharis spp. marsh, is the larval habitat for Anopheles albimanus. Geographic Information Systems (GIS) analyses of land cover demonstrate that the amount of Typha domingensis in a marsh is positively correlated with the amount of agricultural land in the adjacent upland, and negatively correlated with the amount of adjacent forest. This finding is consistent with the hypothesis that nutrient (phosphorus) runoff from agricultural lands is causing an expansion of Typha domingensis in northern Belize. Thus, land use induced expansion of Anopheles vestitipennis larval habitat is potentially increasing malaria risk in Belize, and in other regions where Anopheles vestitipennis is a major malaria vector.
Author

Satellite Imagery; Parasitic Diseases; Insects; Land Use; Marshlands; Breeding (Reproduction)

20040082252 Boston Univ., Boston, MA, USA

Monitoring Change in Temperate Coniferous Forest Ecosystems

Williams, Darrel, Technical Monitor; Woodcock, Curtis E.; [2004]; 14 pp.; In English

Contract(s)/Grant(s): NAG5-3439; No Copyright; Avail: CASI; A03, Hardcopy

The primary goal of this research was to improve monitoring of temperate forest change using remote sensing. In this context, change includes both clearing of forest due to effects such as fire, logging, or land conversion and forest growth and succession. The Landsat 7 ETM+ proved an extremely valuable research tool in this domain. The Landsat 7 program has generated an extremely valuable transformation in the land remote sensing community by making high quality images available for relatively low cost. In addition, the tremendous improvements in the acquisition strategy greatly improved the overall availability of remote sensing images. I believe that from an historical prespective, the Landsat 7 mission will be considered extremely important as the improved image availability will stimulate the use of multitemporal imagery at resolutions useful for local to regional mapping. Also, Landsat 7 has opened the way to global applications of remote sensing at spatial scales where important surface processes and change can be directly monitored. It has been a wonderful experience to have participated on the Landsat 7 Science Team. The research conducted under this project led to contributions in four general domains: I. Improved understanding of the information content of images as a function of spatial resolution; II. Monitoring Forest Change and Succession; III. Development and Integration of Advanced Analysis Methods; and IV. General

support of the remote sensing of forests and environmental change. This report is organized according to these topics. This report does not attempt to provide the complete details of the research conducted with support from this grant. That level of detail is provided in the 16 peer reviewed journal articles, 7 book chapters and 5 conference proceedings papers published as part of this grant. This report attempts to explain how the various publications fit together to improve our understanding of how forests are changing and how to monitor forest change with remote sensing. There were no new inventions that resulted from this grant.
Author
Conifers; Ecosystems; Forests; Remote Sensing; Temperate Regions

20040082640 GeoSyntec Consultants, Inc., Guelph, Ontario
Assessing the Feasibility of DNAPL Source Zone Remediation: Review of Case Studies
May 2004; 293 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): CR-04-002-ENV
Report No.(s): AD-A423597; No Copyright; Avail: CASI; A13, Hardcopy

The overall goal of this project was to gather information on the relative successes of remediation applications under different site conditions in order to initiate the development of guidelines on DNAPL source treatment. Members of the environmental community that had attempted to remediate DNAPL source zone areas were invited to participate in a web-based survey. which remained open for several months. Survey respondents were asked a number of questions dealing with site-specific issues (e.g.. geology. hydrogeology. contaminant distribution. monitoring network) and technology specific issues (c_U.. type of remedial technology. remediation stage. cost. treatment effectiveness). The number of survey respondents totaled 213. Of the 213. complete sets of data were obtained for 118 locations. Data from 21 published case studies was also entered into the survey. This report also includes a brief overview of chlorinated solvent DNAPL contamination and remediation processes. The data collected from this survey suggests that DNAPL remediation efficacy is extremely difficult to gauge. and although employing aggressive remedial technologies cannot achieve site closure. significant mass removal can be achieved.
DTIC
Hydrogeology

20040082666 Defence Science and Technology Organisation, Salisbury
The Compression of Digital Terrain Elevation Data (DTED) Using JPEG2000
Owen, M. J.; Grigg, M. W.; Feb. 2004; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423664; DSTO-TR-1548; DODA-AR-013-023; No Copyright; Avail: CASI; A03, Hardcopy

This report summarises the results of an investigation of the applicability of the JPEG20O0 compression system to Digital Terrain Elevation Data (DTED) and in particular the application of the region-of-interest, ROI, capabilities built into the standard. JPEG2000 is a new image compression standard offering a number of advantages, particularly relevant to Defence, over previous image compression standards. Its application to DTED would not normally be considered, given that DTED is not an imagery data type. However DTED has similar characteristics to monochrome imagery data and the utility of JPEG2O00 and in particular ROI capability would have benefits for the storage and dissemination of DTED within Defence. The advantage of ROI coding is that very high compression ratios can be achieved while maintaining high fidelity of the data in regions of importance. Possible applications of such techniques would be in the distribution or dissemination of DTED, or mission rehearsal products containing elevation data, to deployed units where they could be used to support tactical mission planning and rehearsal.
DTIC
Data Compression; Digital Data; Elevation; Image Processing; Terrain

20040082718 Utah Univ., Salt Lake City, UT
A Statistical Approach to 3D Terrain Reconstruction
Whitaker, Ross T.; Sep. 19, 2003; 43 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0033
Report No.(s): AD-A423778; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the work and accomplishments of the University of Utah on the ONR grant N00014-01-1-0033 entitled ″A Statistical Approach To 3D terrain Reconstruction″. The report, as agreed with the Program Officer, Dr. L. Rosenblum, is the same as the presentation of the final meeting for this project, and consists of a series of slides with notes

that explain the meaning of each slide. The report describes the motivation and overall goals of the project, presents results from this work, lists the publications that have resulted from this grant, and describes the mechanisms by which technology has been disseminated. This project addresses the question of surface reconstruction, particularly with the application of visualizing and analyzing terrain data. Results include fundamental developments in how to formulate the problem of surface fitting and smoothing and engineering developments, including fast algorithms on specialized hardware.
DTIC
Statistical Analysis; Terrain

20040083106 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Polarimetric Extension of the van Cittert-Zernike Theorem for Use with Microwave Interferometers
Piepmeier, J. R.; Simon, N. K.; May 03, 2004; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

The van Cittert-Zernike theorem describes the Fourier-transform relationship between an extended source and its visibility function. Developments in classical optics texts use scalar field formulations for the theorem. Here, we develop a polarimetric extension to the van Cittert-Zernike theorem with applications to passive microwave Earth remote sensing. The development provides insight into the mechanics of two-dimensional interferometric imaging, particularly the effects of polarization basis differences between the scene and the observer.
Author
Microwave Interferometers; Fourier Transformation; Imaging Techniques; Microwave Imagery; Theorems

20040084157 Florida Univ., FL, USA
Interfacial Instabilities During Evaporation
Ozen, Ozgur; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 125; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Interfacial instabilities in the presence of vapors have traditionally been investigated by others who have assumed that the vapor phase is infinitely deep and passive, i.e. vapor fluid dynamics has been ignored. However, when we look at many engineering processes, such as heat pipes and coating technologies where interfacial instabilities take place, we might imagine that the assumption of an infinitely deep vapor layer, or at least that of a passive vapor, is inappropriate. We have looked at a variety of problems where a liquid is in contact with a gas (sometimes even its own vapor) and investigated the role of the active gas phase on the interfacial instability. We have especially focused on the evaporative instabilities where the instability mechanism is more complicated. In order to understand the physics of these instabilities, calculations were done employing the techniques of linear stability analysis and the dominant balance method. The theoretical results and interpretations are also backed by experiments in bilayer fluid systems using IR imaging for flow visualization.
Derived from text
Vapors; Stability; Infrared Imagery; Heat Pipes

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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*.

20040082289 Sverdrup Technology, Inc., Huntsville, AL, USA
Gravitation and Special Relativity from Compton Wave Interactions at the Planck Scale: An Algorithmic Approach
Blackwell, William C., Jr.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: Other Sources; Abstract Only

In this paper space is modeled as a lattice of Compton wave oscillators (CWOs) of near- Planck size. It is shown that gravitation and special relativity emerge from the interaction between particles Compton waves. To develop this CWO model an algorithmic approach was taken, incorporating simple rules of interaction at the Planck-scale developed using well known physical laws. This technique naturally leads to Newton s law of gravitation and a new form of doubly special relativity. The

model is in apparent agreement with the holographic principle, and it predicts a cutoff energy for ultrahigh-energy cosmic rays that is consistent with observational data.
Author
Cosmic Rays; Wave Interaction; Gravitation; Holography; Energy Spectra

20040082409 International Solar Electric Technology, Inglewood, CA, USA
Lab to Largbe Scale Transition for Non-Vacuum Thin Film CIGS Solar Cells. Phase I Annual Technical Report 1 August 2002-31 July 2003
Kapur, V. K.; Bansal, A.; Le, P.; Asensio, O.; Shigeoka, N.; Feb. 2004; 28 pp.; In English
Report No.(s): DE2004-15006756; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this subcontract is to (1) identify the challenges that ISET may face in the process of making a 'Lab to Large-Scale' transition for its ink-based non-vacuum process in production of thin-film CIGS solar cells and modules, and (2) develop workable solutions for these challenges such that they can readily be implemented in a large-scale processing line for CIGS modules. The primary objective of this research is to streamline ISET's ink-based non-vacuum process for fabricating efficient CIGS modules at a lower cost of module production of \h $1.0 watt. To achieve this objective, ISET focuses R&D efforts on investigating topics that directly impact the ultimate cost of processing CIGS modules. These topics include (1) module output, and therefore, the solar cell and module efficiency, (2) overall process yield, which requires developing a process that offers a very high degree of repeatability for every manufacturing step, and finally (3) a process approach that maximizes the utilization of the materials used. In accordance with the above, this report will cover activity during Phase I in the investigation of methods for low-cost manufacturing and process development. Specific tasks cover four broad areas: (1) solar cell efficiency, (2) process control, (3) module integration, and (4) enhanced material utilization by recycling unused materials.
NTIS
Thin Films; Solar Cells

20040082811 Secretary of the Air Force, Washington, DC
Guide To Bare Base Power Plant Installation - Air Force Handbook 10-222, Volume 5
Oct. 1998; 67 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423972; No Copyright; Avail: CASI; A04, Hardcopy
This handbook is designed to assist you in establishing a power plant network at a bare base or remote location. It discusses in a generic sense bare base power requirements. site selection and layout. primary electrical connections. safety considerations. and basic maintenance and emergency planning requirements. When coupled with information contained in AFPAM t()-2 t9. Vol 5. Bare Base Conceptual Planning Guide. and instruction received at Silver Flag training sites. electrical and power production personnel should be capable of effectively setting up a bare base primary power generation system.
DTIC
Communication Networks; Electric Connectors; Electric Power Plants; Handbooks; Installing

20040083017 Colorado School of Mines, Golden, CO, USA, National Renewable Energy Lab., Golden, CO
Enhanced Utilization of Corn Based Plasticis
Dow, C.; Oct. 20, 2003; In English
Report No.(s): DE2003-816437; No Copyright; Avail: National Technical Information Service (NTIS)
Department of Energy award number DE-FC07-99CH11010, Enhanced Utilization of Corn Based Biomaterials, supported a technology development program sponsored by Cargill Dow LLC from September 30, 1999 through June 30, 2003. The work involved fundamental scientific studies on poly lactic acid (PLA), a new environmentally benign plastic material from renewable resources. DOE funds supported academic research at the Colorado School of Mines and the National Renewable Energy Laboratory (NREL), and industry cost share was directed towards applied research into new product development utilizing the fundamental information generated by the academic partners. Under the arrangement of the grant, the fundamental information is published so that other companies can utilize it in evaluating the applicability of PLA in their own products. The overall project objective is to increase the utilization of PLA, a renewable resource based plastic, currently produced from fermented corn sugar.
NTIS
Corn; Plastics; Product Development; Renewable Energy

20040084150

Photoregulated Electron Transfer at Bio-organic Interfaces

Lebedev, Nikolai; Trammell, Scott A.; Spano, Anthony; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 103-104; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Efficient connection between bio- and inorganic materials is crucial for the development of new generation of photo-, chemo- and bio-sensors, power sources, information processing devices, and ultimately will lead to the construction of integrated bio-computer hybrids. The main problem in the construction of such bioinorganic devices is the electrical connection between biomolecules and semiconductors or metals, and viability of the protein after immobilization. In the present work using genetically engineered proteins and specifically synthesized organic linkers, we were able to construct self-assembling aligned biomolecular surfaces on various metals and semiconductors, including gold, ITO, glasses, porous SnO2, carbon nanotubes, and in artificial lipid membranes. Using bacterial photosynthetic reaction centers (RCs) as an active protein, we were able to demonstrate that after immobilization on the surfaces this protein can operate as a photosensor, optical switch, or photovoltaic device for local power generation. Our experimental results have shown that after binding to an electrode, photosynthetic RCs are able to undergo efficient photoinduced charge separation, operate as a photorectifier and transfer current only in only one, protein orientation-dependent direction. Part of the protein (H-subunit) acts as an insulator and must be removed for substantial improvement of the protein performance. Electron transfer in the constructed devices follows a tunneling mechanism and can be described by integrated Marcus formalism. It shows an exponential dependence of the rate of electron transfer on the distance between RC and electrode and demonstrates rather low reorganization energy. Author

Electron Transfer; Biochemistry; Electric Connectors; Photoelectricity; Polarization (Charge Separation); Photovoltaic Conversion

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ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20040079792 Lawrence Livermore National Lab., Livermore, CA

National Ignition Facility: Project Input for Assessment of Environmental Impacts of NIF for the Sitewide Environmental Impact Statement

Oct. 2003; 74 pp.; In English

Report No.(s): DE2004-15006532; UCRL-TR-155675; No Copyright; Avail: Department of Energy Information Bridge

This report provides the baseline data from which the environmental impacts of bounding NIF operations can be assessed. Included are operations in the NIF Laser and Target Area Building (LTAB) and the Optics Assembly Building (OAB), (Buildings 581 and 681), and the Building 582 equipment building.

NTIS

Laser Fusion; Environmental Surveys

20040081075 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Recovery of the Antarctic Ozone Hole

Newman, Paul A.; April 13, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The ozone hole is a massive loss of ozone that annually occurs over Antarctica during the Austral spring (August-November). Man-made chlorine and bromine compounds cause the ozone hole. As opposed to local urban pollution, the hole illustrates how man-made chemicals can affect the atmosphere over enormous regions remote from their release point. These chlorine and bromine gases have long lifetimes in the atmosphere; hence, the ozone hole will slowly recover into the next few decades. In this talk I will briefly cover some of the history of the Antarctic ozone hole and the theory behind the phenomena. I will then discuss the recovery of ozone over Antarctica. State-of-the-art computer models project the recovery of the ozone hole to 1980 levels by about 2050. However, this recovery may be affected by greenhouse warming.

Author

Antarctic Regions; Ozone Depletion; Annual Variations; Earth Atmosphere

20040081318 Battelle Columbus Labs., OH
Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program
Sep. 2003; In English
Report No.(s): PB2004-103530; EPA-454/B-03-005; 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 the scattering and absorption processes is a reduction of the amount of light from a scene that is returned to the observer, and scattering of other light into the sight path, creating a hazy condition. The term 'natural visibility conditions' represents the ultimate goal of the regional haze program, consistent with the national visibility goal set forth in section 169A of the Clean Air Act (CAA). The purpose of this document is to provide guidance to the States in implementing the regional haze program under the Clean Air Act.
NTIS
Air Quality; Visibility; Haze

20040081320 Environmental Protection Agency, Washington, DC, USA
Summary and Analysis of the Highway Diesel Fuel, 2003 Pre-Compliance Reports
Oct. 2003; In English
Report No.(s): PB2004-103781; EPA/420/R/03-013; No Copyright; Avail: National Technical Information Service (NTIS)

Any refiner or importer planning to produce or import highway diesel fuel in 2006-10, is required to submit to the U.S. Environmental Protection Agency (EPA or the Agency) pre-compliance reports. These reports are due annually from June 2003 through 2005. They must contain estimates of the volumes of 15 parts-per-million (ppm) sulfur highway diesel fuel and 500 ppm sulfur diesel fuel that will be produced at each refinery or imported by each importer from June 2006 through May 2010. For those refineries planning to participate in the credit trading program, the reports must contain a projection of how many credits will be generated or used by each refinery. The pre-compliance reports must also contain information outlining each refinery's timeline for compliance with the 15 ppm sulfur standard and provide information regarding engineering plans (e.g., design and construction), the status of obtaining any necessary permits, and capital commitments for making the necessary modifications to produce 15 ppm sulfur highway diesel fuel. In general, the reports for 2003 indicate that (1) the industry is on target for complying with the 15 ppm sulfur standard on time, (2) highway diesel fuel production will be sufficient to meet demand, and (3) 15 ppm sulfur diesel fuel will be widely available nationwide.
NTIS
Diesel Fuels; Environment Protection; Refining

20040081331 Nature Conservancy, Arlington, VA, USA, Winrock International, Arlington, VA, USA
Technical Progress Report on Application and Development of Appropriate Tools and Technologies for Cost-Effective Carbon Sequestration
Stanley, B.; Brown, S.; Hawes, E.; Kant, Z.; Calmon, M.; Sep. 2002; In English
Report No.(s): DE2003-814908; No Copyright; Avail: National Technical Information Service (NTIS)

The Nature Conservancy is participating in a Cooperative Agreement with the Department of Energy (DOE) National Energy Technology Laboratory (NETL) to explore the compatibility of carbon sequestration in terrestrial ecosystems and the conservation of biodiversity. The title of the research projects is ''Application and Development of Appropriate Tools and Technologies for Cost-Effective Carbon Sequestration''. The objectives of the project are to: (1) improve carbon offset estimates produced in both the planning and implementation phases of projects; (2) build valid and standardized approaches to estimate project carbon benefits at a reasonable cost; and (3) lay the groundwork for implementing cost-effective projects, providing new testing ground for biodiversity protection and restoration projects that store additional atmospheric carbon. This Technical Progress Report discusses preliminary results of the six specific tasks that The Nature Conservancy is undertaking to answer research needs while facilitating the development of real projects with measurable greenhouse gas impacts. The specific tasks discussed include: Task 1: carbon inventory advancements; Task 2: advanced videography testing; Task 3: baseline method development; Task 4: third-party technical advisory panel meetings; Task 5: new project feasibility studies; and Task 6: development of new project software screening tool.
NTIS
Technology Assessment; Cost Effectiveness; Carbon; Energy Technology

20040081339 Technical Research Centre of Finland, Espoo, Finland
Advanced Energy Production Based on Fossil and Renewable Fuels
Hepola, J.; Kurkela, E.; 2002; 74 pp.; In Finnish
Report No.(s): PB2004-106085; VTT/RN-2155; No Copyright; Avail: CASI; A04, Hardcopy

The objects of this survey were gasification and combustion techniques, coproduction alternatives of energy, fuels and chemicals, as well as high-temperature fuel cells and hybrid fuel cell systems. The potential and market outlook of pressurized fluidized-bed combustion have been declined, i.e., due to the good competitivity of natural gas combined-cycle technology, tightening emission standards, and the development outlook for gasification combined-cycle technology.
NTIS
Fossil Fuels; Pollution Control

20040081348 Technical Research Centre of Finland, Espoo, Finland
Road Traffic Exhaust Gas Emissions in Finland. LIISA 2001
Makela, K.; Laurikko, J.; Kanner, H.; 2002; In Finnish
Report No.(s): PB2004-106102; VTT/RN-2177; No Copyright; Avail: National Technical Information Service (NTIS)

The report describes the modification of the road traffic exhaust emission calculation model LIISA and presents the new calculation results. The model has already established its position as the most important inventory tool for regional road traffic emissions in Finland. The LIIA model calculates road traffic emissions as a whole. The system is comprised of three separate models: 1. a model for calculating automobile emissions for the years 2001-2021, 2. a model for calculating emissions backwards for the years 1980-2000, and 3. a model for calculating the emissions of motorcycles and mopeds. All three parts have been modified.
NTIS
Automobiles; Exhaust Emission

20040081360 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Chracterizing the Fabric of the Urban Environment: A Case Study of Salt Lake City, Utah
Akbari, H.; Rose, L. S.; Feb. 2001; In English
Report No.(s): DE2003-816058; LBNL-47851; No Copyright; Avail: National Technical Information Service (NTIS)

Urban fabric data are needed in order to estimate the impact of light-colored surfaces (roofs and pavements) and urban vegetation (trees, grass, shrubs) on the meteorology and air quality of a city, and to design effective implementation programs. In this report, we discuss the result of a semi-automatic Monte-Carlo statistical approach used to develop data on surface-type distribution and city-fabric makeup (percentage of various surface-types) using aerial color orthophotography. The digital aerial photographs for Salt Lake City covered a total of about 34 km2 (13 mi2). At 0.50-m resolution, there were approximately 1. 4 x 108 pixels of data. Four major land-use types were examined: (1) commercial, (2) industrial, (3) educational, and (4) residential. On average, for the areas studied, vegetation covers about 46 percent of the area (ranging 44-51 percent), roofs cover about 21 percent (ranging 15-24 percent), and paved surfaces about 26 percent (ranging 21-28 percent).
NTIS
Air Quality; Orthophotography; Statistical Analysis

20040082149 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radicals and Reservoirs in the GMI Chemistry and Transport Model: Comparison to Measurements
Douglas, Anne R.; Stolarski, Richard S.; Strahan, Susan E.; Connell, Peter S.; [2004]; 47 pp.; In English
Contract(s)/Grant(s): W-7405-eng-48; Copyright; Avail: CASI; A03, Hardcopy

The most important use of atmospheric chemistry and transport models is to predict the future composition of the atmosphere. The amounts of gases like chlorofluorcarbons, methyl bromide, nitrous oxide and methane are changing and the stratospheric ozone layer will change because these gases are changing. Methyl bromide, nitrous oxide and methane all have natural sources, and also change because of human activity. Chlorofluorcarbons are man-made gases; these are known to decrease stratospheric ozone and future production is banned. They are long-lived gases, and many decades will pass before they are insignificant in the atmosphere. The models are used to predict changes in ozone and other gases; this is a straightforward application. The models must be also tested using observations for the present day atmosphere. This is a challenging task, because the model contains more than 50 species and more than 150 chemical reactions. Data from satellites, ground stations, aircraft and balloons are used to evaluate the model. Different models that are used in international

assessments produce different results; in the most recent assessment some predict that ozone will return to 1980 levels by 2025 and others predict that this will not happen until 2050. Since all the parts of the models are conceptually the same, there must be differences in implementation that produce these differences, This work takes a single model, two different sets of winds and temperatures, and repeats the same prediction for the future. Here we compare the results for these two simulations with many observations. The purpose is to identify differences in the model results for the present atmosphere that will lead to different predictions. This sort of controlled comparison will reduce uncertainty in the predictions for stratospheric ozone.
Author
Atmospheric Chemistry; Transport Properties; Models; Atmospheric Composition; Radicals

20040082178 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Perspectives on African Ozone from Sondes, Dobson and Aircraft Measurements
Thompson, A. M.; Witte, J. C.; Chatfield, R. B.; Diab, R. D.; Thouret, V.; Sauvage, B.; 2004; 1 pp.; In English; 2004 Joint Assembly - CGU/AGU/SEG/EEGS, 17-21 May 2004, Montreal, Canada; Copyright; Avail: Other Sources; Abstract Only

We have been studying variability in ozone over Africa using data from ozonesondes (vertical profiles from surface to stratosphere), aircraft (the MOZAIC dataset with cruise altitude and landing/takeoff profiles) and the ground (Dobson spectrophotometer total ozone column measurement). The following may give context for ozone investigations during AMMA: 1. Total ozone measurements since 1989 show considerable variability in mean value among the African stations in Algeria, Kenya, Egypt, South Africa, as well as in seasonal cycles and year-to-year. Trends are not evident. 2. The impacts of convection, stratospheric injection, biomass burning and lightning appear in ozone sounding profile data. Time-series analysis and case studies point to periodic influences of long-range interactions with the Atlantic (″ozone paradox,″ wave-one″) and Indian Oceans. 3. Tropospheric ozone variations, observed in tropospheric profiles and integrated column amount, follow general seasonal patterns but short- term variability is so strong that simple averages are inadequate for describing ″climatology″ and statistical classification approaches may be required.
Author
Ozone; Statistical Analysis; Time Series Analysis; Africa

20040082255 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Environmental Snapshots for Satellite Multi-Angle Aerosol Retrieval Validation During the ACE-Asia Field Campaign
Kahn, Ralph; Anderson, Jim; Anderson, Theodore L.; Bates, Tim; Brechtel, Fred; Clarke, Antony; Dutton, Ellsworth; Flagan, Richard; Fouin, Robert; Fukushima, Hajime, et al.; November 12, 2003; 62 pp.; In English; Copyright; Avail: CASI; A04, Hardcopy

On five occasions spanning the ACE-Asia field experiment in spring 2001, the multi-angle imaging MISR instrument, flying aboard the NASA Earth Observing System s Terra satellite, took quarter-kilometer data over a 400-km-wide swath, coincident with high-quality observations by multiple instruments on two or more participating surface and airborne platforms. The cases capture a range of clean, polluted, and dusty aerosol conditions. They represent some of the best opportunities during ACE- Asia for comparative studies among intensive and extensive aerosol observations in their environmental context. We inter-compare related measurements and discuss the implications of apparent discrepancies for each case, at a level of detail appropriate to the analysis of satellite observations. With a three-stage optical modeling process, we synthesize data from multiple sources into layer-by-layer snapshots that summarize what we know about the state of the atmosphere and surface at key locations during each event, to be used for satellite vicarious calibration and aerosol retrieval validation. Aerosols within a few kilometers of the surface were composed primarily of pollution and Asian dust mixtures, as expected. Accumulation and coarse-mode particle size distributions varied little among the events studied, but column aerosol optical depth changed by more than a factor of four, and the near-surface proportion of dust ranged from about 25% to 50%. The amount of absorbing material in the sub-micron fraction was highest when near-surface winds crossed Beijing and the Korean Peninsula, and was considerably lower for all other cases. Ambiguities remain in segregating size distributions by composition; having simultaneous single scattering albedo measurements at more than a single wavelength would significantly reduce the resulting optical model uncertainties, as would integral constraints from surface and atmospheric radiative flux observations. The consistency of component particle micro-physical properties among the five events, even in this relatively complex aerosol environment, suggests that global, satellite-derived maps of aerosol-air-mass-type extent, combined with targeted in situ measurements, can provide a detailed global picture of aerosol behavior. Further joint satellite and in situ analysis is needed to assess the spatial variability of both intensive and extensive aerosol properties within aerosol air masses in two spatial dimensions.
Author
Aerosols; Environmental Quality; Asia; Pollution; In Situ Measurement; Imaging Techniques

20040082332 NASA Glenn Research Center, Cleveland, OH, USA

Further Progress in Noise Source Identification in High Speed Jets via Causality Principle

Panda, J.; Seasholtz, R. G.; Elam, K. A.; May 2004; 34 pp.; In English; Ninth Aeroacoustic Conference and exhibit, 12-14 May 2003, Hilton Head, SC, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-714-08-14

Report No.(s): NASA/TM-2004-212385; AIAA Paper 2003-3126; E-13963; No Copyright; Avail: CASI; A03, Hardcopy

To locate noise sources in high-speed jets, the sound pressure fluctuations p/, measured at far field locations, were correlated with each of density p, axial velocity u, radial velocity v, puu and pvv fluctuations measured from various points in fully expanded, unheated plumes of Mach number 0.95, 1.4 and 1.8. The velocity and density fluctuations were measured simultaneously using a recently developed, non-intrusive, point measurement technique based on molecular Rayleigh scattering (Seasholtz, Panda, and Elam, AIAA Paper 2002-0827). The technique uses a continuous wave, narrow line-width laser, Fabry-Perot interferometer and photon counting electronics. The far field sound pressure fluctuations at 30 to the jet axis provided the highest correlation coefficients with all flow variables. The correlation coefficients decreased sharply with increased microphone polar angle, and beyond about 60 all correlation mostly fell below the experimental noise floor. Among all correlations \h puu; p/\g showed the highest values. Interestingly, \hp; p/\g, in all respects, were very similar to \hpuu; p/\g. The \hv;p/\g and \hpvv;p/\g correlations with 90deg microphone fell below the noise floor. By moving the laser probe at various locations in the jet it was found that the strongest noise source lies downstream of the end of the potential core and extends many diameters beyond. Correlation measurement from the lip shear layer showed a Mach number dependency. While significant correlations were measured in Mach 1.8 jet, values were mostly below the noise floor for subsonic Mach 0.95 jet. Various additional analyses showed that fluctuations from large organized structures mostly contributed to the measured correlation, while that from small scale structures fell below the noise floor.

Author

Noise (Sound); Jet Aircraft Noise; Rayleigh Scattering; Sound Pressure; Noise Generators; Pressure Oscillations

20040082439 National Cancer Inst., Bethesda, MD, USA

Health Effects of Exposure to Environmental Tobacco Smoke. Smoking and Tobacco Control Monograph 10

Aug. 1999; 470 pp.; In English

Report No.(s): PB2004-106290; No Copyright; Avail: CASI; A20, Hardcopy

Exposure to environmental tobacco smoke (ETS) has been linked to a variety of adverse health outcomes. Many Californians are exposed at home, at work, and in public places. In the comprehensive reviews published as Reports of the Surgeon General and by the U.S. Environmental Protection Agency (U.S. EPA) and the National Research Council (NRC), ETS exposure has been found to be causally associated with respiratory illnesses -including lung cancer, childhood asthma, and lower respiratory tract infections. Scientific knowledge about ETS-related effects has expanded considerably since the release of the above-mentioned reviews. The state of California has therefore undertaken a broad review of ETS covering the major health endpoints potentially associated with ETS exposure: perinatal and postnatal manifestations of developmental toxicity, adverse impacts on male and female reproduction, respiratory disease, cancer, and cardiovascular disease. A 'weight of evidence' approach has been used, in which the body of evidence is examined to determine whether or not it can be concluded that ETS exposure is causally associated with a particular effect. Because the epidemiological data are extensive, they serve as the primary basis for assessment of ETS-related effects in humans. The report also presents an overview on measurements of ETS exposure (particularly as they relate to characterizations of exposure in epidemiological investigations) and on the prevalence of ETS exposure in California and nationally.

NTIS

Tobacco; Smoke; Environment Protection

20040082635 Civil Aeromedical Inst., Oklahoma City, OK

What Aircrews Should Know About Their Occupational Exposure to Ionizing Radiation

Friedberg, Wallace; Copeland, Kyle; Oct. 2003; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423589; DOT/FAA/AM-03/16; No Copyright; Avail: CASI; A03, Hardcopy

Aircrews are occupationally exposed to ionizing radiation, principally from galactic cosmic radiation. A main source of galactic cosmic radiation is believed to be supernovae. On infrequent occasions, the sun contributes to the ionizing radiation received during air travel. Ionizing radiation consists of subatomic particles that, on interacting with an atom, can cause the atom to lose one or more orbital electrons or even break apart its nucleus. Such events occurring in body tissues may lead to health problems. For aircrews, and their children irradiated in utero, the principal health concern is a small increase in the lifetime risk of fatal cancer. For both of these groups exposure to ionizing radiation also leads to a risk of genetic defects in

future generations. The FAA recommends limits for aircrews in their occupational exposure to ionizing radiation and provides computer software for estimating the amount of galactic cosmic radiation received on a flight.
DTIC
Flight Crews; Ionizing Radiation; Radiation Dosage

20040083030 Army War Coll., Carlisle Barracks, PA
International Environmental Security: The Regional Dimension
Bradshaw, Arthur L., Jr; Jan. 1998; 96 pp.; In English
Report No.(s): AD-A423861; No Copyright; Avail: CASI; A05, Hardcopy

As we prepare for the new opportunities and unique challenges of the 21st Century, we recognize that the USA must work closer with the global community of nations to find better, more efficient and cost effective ways to reduce the potential for instability and conflict. Under the leadership of the Vice President, the USA has begun to explore ways of using environmental issues to promote regional cooperation and enhance global security. In this spirit, the Center for Strategic Leadership of the USA Army War College hosted the fifth in a series of Environmental Security seminars, games, and conferences. The purpose of this executive seminar was to further the international community's understanding of environmental security, promote the Department of State's Environmental Hub concept, and provide federal agencies and CINCs with regional perspectives on how the USA could use the environment to promote regional security. Several insights were reinforced and validated during the seminar. First, it was affirmed that environmental issues could be used to promote regional confidence-building measures and create opportunities for better communication and closer cooperation between states that might otherwise become antagonists. Environmental Security portends a viable new option for U.S. preventive diplomacy and regional CINC engagement strategies to ″shape the international environment.″ A most important message was the need for successful U.S. policy to reflect the issue of national sovereignty. The USA must be aware of and sensitive to other nations' perceptions, interests, and culture. Public education will play an important role in most of the opportunities for environmental cooperation, and will be critical in forging the trust and communication necessary to achieve the desired results and an enduring success.
DTIC
Disasters; Earth Resources; Environment Management; Foreign Policy; Stability; United States

20040083975 United Space Alliance, USA
Design for the Environment
Harm, Eugene; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 15 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The triple bottom line for design for the environment are: Ecological Integrity Consume less energy Avoid persistent, toxic, bio-accumulative compounds. Societal Responsibility Educate employees, customers, suppliers, etc. Economic Viability Assure continuity of critical production inputs Develop products and services with enduring value.
CASI
Economics; Environment Management

20040083986 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA's Principal Center for Review of Clean Air Act Regulations
Clark-Ingram, Marceia; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 21 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Marshall Space Flight Center (MSFC) was selected as the Principal Center for review of Clean Air Act (CAA) regulations. The CAA Principal Center is tasked to: 1) Provide centralized support to NASA/HDQ Code JE for the management and leadership of NASA's CAA regulation review process; 2) Identify potential impact from proposed CAA regulations to NASA program hardware and supporting facilities. The Shuttle Environmental Assurance Initiative, one of the responsibilities of the NASA CAA Working Group (WG), is described in part of this viewgraph presentation.
Derived from text
NASA Programs; Regulations; Air Quality

20040084005 Dnipropetrovsk National Univ., Dnipropetrovsk, Ukraine
Urban Plant Potentiality for VOC Detoxification
Patalakh, Irene I.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Plant components of artificial ecosystems may be an effective barrier for volatile organic compound (VOC) contaminants during their migration in soil, subsoil water, and partial emission in atmosphere. Most plants are able to filtrate hydrophobic compounds from the environment; the problem is in surviving and normal functioning of such green filters. Detailed investigations to obtain complex estimations of plant states and their amortization possibilities should include these next steps: the determination of the normal state of plant population throughout the natural variance of the state parameters; the elucidation of the threshold and critical values for VOC contamination; calculation of toxic loading maximum for every plant species. A certain integral parameter for the estimation of the leaves affection intensity by VOC (index of leaves injury) has been tested as the plant organism reaction both for air pollution and soil contamination simultaneously. Such index we found has a certain correlation with total resistance of the species, but we determined that resistant plants are not such beautiful accumulators of hydrocarbon as a rule. Obviously, it is necessary to determinate phytoaccumulative properties corresponding to intensity of some climatic factors (light intensity, air and soil humidity and temperature). We received some preliminary results concerning plant ability to absorb and partially transform VOC from air and soil. These results we are using to measure the cleaning-up efficiency of plants for non-dangerous hydrocarbon (HC) doses. Some practical approaches are elaborated by our scientific group for the phytoremediation of VOC: (1) For the estimation of VOC uptake in plant organs, it is necessary to distinguish between exogenous and endogenous VOC origin. Emission rates of light HC from some crops are in the range of some 10 nanograms/gram dry weight per hour, whereas anthropogenic VOC uptake varies between some hundred ppm and ppb. (2) Harmless accumulation of HC by leaves depends on the way of drawing xenobiotic in metabolism. This process can be realized either through breaking of aromatic rings and final oxidation to some organic acids (OA) or through spontaneous metabolic transformation into some aromatic amino acids (AA). The first way is harmful; the second one is not dangerous for plants. (3) Predominance of the OA or AA pathway depends considerably on ambient conditions (mainly on air temperature and humidity). Some practical approaches are elaborated by our scientific group on such theoretical bases.
Author
Ecosystems; Volatile Organic Compounds; Contaminants; Soil Pollution

20040084007 Boeing Co., Vandenberg AFB, CA, USA
Wastewater Recycling at Space Launch Complex 6
Cardinal, Rhonda; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Wastewater at a launch site is typically generated through four different processes. Acoustic-suppression water has traditionally been used to dampen the effect of launch-induced sound waves on the vehicle and payload. Wash-down water after a launch involving solid rocket motors also is needed to remove corrosive particles from the launch pad and surrounding areas. Fire-suppression water is used to put out fires or cool surrounding areas. Additionally, rainwater accumulates in open containment pits. The Space Shuttle installation at Space Launch Complex 6 (SLC-6) used approximately 400,000 gal of acoustic-suppression water per launch, released in about 30 sec. The installation at Vandenberg Air Force Base, California, included an elevated water storage tank, pumps and piping to carry water from the flame ducts to a wastewater treatment area, and pumps and piping to carry treated water back up a hill to refill the storage tank. As part of the USA Air Force s Pollution Prevention program, a modular, portable wastewater treatment unit was developed. The unit polishes post-launch wash-down water mixed with acoustic-suppression water from the NASA Delta II launch site and recycles it back to a storage tank. This water is mildly contaminated and is not considered to be hazardous waste; however, it is too contaminated to be released to grade.
Derived from text
Waste Water; Recycling; Hazardous Wastes; Launching Sites

20040084020 Versar, Inc., Enon, OH, USA
Non-ODC Aircraft Oxygen Line Cleaning System
Herrington, John; Caldwell, Terence A.; Gore, Jerry L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Tinker Air Force Base, OK, in conjunction with the Environmental Security Technology Certification Program (ESTCP) and the Joint Group on Pollution Prevention (JG-PP) coordinated efforts with Versar Inc., in regard to pollution prevention issues identified during a defense system s acquisition process. The primary objectives of this task were to reduce or eliminate the use of CFC-113, a Hazardous Material (HazMat), and to avoid duplication of efforts in action required to reduce or eliminate HazMats through joint service cooperation and technology sharing. The Scope of work was to design, develop and construct a prototype oxygen line cleaning system (POLCS), and cleaning process, to precision-clean the critical life support

oxygen distribution system for the Air Force B-1B weapon system (and other aerospace vehicles) while all equipment and tubing remains installed onboard the aircraft. The POLCS design will provide the Air Force with a suitable and applicable fluid system that will meet or exceed special operation and cleanliness requirements in accordance with Government and non-Government documents for maintaining on-board aerospace vehicle oxygen tubing. This effort also included testing, troubleshooting and the validation of a selected solvent solution on various aerospace vehicles using the POLCS. Laboratory testing began in October 1999; field-testing was conducted during fall 2001.
Author
Cleaning; Hazardous Materials; Maintenance; Pollution Control

20040084024 Puget Sound Clean Air Agency, Seattle, WA, USA
The Puget Sound Clean Air Agency Aerospace NESHAP Inspection Program: Lessons Learned
Schantz, John; Hess, Rick; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 3 pp.; In English; See also 20040083973; No Copyright; Avail: CASI; A01, Hardcopy

The Federal Clean Air Act, under section 112, requires EPA to evaluate and control the emissions of Hazardous Air Pollutants (HAP) by source category. Aerospace manufacturing and rework facilities having the potential to emit at major source HAP thresholds are subject to Maximum Achievable Control Technology (MACT)- based standards regulated under the National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR Part 63 subpart GG, effective September 1, 1998. For the aerospace industry, the MACT standards require affected facilities to reduce HAP emissions from solvents and other materials used in four types of aerospace operations: cleaning, primer and topcoat application, paint removal and the application of chemical milling maskants. This rule also has standards for work practices and requires extensive monitoring, record-keeping, and self-reporting for certifying compliance. Furthermore, some processes and control requirements are exempt from the rule. There are nine facilities subject to the Aerospace NESHAP (ANESHAP) spread across the central Puget Sound region. They are, by definition, also subject to the Title V air operating permit regulation. As the September 1, 1998 implementation date for the Aerospace NESHAP approached, the Agency organized what was dubbed the Aerospace Team. Currently the Team consists of three inspectors, two engineers, a public educator, two senior staff members, and an administrative support person. The team was formed with the goals of establishing a consistent approach to conducting inspections and interpreting and applying the regulations. The team was tasked with focusing on becoming familiar with the ANESHAP and working together to reach consensus on interpreting and enforcing its provisions. It was also expected that this process would involve the team collaborating with the regulated facilities and serving as a resource for them. This, in retrospect, has been one of the most successful outcomes of the aerospace team.
Derived from text
Air Pollution; Air Quality; Environment Management; Management Systems

20040084027 International Trade Bridge, Inc., Beavercreek, OH, USA
NASA AP2 Integrated Technology Database
Crawford, David; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA Acquisition Pollution Prevention (AP2) Office has developed a management tool used to identify common pollution prevention (P2) technology needs/opportunities and potential solutions. This database, called the NASA AP2 Integrated Technology Database will be used to integrate P2 needs with known technologies and/or solutions. One of the key features of this tool is the ability to use the combination of process and hazardous material to search and compare other P2 technology needs identified by the Army, Air Force, and Navy, as well as the Strategic Environmental Research and Development Program (SERDP), the Environmental Security Technology Certification Program (ESTCP), and the National Laboratories. This unique capability provides a means to check for duplication of effort, enhances technology transfer, and provides for potential leveraging of resources through joint efforts in funding solutions or RDT&E. The database also acts as a repository for information such as success stories and potential solutions and a ranking algorithm that will score the need/opportunity based on potential cost impact, ESOH risks, pervasiveness, and compliance burden. This management tool is becoming recognized for its potential to integrate all NASA P2 Technology needs and opportunities into one central data warehouse. The management tool will aid in identification, documentation, and then justification for expending resources to either solve or mitigate the need/opportunity.
Author
Data Bases; Pollution Control; Technology Transfer; NASA Programs

20040084060 Massachusetts Univ., Lowell, MA, USA
Protecting the Global Environment: The Role of Industrial Process Engineers
Leblanc, Carole; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

What is an industrial process engineer? Some definitions from the internet suggest that responsibilities include: 1) Selecting materials and processes used to manufacture products; 2) Developing technology to enhance the production process; 3) Safety engineering; and 4) Developing, installing and maintaining cost-effective methods of manufacturing as well as fair and equitable manufacturing operating standards in a safe environment. The industrial process engineer is a key player in creating demand for the materials consumed by industry and ultimately for their use, disposal, and release to the environment. Some of these materials create local or regional pollution problems, while others create little if any local notice but collectively result in significant global impact. The environmental impact of the collective weight of globally common industrial processes have resulted in global responses in the form of three treaties negotiated under the United Nations. They are Montreal Protocol on Substances that Deplete the Ozone Layer, the Kyoto Protocol on Global Climate Change, and the Basel Convention on Transboundary Shipment of Hazardous Waste. This presentation will provide an overview of these three treaties, describe how they affect industrial process engineers, and how they can impact companies and industries that are not aware of them.
Author
Process Control (Industry); Engineering; Manufacturing; Earth Environment

20040084088 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ozone Measurements and a 3D Chemical Transport Model
Stolarski, Richard S.; Douglass, Anne R.; Frith, Stacey; Steenrod, Steven; Polansky, Brian; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

We have used our three-dimensional chemical transport model (CTM) to calculate the expected reponse of stratospheric composition over the past 30 years to forcing by chlorine and bromine compounds, solar ultraviolet, and volcanic aerosols. The CTM uses off-line winds and temperatures fiom a 50-year run of the finite volume general circulation model (FVGCM). We compare the total column ozone and the ozone profile fiom the CTM output to a variety of data sources. These include a merged total ozone data set from TOMS and SBUV using the new version 8 algorithm. Total ozone fiom the CTM are compared to ground-station measurements of total ozone at specific locations. Ozone profiles are compared to satellite meausrements fiom SBUV, SAGE, and HALOE. Profiles are also compared to ozonesondes over several locations. The results of the comparisons are quantified by using a time-series statistical analysis to determine trends, solar cycle, and volcanic reponse in both the model and in the data. Initial results indicate that the model responds to forcings in a way that is similar to the observed atmospheric response. The model does seem to be more sensitive to the chlorine and bromine perturbation ihan is the data. Further details and comparisons wiii be discussed.
Author
Ozone; Three Dimensional Models; Transport Theory; Reaction Kinetics

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20040082073 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The IGS Global Data Center at the CDDIS: An Update
Noll, Carey; Dube, Maurice; [2004]; 1 pp.; In English; IGS Workshop 2004 and Governing Board Meeting, 29 Feb. - 5 Mar. 2004, Berne, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

The Crustal Dynamics Data Information System (CDDIS) has served as a global data center for the International GPS Service (IGS) since its start in June 1992, providing on-line access to data from nearly 300 sites on a daily basis. The CDDIS provides easy and ready access to a variety of data sets, products, and information about these data. The specialized nature of the CDDIS lends itself well to enhancement and thus can accommodate diverse data sets and user requirements. This poster paper will present information about the GPS and GLONASS data and products archive at the CDDIS. General information

about the system, the computer architecture, archive contents, and future plans, and its support of other international space geodesy services (the ILRS, IVS, and IDS) will be discussed.
Author
Earth Crust; Geodynamics; Global Positioning System; Information Systems; Data Acquisition

20040082081 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Oscillations
Duvall, Thomas; [2004]; 1 pp.; In English; APS Meeting, 2-4 May 2004, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Oscillations were first detected in the solar photosphere in 1962 by Leighton and students. In 1970 it was calculated that these oscillations, with a period near five minutes, were the manifestations of acoustic waves trapped in the interior. The subsequent measurements of the frequencies of global oscillation modes from the spatio-temporal power spectrum of the waves made possible the refinement of solar interior models. Over the years, increased understanding of the nuclear reaction rates, the opacity, the equation of state, convection, and gravitational settling have resulted. Mass flows shift the frequencies of modes leading to very accurate measurements of the interior rotation as a function of radius and latitude. In recent years, analogues of terrestrial seismology have led to a tomography of the interior, including measurements of global north-south flows and flow and wave speed measurements below features such as sunspots. The future of helioseismology seems bright with the approval of NASA's Solar Dynamics Observatory mission, to be launched in 2008.
Derived from text
Solar Oscillations; Helioseismology; Reaction Kinetics; Flow Measurement

20040082135 NASA Goddard Space Flight Center, Greenbelt, MD, USA
ICESat Laser Altimeter Pointing, Ranging and Timing Calibration from Integrated Residual Analysis: A Summary of Early Mission Results
Lutchke, Scott B.; Rowlands, David D.; Harding, David J.; Bufton, Jack L.; Carabajal, Claudia C.; Williams, Teresa A.; 2003; 11 pp.; In English; NASA/GSFC Flight Mechanics Symposium Conference Proceedings, October 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

On January 12, 2003 the Ice, Cloud and land Elevation Satellite (ICESat) was successfUlly placed into orbit. The ICESat mission carries the Geoscience Laser Altimeter System (GLAS), which consists of three near-infrared lasers that operate at 40 short pulses per second. The instrument has collected precise elevation measurements of the ice sheets, sea ice roughness and thickness, ocean and land surface elevations and surface reflectivity. The accurate geolocation of GLAS's surface returns, the spots from which the laser energy reflects on the Earth's surface, is a critical issue in the scientific application of these data Pointing, ranging, timing and orbit errors must be compensated to accurately geolocate the laser altimeter surface returns. Towards this end, the laser range observations can be fully exploited in an integrated residual analysis to accurately calibrate these geolocation/instrument parameters. Early mission ICESat data have been simultaneously processed as direct altimetry from ocean sweeps along with dynamic crossovers resulting in a preliminary calibration of laser pointing, ranging and timing. The calibration methodology and early mission analysis results are summarized in this paper along with future calibration activities
Derived from text
Ice, Cloud and Land Elevation Satellite; Laser Altimeters; Calibrating; Geophysics; Earth Observing System (Eos); Geology

20040082166 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On Physical Interpretation of the In-Site Measurement of Earth Rotation by Ring Laser Gyrometers
Chao, B. F.; 2004; 1 pp.; In English; FGS-Workshop 2004, 24-26 Mar. 2004, Wettzell, Germany; No Copyright; Avail: Other Sources; Abstract Only

Large ring laser gyrometers under development have demonstrated the capability of detecting minute ground motions and deformations on a wide range of timescales. The next challenge and goal is to measure the Earth's rotation variations to a precision that rivals that of the present space-geodesy techniques, thus providing an in-situ (and cost effective alternatives of Earth rotation measurement for geophysical research and geodetic applications. Aside from thermal and mechanical instabilities, ″undesirable″ ground motion and tilt that appear in the signal will need to be removed before any variation in Earth rotation can be detected. Removal of these signals, some of them are larger than the sought rotation signals, has been a typical procedure in many precise geophysical instruments, such as gravimeters, seismometers, and tiltmeters. The remaining Earth rotation signal resides in both the spin around the axis and in the orientation of the axis. In the case of the latter, the

in-situ measurement is complementary to the space-geodetic observables in terms of polar motion and nutation, a fact to be exploited.
Author
Earth Rotation; Ring Lasers; Earth Movements; Geophysics; Geodesy; Gravimeters; In Situ Measurement

20040082298 NASA Marshall Space Flight Center, Huntsville, AL, USA
Quiet-Region Filament Eruptions
Choudhary, Debi Prasad; Moore, Ronald L.; [2004]; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

We report characteristics of quiescent filament eruptions that did not produce coronal mass ejections (CMEs). It is known that there is a dichotomy of quiescent filament eruptions: those that produce CMEs and those that do not. We examined the quiescent filament eruptions, each of which was located far from disk center (greater than or equal to 0.7 R(sub Sun)) in diffuse remnant magnetic fields of decayed active regions, was well observed in Ha observations and Fe XII, and had good coronagraph coverage. We present the similarity and differences of two classes of filament eruptions. From their lack of CME production and the appearance of their eruptive motion in Fe XII movies, we conclude that the non-CME-producing filament eruptions are confined eruptions like the confined filament eruptions in active regions. We take the similarity of the confined and eruptive quiescent filament eruptions with their active-region counterparts to favor runaway tether-cutting connection for unleashing the magnetic explosion in all these eruptions.
Author
Coronal Mass Ejection; Dichotomies; Solar Prominences; Geophysics

20040082322 NASA Marshall Space Flight Center, Huntsville, AL, USA
Crystal Quality, the Long and the Short of It
Snell, Eddie H.; [2004]; 1 pp.; In English; International Conference on the Crystallization of Biological Macromolecules 10, 5-9 Jun. 2004, Beijing, China; No Copyright; Avail: Other Sources; Abstract Only

The term ″crystal quality″ is ambiguous and implies different meanings to different crystallographers. For the physical crystallographer who aims to understand long-range aspects of crystal growth mosaicity is one of the leading measures of perfection. For the structural crystallographer and those seeking to understand growth at a short-range, molecular level, the detail in the resulting structure is a key goal. Different quality measures have been developed due to different needs. Each of the measures has advantages and each has limitations. In this talk a sample of these measures will be discussed with particular emphasis applied to their application in the analysis of microgravity grown crystals. The advantages and limitations of each will be discussed. Ultimately, the choice of crystal quality measurement lies in the nature of the question asked. It is ~scfill to remember that beauty is often in the eye of the beholder.
Author
Crystal Growth; Crystals; Microgravity

20040082342 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Possibilities of Predicting Geomagnetic Secular Variation with Geodynamo Modeling
Kuang, Wei-Jia; Tangborn, Andrew; Sabaka, Terrance; [2004]; 11 pp.; In English
Contract(s)/Grant(s): NSF EAR-00-79998; NSF EAR 03-27875; Copyright; Avail: CASI; A03, Hardcopy

We use our MoSST core dynamics model and geomagnetic field at the core-mantle boundary (CMB) continued downward from surface observations to investigate possibilities of geomagnetic data assimilation, so that model results and current geomagnetic observations can be used to predict geomagnetic secular variation in future. As the first attempt, we apply data insertion technique to examine evolution of the model solution that is modified by geomagnetic input. Our study demonstrate that, with a single data insertion, large-scale poloidal magnetic field obtained from subsequent numerical simulation evolves similarly to the observed geomagnetic variation, regardless of the initial choice of the model solution (so long it is a well developed numerical solution). The model solution diverges on the time scales on the order of 60 years, similar to the time scales of the torsional oscillations in the Earth's core. Our numerical test shows that geomagnetic data assimilation is promising with our MoSST model.
Author
Geomagnetism; Magnetic Variations; Secular Variations; Core-Mantle Boundary; Dynamo Theory; Computerized Simulation

20040082716 Air Force Research Lab., Hanscom AFB, MA
Real-Time Specifications of the Geospace Environment
Kamide, Y.; Kihn, E. A.; Ridley, A. J.; Cliver, E. W.; Kadowaki, Y.; Jan. 2003; 11 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423773; AFRL-VS-HA-TR-2004-1117; No Copyright; Avail: CASI; A03, Hardcopy

We report the recent progress in our joint program of real-time mapping of ionospheric electric fields and currents and field-aligned currents through the Geospace Environment Data Analysis System (GEDAS) at the Solar- Terrestrial Environment Laboratory and similar computer systems in the world. Data from individual ground magnetometers as well as from the solar wind are collected by these systems and are used as input for the KRM and AMIE magnetogram-inversion algorithms, which calculate the twodimensional distribution of the ionospheric paranaeters. One of the goals of this program is to specify the solar- terrestrial environment in terms of ionospheric processes, providing the scientific community with more than what geomagnetic activity indices and statistical models provide.
DTIC
Electric Fields; Real Time Operation

20040082730 Army Engineer Research and Development Center, Vicksburg, MS
Application of an Ecological Model for the Cibolo Creek Watershed
Price, David; McLendon, Terry; Coldren, Cade; Apr. 2004; 7 pp.; In English
Report No.(s): AD-A423809; ERDC WQTN-CS-04; No Copyright; Avail: CASI; A02, Hardcopy

The U.S. Army Engineer District, Fort Worth (CESWF) is involved in demon-strating the utility of an ecological model in the performance and interpretation of a comprehensive General Investigations (GI) study of the Cibolo Creek watershed upstream of Interstate 10 near San Antonio, Texas. Partners to the District in this project are the Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), and U.S. Fish and Wildlife Service (USFW). Project sponsors are the Guadalupe-Blanco River Authority (GBRA) , San Antonio River Authority (SARA), and San Antonio Water System (SAWS). CESWF requested assistance from the U.S. Army Engineer Research and Development Center (ERDC) in conducting this study. The first phase of the study was to establish existing conditions of the hydrologic, engineering, economic, and environmental aspects of the study area, and to demonstrate watershed modeling tools. The second phase will evaluate a recharge/dry detention structure to identify the relative magnitude of the structure's flood damage reduction and aquifer recharge benefits. The third phase will formulate and screen alternatives to meet national and local plans regarding detention structures, restoration of aquatic habitats and hydrology, reforested riparian and wetland buffer zones, creation of emergent wetlands, brush management techniques, watershed policies dealing with urban/suburban growth, and nonstructural flood damage reduction. During the first phase, researchers at ERDC set up and demonstrated the ecological model. Implementation of the second phase is dependent on evaluation of the first phase by the sponsors.
DTIC
Earth Resources; Ecology; Geological Surveys; Watersheds

20040082748 Air Force Research Lab., Hanscom AFB, MA
Evaluation of the Dynamic Cutoff Rigidity Model Using Dosimetry Data From the STS-28 Flight
Smart, D. F.; Shea, M. A.; Golightly, M. J.; Weyland, M.; Johnson, A. S.; Jan. 2003; 7 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423844; AFRL-VS-HA-TR-2004-1119; No Copyright; Avail: CASI; A02, Hardcopy

We have a developed a dynamic cutoff rigidity model based on computed world grids of vertical cutoff rigidities derived from employing the Tsyganenko magnetospheric model. The dynamic range of this model covers all magnetic activity levels specified by integer values of the Kp magnetic index. We present comparisons of the measured dose observed on the space shuttle during the August 1989 solar proton event with the dose computed from solar particles predicted to be allowed through the magnetosphere to the space shuttle position. We find a one-to-one correspondence between the portion of the orbit predicted to be subjected to solar protons and the portion of the orbit where solar particle dose measurements were obtained.
DTIC
Dosimeters; Dynamic Models; Magnetic Fields; Solar Cosmic Rays; Space Transportation System

20040084106 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Aerosol Profiling by Orbital Lidar, GLAS Results and Validation
Spinhirne, J. D.; Palm, S. P.; Hlavka, D. L.; Hart, W. D.; Mahesh, A.; Welton, E. J.; [2004]; 1 pp.; In English; Aeronet/Photon Workshop, 10-14 May 2004, Huelva, Spain; No Copyright; Avail: Other Sources; Abstract Only

The Geoscience Laser Altimeter System (GLAS) launched in 2003 is the first polar orbiting satellite lidar. The instrument was designed for high performance observations of the distribution and optical scattering cross sections of clouds and aerosol. GLAS is approaching six months of on orbit data operation. These data from thousands of orbits illustrate the ability of space lidar to accurately and dramatically measure the height distribution of global aerosol to an unprecedented degree. There were many intended science applications of the GLAS data and significant results have already been realized, profiling is a fundamentally new measurement from space with multiple applications. A most important aerosol application is providing input to global aerosol generation transport models. Another is improved measurement of aerosol optical depth. A main approach to verify the aerosol optical depth retrieval is comparison to surface measurements by Aeronet. A special feature of the GLAS satellite bus is to rapidly point the lidar instrument at off nadir targets with less than 100 m accuracy. About a dozen selected Aeronet sites were pointed at whenever the GLAS lidar came within 5 degrees of zenith. These plus a more general comparison to nearby sites support the GLAS data product values. In addition the GLAS data can be used to add vertical distribution information to Aeronet aerosol measurements. As an EOS project instrument, GLAS data products are openly available to the science community. First year results from GLAS are summarized.
Author
Geophysics; Laser Altimeters; Optical Radar; Aerosols; Polar Orbits

20040084139 Elizabeth City State Univ., NC, USA
Effect of Microgravity on Mammalian Lymphocytes
Banerjee, H.; Blackshear, M.; Mahaffey, K.; Knight, C.; Khan, A. A.; Delucas, L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 51-52; In English; See also 20040084137
Contract(s)/Grant(s): NAG5-1254; NSF DTD-42501; No Copyright; Avail: CASI; A01, Hardcopy

The effect of microgravity on mammalian system is an important and interesting topic for scientific investigation, since NASA s objective is to send manned flights to planets like Mars and eventual human colonization.The Astronauts will be exposed to microgravity environment for a long duration of time during these flights.Our objective of research is to conduct in vitro studies for the effect of microgravity on mammalian immune system.We did our preliminary investigations by exposing mammalian lymphocytes to a microgravity simulator cell bioreactor designed by NASA and manufactured at Synthecon Inc (USA).Our initial results showed no significant change in cytokine expression in these cells for a time period of forty eight hours exposure.Our future experiments will involve exposure for a longer period of time.
Author
Mammals; Microgravity; Gravitational Effects; In Vitro Methods and Tests; Lymphocytes

20040084164 NASA Glenn Research Center, Cleveland, OH, USA
Transition from Ignition to Flame Growth under External Radiation in Three Dimensions (TIGER-3D)
Kashiwagi, Takashi; Nakamura, Yuji; Olson, Sandra L.; Mell, William; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 91; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This study focuses on localized ignition by external radiant flux and subsequent flame growth over thin polymeric materials (plastic and paper) in microgravity. Two transition stages were observed. The first transition stage covers the period from the onset of ignition to the formation of stabilized flame near the ignited area. This is followed by the second transition of the flame growth stage from the initial stabilized flame to sustained fire growth away from the ignited area. For the first stage, ignition experiments of thin PMMA sheets were conducted using a CO2 laser as an external source in the 10 s drop tower. The results of front side surface ignition and of backside surface ignition were observed. The effects of imposed flow velocity, sample thickness, and ambient oxygen concentration on ignition are obtained. Numerical study was conducted to investigate to understand and predict ignition behavior observed in the experiments. For the second stage, numerical study is being conducted to describe the effects of gravity on heat release rate of a PMMA sheet. The gravity level was varied from zero to normal gravity. The preliminary results show that the maximum heat release occurs at around 0.02 g.
Author
Flame Propagation; Microgravity; Ignition; Flames; Gravitational Effects; Heat Transfer

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040081336 Chemonics International, Inc., Washington, DC, USA
Cyclone Recovery Program. Final Report Tranche II from January 2001 to December 2002
Dec. 2002; In English
Report No.(s): PB2004-106072; PD-ABZ-095; No Copyright; Avail: National Technical Information Service (NTIS)

This is the final report of activities implemented under the Cyclone Recovery Program (Tranche II), covering the period from January 2001 through December 2002. The Cyclone Recovery Program (CRP) has reached all targets and in some cases has achieved results beyond contractual indicators. The CRP moved ahead rapidly, according to schedule, and has generated strong impacts in both regions. Three specific features of this program deserve to be emphasized, because they are the main factors behind the successful implementation of the CRP: First, we were able to initiate our work swiftly and efficiently, since Landscape Development Interventions (LDI) teams were already in the field and had identified rural infrastructures severely damaged by cyclones Eline and Gloria in our zones of intervention. Second, we have decided to rehabilitate irrigation systems whose costs are quite low, around $150/ha, so that we can meet our targets and maximize the impact of cyclone funds. Finally, the CRP has created remarkable opportunities for productive synergies with LDI regular activities.
NTIS
Cyclones; Irrigation; Terrain

20040081366 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Alternative Approaches to Land Initialization for Seasonal Precipitation and Temperature Forecasts
Koster, Randal; Suarez, Max; Liu, Ping; Jambor, Urszula; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The seasonal prediction system of the NASA Global Modeling and Assimilation Office is used to generate ensembles of summer forecasts utilizing realistic soil moisture initialization. To derive the realistic land states, we drive offline the system's land model with realistic meteorological forcing over the period 1979-1993 (in cooperation with the Global Land Data Assimilation System project at GSFC) and then extract the state variables' values on the chosen forecast start dates. A parallel series of forecast ensembles is performed with a random (though climatologically consistent) set of land initial conditions; by comparing the two sets of ensembles, we can isolate the impact of land initialization on forecast skill from that of the imposed SSTs. The base initialization experiment is supplemented with several forecast ensembles that use alternative initialization techniques. One ensemble addresses the impact of minimizing climate drift in the system through the scaling of the initial conditions, and another is designed to isolate the importance of the precipitation signal from that of all other signals in the antecedent offline forcing. A third ensemble includes a more realistic initialization of the atmosphere along with the land initialization. The impact of each variation on forecast skill is quantified.
Author
Weather Forecasting; Land Management; Precipitation (Meteorology); Atmospheric Temperature; Seasons

20040081404 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Exploring New Pathways in Precipitation Assimilation
Hou, Arthur; Zhang, Sara Q.; 2004; 1 pp.; In English; Symposium on the 50th Anniversary of Operational Numerical Weather Prediction, 14-17 Jun. 2004, College Park, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

Precipitation assimilation poses a special challenge in that the forward model for rain in a global forecast system is based on parameterized physics, which can have large systematic errors that must be rectified to use precipitation data effectively within a standard statistical analysis framework. We examine some key issues in precipitation assimilation and describe several exploratory studies in assimilating rainfall and latent heating information in NASA's global data assimilation systems using the forecast model as a weak constraint. We present results from two research activities. The first is the assimilation of surface rainfall data using a time-continuous variational assimilation based on a column model of the full moist physics. The second is the assimilation of convective and stratiform latent heating retrievals from microwave sensors using a variational technique with physical parameters in the moist physics schemes as a control variable. We will show the impact of assimilating these data on analyses and forecasts. Among the lessons learned are (1) that the time-continuous application of moisture/temperature tendency corrections to mitigate model deficiencies offers an effective strategy for assimilating precipitation information, and (2) that the model prognostic variables must be allowed to directly respond to an improved rain

and latent heating field within an analysis cycle to reap the full benefit of assimilating precipitation information. of microwave radiances versus retrieval information in raining areas, and initial efforts in developing ensemble techniques such as Kalman filter/smoother for precipitation assimilation. Looking to the future, we discuss new research directions including the assimilation

Author

Assimilation; Precipitation (Meteorology); Weather Forecasting; Atmospheric Models

20040081405 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Meridional Propagation of the MJO/ISO and Prediction of Off-equatorial Monsoon Variability

Wu, Man Li C.; Schubert, S.; Suarez, M.; Pegion, P.; Bacmeister, J.; Waliser, D.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In this study we examine the links between tropical heating, the Madden Julian Oscillation (MJO)/Intraseasonal Oscillation (ISO), and the off-equatorial monsoon development. We examine both observations and idealized ″MJO heating″ experiments employing the NASA Seasonal-Interannual Prediction Project (NSIPP) atmospheric general circulation model (AGCM). In the simulations, the model is forced by climatological SST and an idealized eastward propagating heating profile that is meant to mimic the canonical heating associated with the MJO in the Indian Ocean and western Pacific. The observational analysis highlights the strong link between the Indian summer monsoon and the tropical ISO/MJO activity and heating. Here we focus on the potential for skillful predictions of the monsoon on subseasonal time scales associated with the meridional propagation of the ISOMJO. In particular, we show that the variability of the Indian summer monsoon lags behind the variability of tropical ISOMJO heating by about 15 days when the tropical heating is around 60E and 90E. This feature of the ISOMJO is reproduced in the AGCM experiments with the idealized eastward propagating MJO-like heating, suggesting that models with realistic ISOM0 variability should provide useful skill of monsoon breaks and surges on subseasonal time scales.

Derived from text

Oscillations; Heating; Atmospheric General Circulation Models

20040081411 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Common Calibration Source for Monitoring Long-term Ozone Trends

Kowalewski, Matthew; [2004]; 1 pp.; In English; 35th Committee on Space Research Scientific Assembly, 18-25 Jul. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

Accurate long-term satellite measurements are crucial for monitoring the recovery of the ozone layer. The slow pace of the recovery and limited lifetimes of satellite monitoring instruments demands that datasets from multiple observation systems be combined to provide the long-term accuracy needed. A fundamental component of accurately monitoring long-term trends is the calibration of these various instruments. NASA s Radiometric Calibration and Development Facility at the Goddard Space Flight Center has provided resources to minimize calibration biases between multiple instruments through the use of a common calibration source and standardized procedures traceable to national standards. The Facility s 50 cm barium sulfate integrating sphere has been used as a common calibration source for both US and international satellite instruments, including the Total Ozone Mapping Spectrometer (TOMS), Solar Backscatter Ultraviolet 2 (SBUV/2) instruments, Shuttle SBUV (SSBUV), Ozone Mapping Instrument (OMI), Global Ozone Monitoring Experiment (GOME) (ESA), Scanning Imaging SpectroMeter for Atmospheric ChartographY (SCIAMACHY) (ESA), and others. We will discuss the advantages of using a common calibration source and its effects on long-term ozone data sets. In addition, sphere calibration results from various instruments will be presented to demonstrate the accuracy of the long-term characterization of the source itself.

Author

Calibrating; Imaging Spectrometers; Total Ozone Mapping Spectrometer; Ozone; Solar Backscatter UV Spectrometer; Satellite Instruments

20040081417 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Aerosol Absorption in the Atmosphere: Perspectives from Global Model, Ground-Based Measurements, and Field Observations

Chin, Main; Dubovik, Oleg; Holben, Brent; Anderson, Tad; Quinn, Patricia; Duncan, Bryan; Ginoux, Paul; 2004; 1 pp.; In English; AeroCom Workshop, 10-12 Mar. 2004, Ispra, Italy; No Copyright; Avail: Other Sources; Abstract Only

Aerosol absorption in the atmosphere poses a major uncertainty in assessing the aerosol climate effects. This uncertainty arises from the poorly quantified aerosol sources, especially black carbon emissions, and our limited knowledge of aerosol

mixing state and optical properties. Here we use a global model GOCART to simulate atmospheric aerosols, including sulfate, black carbon, organic carbon, dust, and sea salt. We compare the model calculated total aerosol optical thickness, 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. We will examine the most sensitive factors in determining the aerosol absorption, and the consequences of assessing the aerosol radiative forcing and atmospheric heating associated with those factors.
Author
Aerosols; Absorption; Atmospheric Models; Atmospheric Chemistry; Climatology

20040082045 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Discrete Constraint for Entropy Conservation and Sound Waves in Cloud-Resolving Modeling
Zeng, Xi-Ping; Tao, Wei-Kuo; Simpson, Joanne; [15 January 2003]; 36 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Ideal cloud-resolving models contain little-accumulative errors. When their domain is so large that synoptic large-scale circulations are accommodated, they can be used for the simulation of the interaction between convective clouds and the large-scale circulations. This paper sets up a framework for the models, using moist entropy as a prognostic variable and employing conservative numerical schemes. The models possess no accumulative errors of thermodynamic variables when they comply with a discrete constraint on entropy conservation and sound waves. Alternatively speaking, the discrete constraint is related to the correct representation of the large-scale convergence and advection of moist entropy. Since air density is involved in entropy conservation and sound waves, the challenge is how to compute sound waves efficiently under the constraint. To address the challenge, a compensation method is introduced on the basis of a reference isothermal atmosphere whose governing equations are solved analytically. Stability analysis and numerical experiments show that the method allows the models to integrate efficiently with a large time step.
Author
Entropy; Sound Waves; Clouds (Meteorology); Conservation; Atmospheric Models; Discretization (Mathematics)

20040082057 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Climatic Analysis of Oceanic Water Vapor Transports Based on Satellite E-P Datasets
Smith, Eric A.; Sohn, Byung-Ju; Mehta, Vikram; [2004]; 2 pp.; In English; NASA-NSF-CRCES-IPRC Workshop, 23-27 Feb. 2004, Kona, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

Understanding the climatically varying properties of water vapor transports from a robust observational perspective is an essential step in calibrating climate models. This is tantamount to measuring year-to-year changes of monthly- or seasonally-averaged, divergent water vapor transport distributions. This cannot be done effectively with conventional radiosonde data over ocean regions where sounding data are generally sparse. This talk describes how a methodology designed to derive atmospheric water vapor transports over the world oceans from satellite-retrieved precipitation (P) and evaporation (E) datasets circumvents the problem of inadequate sampling. Ultimately, the method is intended to take advantage of the relatively complete and consistent coverage, as well as continuity in sampling, associated with E and P datasets obtained from satellite measurements. Independent P and E retrievals from Special Sensor Microwave Imager (SSM/I) measurements, along with P retrievals from Tropical Rainfall Measuring Mission (TRMM) measurements, are used to obtain transports by solving a potential function for the divergence of water vapor transport as balanced by large scale E - P conditions.
Author (revised)
Marine Meteorology; Water Vapor; Climate Models

20040082063 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Hurricane-Flood-Landslide Continuum: Forecasting Hurricane Effects at Landfall
Negri, A.; Golden, J. H.; Updike, R.; [2004]; 2 pp.; In English; AMS 18th Conference on Hydrology, 11-15 Jan. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

Hurricanes, typhoons, and cyclones strike Central American, Caribbean, Southeast Asian and Pacific Island nations even more frequently than the U.S. The global losses of life and property from the floods, landslides and debris flows caused by cyclonic storms are staggering. One of the keys to reducing these losses, both in the U.S. and internationally, is to have better forecasts of what is about to happen from several hours to days before the event. Particularly in developing nations where science, technology and communication are limited, advance-warning systems can have great impact. In developing countries, warnings of even a few hours or days can mitigate or reduce catastrophic losses of life. With the foregoing needs in mind,

we propose an initial project of three years total duration that will aim to develop and transfer a warning system for a prototype region in the Central Caribbean, specifically the islands of Puerto Rico and Hispanola. The Hurricane-Flood-Landslide Continuum will include satellite observations to track and nowcast dangerous levels of precipitation, atmospheric and hydrological models to predict near-future runoff, and streamflow changes in affected regions, and landslide models to warn when and where landslides and debris flows are imminent. Since surface communications are likely to be interrupted during these crises, the project also includes the capability to communicate disaster information via satellite to vital government officials in Puerto Rico, Haiti, and Dominican Republic.
Author
Warning Systems; Hurricanes; Landslides; Floods

20040082067 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Comparisons and Contrasts Between Mediterranean Flood-Producing Orographic Storms and Tropical Cyclones Modified by Complex Orography
Smith, Eric A.; Tripoli, Gregory J.; Lee, Chun-Woo; Mehta, Amita; Mugnai, Alberto; Panegrossi, Giulia; Sohn, Byung-Ju; [2003]; 1 pp.; In English; 5th EGU Plinius Conference, 1-3 Oct. 2003, Ajaccio, Corsica, France; Copyright; Avail: Other Sources; Abstract Only

Often, late-year, flood-producing storms in the Mediterranean Alps region arise from baroclinic disturbances developing on westerly longwaves, with the incipient storm circulations appearing well west of the flood zone. Regardless of the genesis locations and before the storms begin their flow interactions with the orography of the Mediterranean Alps, a process which can produce intense long-lived rainfall over the mountainous terrain of Italy and France, most of their moisture is drawn from warm Mediterranean waters while important elements of their thermodynamic structure are derived from airmass properties originating in north Africa and the Mediterranean basin itself. In fact, because of strong thermodynamic contrasts between the baroclinic zone producing the incipient disturbance and high potential temperature air from the south advecting into and wrapping around the storm center, a Mediterranean storm whose origins are from an evolving shortwave baroclinic perturbation, can become a quasi-warm core hybrid in term of its energetics composition, a process somewhat akin to the development of polar lows. This process begs the question of whether there are similarities between the autumn-winter season flood producing storms of the Mediterranean Alps and warm core tropical cyclones which become altered dynamically and thermodynamically by landfall over steep orographic terrain. This study investigates, from a comparison and contrast perspective, how the similarities and differences between the two types of storms manifest themselves over their respective life cycles. Before the orographically-induced precipitation-release stage in which both types of storm have evolved to the same hydrometeorlogical conclusion, the two storm categories are transforming from entirely distinctive origins, i.e., the classic eastward traveling, baroclinic mid-latitude cyclone forming in western Europe, and the classic eastward-traveling, warm core tropical cyclone developing in the western Pacific. The analyses use high resolution, nonhydrostatic model simulations, satellite data, and various types of ground data to conduct the study. The flood events of Piemonte- 2000 in northern Italy and Typhoon Rusa-2002 in South Korea are selected to focus the analysis on well documented meteorological events.
Author (revised)
Orography; Cyclones; Mediterranean Sea; Floods; Alps Mountains (Europe)

20040082072 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Warm Core Structure of Hurricane Erin Diagnosed from High Altitude Dropsondes during CAMEX-4
Halverson, J. B.; Simpson, J.; Heymsfield, G.; Pierce, H.; Hock, T.; Ritchie, L.; [2003]; 39 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

A combination multi-aircraft and several satellite sensors were used to examine the core of Hurricane Erin on September 10, 2001, as part of the CAMEX4 program. During the first set of aircraft passes, around 1700 UTC, Erin was still at its maximum intensity with a central pressure of 969 hpa and windspeed of 105 kts (54 m/s). The storm was moving slowly northwestward at 4 m/s, over an increasingly colder sea surface. Three instrumented aircraft, the NOAA P3 with radar, the NASA ER- 2 at 19 km, newly equipped with GPS dropwindsondes, and the NASA DC-8 with dropwindsondes flew in formation across the eye at about 1700 UTC and again 2.5 hrs later around 1930 UTC. The storm had weakened by 13 m/s between the first and second eye penetrations. The warm core had a maximum temperature anomaly of only 11 C, located at 500 hpa, much weaker and lower than active hurricanes. The core appeared to slant rearward above 400 hpa. Even on the first penetration, airborne radar showed that the eye wall cloud towers were dying. The tops fell short of reaching 15 km and a melting band was found throughout. The tropopause had a bulge to 15.8 km elevation (environment approx. 14.4 km) above the dying convection. A feature of Erin at this timt was a pronounced wave-number-one convective asymmetry with all

convective activity being confined to the forward quadrants on the left side of the shear vector as calculated from analyses. This is similar to that predicted by the mesoscale numerical models, which also predict that such small amounts of shear would not affect the storm intensity. In Erin, it is remarkable that relatively small shear produced such a pronounced asymmetry in the convection. In addition, horizontal asymmetries in the low-level warm core were identified. Almost certainly, the colder ocean would kill the tall convective towers feeding the warm core, even if wind shear were absent.
Author
Warm Fronts; Hurricanes; Tropopause; Wind Velocity

20040082085 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atmospheric Soundings from AIRS/AMSU/HSB
Susskind, Joel; Atlas, Robert; [2004]; 10 pp.; In English; SPIE Defense and Security Conference, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

AIRS was launched on EOS Aqua on May 4, 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 lK, and 1 km tropospheric layer precipitable water with an rms error of 20%, in cases with up to 80% effective cloud cover. Pre-launch simulation studies indicated that these results should be achievable. Minor modifications have been made to the pre-launch retrieval algorithm as alluded to in this paper. Sample fields of parameters retrieved from AIRS/AMSU/HSB data are presented and temperature profiles are validated as a function of retrieved effective fractional cloud cover. As in simulation, the degradation of retrieval accuracy with increasing cloud cover is small. Select fields are also compared to those contained in the ECMWF analysis, done without the benefit of AIRS data, to demonstrate information that AIRS can add to that already contained in the ECMWF analysis. Assimilation of AIRS temperature soundings in up to 80% cloud cover for the month of January 2003 into the GSFC FVSSI data assimilation system resulted in improved 5 day forecasts globally, both with regard to anomaly correlation coefficients and the prediction of location and intensity of cyclones.
Author
Atmospheric Sounding; Atmospheric Temperature; Water Vapor; Microwave Sounding; Weather Forecasting

20040082087 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Large Scale Water Vapor Sources Relative to the October 2000 Piedmont Flood
Turato, Barbara; Reale, Oreste; Siccardi, Franco; [2003]; 53 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

Very intense mesoscale or synoptic-scale rainfall events can occasionally be observed in the Mediterranean region without any deep cyclone developing over the areas affected by precipitation. In these perplexing cases the synoptic situation can superficially look similar to cases in which very little precipitation occurs. These situations could possibly baffle the operational weather forecasters. In this article, the major precipitation event that affected Piedmont (Italy) between 13 and 16 October 2000 is investigated. This is one of the cases in which no intense cyclone was observed within the Mediterranean region at any time, only a moderate system was present, and yet exceptional rainfall and flooding occurred. The emphasis of this study is on the moisture origin and transport. Moisture and energy balances are computed on different space- and time-scales, revealing that precipitation exceeds evaporation over an area inclusive of Piedmont and the northwestern Mediterranean region, on a time-scale encompassing the event and about two weeks preceding it. This is suggestive of an important moisture contribution originating from outside the region. A synoptic and dynamic analysis is then performed to outline the potential mechanisms that could have contributed to the large-scale moisture transport. The central part of the work uses a quasi-isentropic water-vapor back trajectory technique. The moisture sources obtained by this technique are compared with the results of the balances and with the synoptic situation, to unveil possible dynamic mechanisms and physical processes involved. It is found that moisture sources on a variety of atmospheric scales contribute to this event. First, an important contribution is caused by the extratropical remnants of former tropical storm Leslie. The large-scale environment related to this system allows a significant amount of moisture to be carried towards Europe. This happens on a time- scale of about 5-15 days preceding the Piedmont event. Second, water-vapor intrusions from the African Inter-Tropical Convergence Zone and evaporation from the eastern Atlantic contribute on the 2-5 day time-scale. The large-scale moist dynamics appears therefore to be one important factor enabling a moderate Mediterranean cyclone to produce heavy precipitation. Finally, local evaporation from the Mediterranean, water-vapor recycling, and orographically-induced low-level convergence enhance and concentrate the moisture over the area where heavy precipitation occurs. This happens on a 12-72 hour time-scale.
Author
Water Vapor; Floods; Mesoscale Phenomena; Weather Forecasting; Rain

20040082088 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of SeaWinds Scatterometer and TMI-SSM/I Rain Rates to Hurricane Analysis and Forecasting

Atlas, Robert; Hou, Arthur; Reale, Oreste; April 08, 2004; 23 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Results provided by two different assimilation methodologies involving data from passive and active space-borne microwave instruments are presented. The impact of the precipitation estimates produced by the TRMM Microwave Imager (TMI) and Special Sensor Microwave/Imager (SSM/I) in a previously developed 1D variational continuous assimilation algorithm for assimilating tropical rainfall is shown on two hurricane cases. Results on the impact of the SeaWinds scatterometer on the intensity and track forecast of a mid-Atlantic hurricane are also presented. This work is the outcome of a collaborative effort between NASA and NOAA and indicates the substantial improvement in tropical cyclone forecasting that can result from the assimilation of space-based data in global atmospheric models.

Author

Microwave Imagery; Assimilation; Atmospheric Models; Precipitation (Meteorology); Hurricanes; Weather Forecasting; Satellite-Borne Instruments

20040082089 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Classification of Particle Shapes from Lidar Depolarization Ratios in Convective Ice Clouds Compared to in situ Observations During CRYSTAL-FACE

Noel, Vincent; Winker, David; McGill, Matthew; Lawson, Paul; 2004; 22 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This manuscript describes a method to class@ cirrus cloud ice particle shape using lidar depolarization measurements as a basis for segregating different particle shape regimes. Measurements from the ER-2 Cloud Physics Lidar (CPL) system during CRYSTAL-FACE provide the basis for this work. While the CPL onboard the ER-2 aircraft was providing remote sensing measurements of cirrus clouds, the Cloud Particle Imager (CPI) onboard the WB-57 aircraft was flying inside those same clouds to sample particle sizes. The results of classifying particle shapes using the CPL data are compared to the in situ measurements made using the CPI , and there is found to be good agreement between the particle shape inferred from the CPL data and that actually measured by the CPI. If proven practical, application of this technique to spaceborne observations could lead to large-scale classification of cirrus cloud particle shapes.

Author

Cirrus Clouds; Depolarization; Radar Measurement; In Situ Measurement; Ice; Cloud Physics

20040082091 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Processes Affecting Tropospheric Ozone over Africa

Diab, Roseanne D.; Thompson, Anne M.; [2004]; 7 pp.; In English; Tropospheric Ozone Over Africa, 26-28 Jan. 2004, Durban, South Africa; No Copyright; Avail: CASI; A02, Hardcopy

This is a Workshop Report prepared for Eos, the weekly AGU magazine, The workshop took place between 26-28 January 2004 at the University of KwaZulu-Natal in Durban, South Africa and was attended by 26 participants (http// www.geography.und.ac.za). Considerable progress has been made in ozone observations except for northern Africa (large data gaps) and west Africa (to be covered by the French-sponsored AMMA program). The present-day ozone findings were evaluated and reviewed by speakers using Aircraft data (MOZAIC program), NASA satellites (MOPITT, TRMM, TOMS) and ozone soundings (SHADOZ). Besides some ozone gaps, there are challenges posed by the need to assess the relative strengths of photochemical and dynamic influences on the tropospheric ozone budget. Biogenic, biofuels, biomass burning sources of ozone precursors remain highly uncertain. Recent findings (by NASA's Chatfield and Thompson, using satellite and sounding data) show significant impact of Indian Ocean pollution on African ozone. European research on pollutants over the Mediterranean and the middle east, that suggests that ozone may be exported to Africa from these areas, also needs to be considered.

Author

Africa; Troposphere; Ozone; Biomass Burning

20040082115 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Tropospheric Ozone Climatology over Irene, South Africa, From 1990-1994 and 1998-2002

Diab, R. D.; Thompson, A. M.; Marl, K.; Ramsay, L.; Coetzee, G. J. R.; [2004]; 25 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes ozone profiles from sonde data during the period of NASA s TRACE-A and the more recent

SHADOZ (Southern Hemisphere Additional Ozonesondes) period. The data were taken by the South African Weather Service at the Irene (25 deg.54 min S; 28 deg. 13 min. E) station near Pretoria, South Africa, an area that is a unique mixture of local industry, heavy biofuels use and importation of biomass burning ozone from neighboring countries to the north. The main findings are: (1) With its geographical position at the edge of the subtropical transition zone, mid- latitude dynamical influences are evident at Irene, predominantly in winter when upper tropospheric ozone is enhanced as a result of stratospheric-tropospheric exchange. (2) There has been an increase in the near-surface ozone amount between the early 1990s and a decade later, presumably due to an influx of rural population toward the Johannesburg-Pretoria area, as well as with industrial growth and development. (3) Most significant for developing approaches for satellite ozone profile climatologies, cluster analysis has enabled the delineation of a background and ″most polluted″ profile. Enhancements of at least 30% occur throughout the troposphere in spring and in certain layers increases of 100 % are observed.
Author
Troposphere; Ozone; Climatology; Africa; Southern Hemisphere

20040082117 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observing Human-induced Linkages between Urbanization and Earth's Climate System
Shepherd, J. Marshall; Jin, Menglin; 2004; 20 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Urbanization is one of the extreme cases of land use change. Most of world s population has moved to urban areas. Although currently only 1.2% of the land is considered urban, the spatial coverage and density of cities are expected to rapidly increase in the near future. It is estimated that by the year 2025, 60% of the world s population will live in cities. Human activity in urban environments also alters atmospheric composition; impacts components of the water cycle; and modifies the carbon cycle and ecosystems. However, our understanding of urbanization on the total Earth-climate system is incomplete. Better understanding of how the Earth s atmosphere-ocean-land-biosphere components interact as a coupled system and the influence of the urban environment on this climate system is critical. The goal of the 2003 AGU Union session Human-induced climate variations on urban areas: From observations to modeling was to bring together scientists from interdisciplinary backgrounds to discuss the data, scientific approaches and recent results on observing and modeling components of the urban environment with the intent of sampling our current stand and discussing future direction on this topic. Herein, a summary and discussion of the observations component of the session are presented.
Derived from text
Cities; Earth Atmosphere; Urban Research; MODIS (Radiometry); Boundary Layers; Climatology

20040082133 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Classification of Tropical Oceanic Precipitation using High Altitude Aircraft: Microwave and Electric Field Measurements
Hood, Robbie E.; Cecil, Daniel; LaFontaine, Frank J.; Blakeslee, Richard; Mach, Douglas; Heymsfield, Gerald; Marks, Frank, Jr.; Zipser, Edward; [2004]; 42 pp.; In English
Contract(s)/Grant(s): NRA-00-OES-06; Copyright; Avail: CASI; A03, Hardcopy

During the 1998 and 2001 hurricane seasons of the western Atlantic Ocean and Gulf of Mexico, 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 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, tropical storms, and other precipitation systems were sampled during these experiments. An oceanic rainfall screening technique has been developed using AMPR passive microwave observations of these systems collected at frequencies of 10.7, 19.35,37.1, and 85.5 GHz. This technique combines the information content of the four AMPR frequencies regarding the gross vertical structure of hydrometeors into an intuitive and easily executable precipitation mapping format. The results have been verified using vertical profiles of EDOP reflectivity and lower altitude horizontal reflectivity scans collected by the National Oceanic and Atmospheric Administration WP-3D Orion radar. Matching the rainfall classification results with coincident electric field information collected by the LIP readily identifies convective rain regions within the precipitation fields. This technique shows promise as a real-time research and analysis tool for monitoring vertical updraft strength and convective intensity from airborne platforms such as remotely operated or uninhabited aerial vehicles. The technique is analyzed and discussed for a wide variety of precipitation types using the 26 August 1998 observations of Hurricane Bonnie near landfall.
Author
Tropical Regions; Tropical Storms; Precipitation (Meteorology); Vertical Air Currents

20040082134 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Extratropical Stratosphere-Troposphere Mass Exchange

Schoeberl, Mark R.; 2004; 37 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Understanding the exchange of gases between the stratosphere and the troposphere is important for determining how pollutants enter the stratosphere and how they leave. This study does a global analysis of that the exchange of mass between the stratosphere and the troposphere. While the exchange of mass is not the same as the exchange of constituents, you can t get the constituent exchange right if you have the mass exchange wrong. Thus this kind of calculation is an important test for models which also compute trace gas transport. In this study I computed the mass exchange for two assimilated data sets and a GCM. The models all agree that amount of mass descending from the stratosphere to the troposphere in the Northern Hemisphere extra tropics is approx. 10(exp 10) kg/s averaged over a year. The value for the Southern Hemisphere by about a factor of two. (10(exp 10) kg of air is the amount of air in 100 km x 100 km area with a depth of 100 m - roughly the size of the D.C. metro area to a depth of 300 feet.) Most people have the idea that most of the mass enters the stratosphere through the tropics. But this study shows that almost 5 times more mass enters the stratosphere through the extra-tropics. This mass, however, is quickly recycled out again. Thus the lower most stratosphere is a mixture of upper stratospheric air and tropospheric air. This is an important result for understanding the chemistry of the lower stratosphere.

Author

Atmospheric Circulation; Atmospheric Composition; Stratosphere; Troposphere

20040082142 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Measurements of Ocean Surface Scattering Using an Airborne 94-GHz Cloud Radar: Implication for Calibration of Airborne and Spaceborne W-band Radars

Li, Li-Hua; Heymsfield, Gerald M.; Tian, Lin; Racette, Paul E.; [2004]; 46 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Scattering properties of the Ocean surface have been widely used as a calibration reference for airborne and spaceborne microwave sensors. However, at millimeter-wave frequencies, the ocean surface backscattering mechanism is still not well understood, in part, due to the lack of experimental measurements. During the Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL-FACE), measurements of ocean surface backscattering were made using a 94-GHz (W-band) cloud radar onboard a NASA ER-2 high-altitude aircraft. The measurement set includes the normalized Ocean surface cross section over a range of the incidence angles under a variety of wind conditions. Analysis of the radar measurements shows good agreement with a quasi-specular scattering model. This unprecedented dataset enhances our knowledge about the Ocean surface scattering mechanism at 94 GHz. The results of this work support the proposition of using the Ocean surface as a calibration reference for airborne millimeter-wave cloud radars and for the ongoing NASA CloudSat mission, which will use a 94-GHz spaceborne cloud radar for global cloud measurements.

Author

Backscattering; Microwave Sensors; Ocean Surface; Spacecraft Instruments; Calibrating; Airborne Surveillance Radar; Mathematical Models; Cirrus Clouds; Airborne Radar; Millimeter Waves

20040082146 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Subtropical Cirrus Properties Derived from GSFC Scanning Raman Lidar Measurements during CAMEX 3

Whiteman, D. N.; Wang, Z.; Demoz, B.; [2004]; 23 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The NASA/GSFC Scanning Raman Lidar (SRL) was stationed on Andros Island, Bahamas for the third Convection and Moisture Experiment (CAMEX 3) held in August - September, 1998 and acquired an extensive set of water vapor and cirrus cloud measurements (Whiteman et al., 2001). The cirrus data studied here have been segmented by generating mechanism. Distinct differences in the optical properties of the clouds are found when the cirrus are hurricane-induced versus thunderstom-induced. Relationships of cirrus cloud optical depth, mean cloud temperature, and layer mean extinction-to-backscatter ratio (S) are presented and compared with mid-latitude and tropical results. Hurricane-induced cirrus clouds are found to generally possess lower values of S than thunderstorm induced clouds. Comparison of these measurements of S are made with other studies revealing at times large differences in the measurements. Given that S is a required parameter for spacebased retrievals of cloud optical depth using backscatter lidar, these large diffaences in S measurements present difficulties for space-based retrievals of cirrus cloud extinction and optical depth.

Author

Cirrus Clouds; Optical Properties; Radar Measurement; Tropical Regions; Raman Spectra; Convection; Atmospheric Moisture; Scanners

20040082147 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Orbit Determination of the Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics (TIMED) Mission Using Differenced One-way Doppler (DOWD)Tracking Data from the Tracking and Data Relay Satellite System (TDRSS)

Marr, Greg C.; Maher, Michael; Blizzard, Michael; Showell, Avanaugh; Asher, Mark; Devereux, Will; 2004; 15 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA

Report No.(s): FMS-2003-25; No Copyright; Avail: CASI; A03, Hardcopy

Over an approximately 48-hour period from September 26 to 28,2002, the Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics (TIMED) mission was intensively supported by the Tracking and Data Relay Satellite System (TDRSS). The TIMED satellite is in a nearly circular low-Earth orbit with a semimajor axis of approximately 7000 km and an inclination of approximately 74 degrees. The objective was to provide TDRSS tracking support for orbit determination (OD) to generate a definitive ephemeris of 24-hour duration or more with a 3-sigma position error no greater than 100 meters, and this tracking campaign was successful. An ephemeris was generated by Goddard Space Flight Center (GSFC) personnel using the TDRSS tracking data and was compared with an ephemeris generated by the Johns Hopkins University's Applied Physics Lab (APL) using TIMED Global Positioning System (GPS) data. Prior to the tracking campaign OD error analysis was performed to justify scheduling the TDRSS support.

Author

Orbit Determination; Tdr Satellites; Thermosphere; Mesosphere; Space Missions; Doppler Radar; Earth Ionosphere

20040082148 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Global Changes of the Water Cycle Intensity

Bosilovich, Michael G.; Schubert, Siegfried D.; Walker, Gregory K.; [2003]; 49 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In this study, we evaluate numerical simulations of the twentieth century climate, focusing on the changes in the intensity of the global water cycle. A new diagnostic of atmospheric water vapor cycling rate is developed and employed, that relies on constituent tracers predicted at the model time step. This diagnostic is compared to a simplified traditional calculation of cycling rate, based on monthly averages of precipitation and total water content. The mean sensitivity of both diagnostics to variations in climate forcing is comparable. However, the new diagnostic produces systematically larger values and more variability than the traditional average approach. Climate simulations were performed using SSTs of the early (1902-1921) and late (1979- 1998) twentieth century along with the appropriate C02 forcing. In general, the increase of global precipitation with the increases in SST that occurred between the early and late twentieth century is small. However, an increase of atmospheric temperature leads to a systematic increase in total precipitable water. As a result, the residence time of water in the atmosphere increased, indicating a reduction of the global cycling rate. This result was explored further using a number of 50-year climate simulations from different models forced with observed SST. The anomalies and trends in the cycling rate and hydrologic variables of different GCMs are remarkably similar. The global annual anomalies of precipitation show a significant upward trend related to the upward trend of surface temperature, during the latter half of the twentieth century. While this implies an increase in the hydrologic cycle intensity, a concomitant increase of total precipitable water again leads to a decrease in the calculated global cycling rate. An analysis of the land/sea differences shows that the simulated precipitation over land has a decreasing trend while the oceanic precipitation has an upward trend consistent with previous studies and the available observations. The decreasing continental trend in precipitation is located primarily over tropical land regions, with some other regions, such as North America experiencing an increasing trend. Precipitation trends are diagnosed further using the water tracers to delineate the precipitation that occurs because of continental evaporation, as opposed to oceanic evaporation. These diagnostics show that over global land areas, the recycling of continental moisture is decreasing in time. However, the recycling changes are not spatially uniform so that some regions, most notably over the USA, experience continental recycling of water that increases in time.

Author

Water Vapor; Numerical Analysis; Climate Change; Atmospheric Moisture

20040082159 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Large Scale Variability of Phytoplankton Blooms in the Arctic and Peripheral Seas: Relationships with Sea Ice, Temperature, Clouds, and Wind

Comiso, Josefino C.; Cota, Glenn F.; [2004]; 33 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Spatially detailed satellite data of mean color, sea ice concentration, surface temperature, clouds, and wind have been analyzed to quantify and study the large scale regional and temporal variability of phytoplankton blooms in the Arctic and

peripheral seas from 1998 to 2002. In the Arctic basin, phytoplankton chlorophyll displays a large symmetry with the Eastern Arctic having about fivefold higher concentrations than those of the Western Arctic. Large monthly and yearly variability is also observed in the peripheral seas with the largest blooms occurring in the Bering Sea, Sea of Okhotsk, and the Barents Sea during spring. There is large interannual and seasonal variability in biomass with average chlorophyll concentrations in 2002 and 2001 being higher than earlier years in spring and summer. The seasonality in the latitudinal distribution of blooms is also very different such that the North Atlantic is usually most expansive in spring while the North Pacific is more extensive in autumn. Environmental factors that influence phytoplankton growth were examined, and results show relatively high negative correlation with sea ice retreat and strong positive correlation with temperature in early spring. Plankton growth, as indicated by biomass accumulation, in the Arctic and subarctic increases up to a threshold surface temperature of about 276-277 degree K (3-4 degree C) beyond which the concentrations start to decrease suggesting an optimal temperature or nutrient depletion. The correlation with clouds is significant in some areas but negligible in other areas, while the correlations with wind speed and its components are generally weak. The effects of clouds and winds are less predictable with weekly climatologies because of unknown effects of averaging variable and intermittent physical forcing (e.g. over storm event scales with mixing and upwelling of nutrients) and the time scales of acclimation by the phytoplankton.
Derived from text
Phytoplankton; Atmospheric Temperature; Sea Ice; Climatology; Arctic Regions; Variability

20040082167 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cirrus Clouds Optical, Microphysical and Radiative Properties Observed During Crystal-Face Experiment: I. A Radar-Lidar Retrieval System
Mitrescu, C.; Haynes, J. M.; Stephens, G. L.; Heymsfield, G. M.; McGill, M. J.; 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A method of retrieving cloud microphysical properties using combined observations from both cloud radar and lidar is introduced. This retrieval makes use of an improvement to the traditional optimal estimation retrieval method, whereby a series of corrections are applied to the state vector during the search for an iterative solution. This allows faster convergence to a solution and is less processor intensive. The method is first applied to a synthetic cloud t o demonstrate its validity, and it is shown that the retrieval reliably reproduces vertical profiles of ice water content. The retrieval method is then applied to radar and lidar observations from the CRYSTAL-FACE experiment, and vertical profiles of ice crystal diameter, number concentration, and ice water content are retrieved for a cirrus cloud layers observed one day of that experiment. The validity of the relationship between visible extinction coefficient and radar reflectivity was examined. While synthetic tests showed such a functional relationship, the measured data only partially supported such a conclusion. This is due to errors in the forward model (as explained above) as well as errors in the data sets, including possible mismatch between lidar and radar profiles or errors in the optical depth. Empirical relationships between number concentrations and mean particle diameter were also examined. The results indicate that a distinct and robust relationship exists between these retrieved quantities and it is argued that such a relationship is more than an artifact of the retrieval process offering insight into the nature of the microphysical processes taking place in cirrus.
Author
Cirrus Clouds; Optical Properties; Cloud Physics

20040082169 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Aerosol Absorption Effects in the TOMS UV Algorithm
Torres, O.; Krotkov, N.; Bhartia, P. K.; 2004; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

The availability of global long-term estimates of surface UV radiation is very important, not only for preventive medicine considerations, but also as an important tool to monitor the effects of the stratospheric ozone recovery expected to occur in the next few decades as a result of the decline of the stratospheric chlorine levels. In addition to the modulating effects of ozone and clouds, aerosols also affect the levels of UV-A and W-B radiation reaching the surface. Oscillations in surface W associated with the effects of aerosol absorption may be comparable in magnitude to variations associated with the stratospheric ozone recovery. Thus, the accurate calculation of surface W radiation requires that both the scattering and absorption effects of tropospheric aerosols be taken into account. Although absorption effects of dust and elevated carbonaceous aerosols are already accounted for using Aerosol Index technique, this approach does not work for urban/industrial aerosols in the planetary boundary layer. The use of the new TOMS long-term global data record on UV aerosol absorption optical depth, can improve the accuracy of TOMS spectral UV products, by properly including the spectral attenuation effects of carbonaceous, urban/industrial and mineral aerosols. The TOMS data set on aerosol properties will be

discussed, and results of its use in the TOMS surface W algorithm will be presented.
Author
Aerosols; Atmospheric Composition; Algorithms; Ultraviolet Radiation; Ozone; Chlorine

20040082170 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Retrieval of Total Ozone Amounts from Zenith-Sky Intensities in the Ultraviolet Region
Bojkov, B. R.; Bhartia, P. K.; Hilsenrath, E.; Labow, G. J.; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium, 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

A new method to determine the total ozone column from zenith-sky intensities in the ultraviolet region has been developed for the Shuttle Solar Backscatter Ultraviolet Spectrometer (SSBUV) operating at the NASA Goddard Space Flight Center. The total ozone column amounts are derived by comparing the ratio of measured intensities from three wavelengths with the equivalent ratios calculated by a radiative transfer model. The differences between the retrieved ozone column amounts and the collocated Brewer double monochromator are within 2% for the measurement period beginning in April 2001. The methodology, as well as the influences of the ozone profiles, aerosols, surface albedo, and the solar zenith angle on the retrieved total ozone amounts will be presented.
Author
Ozone; Backscattering; Ultraviolet Spectrometers; Solar Spectrometers; Radiative Transfer

20040082171 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Hampton Univ., VA, USA
Use of Probability Distribution Functions for Discriminating Between Cloud and Aerosol in Lidar Backscatter Data
Liu, Zhaoyan; Vaughan, Mark A.; Winker, Davd M.; Hostetler, Chris A.; Poole, Lamont R.; Hlavka, Dennis; Hart, William; McGill, Mathew; 2004; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

In this paper we describe the algorithm hat will be used during the upcoming Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission for discriminating between clouds and aerosols detected in two wavelength backscatter lidar profiles. We first analyze single-test and multiple-test classification approaches based on one-dimensional and multiple-dimensional probability density functions (PDFs) in the context of a two-class feature identification scheme. From these studies we derive an operational algorithm based on a set of 3-dimensional probability distribution functions characteristic of clouds and aerosols. A dataset acquired by the Cloud Physics Lidar (CPL) is used to test the algorithm. Comparisons are conducted between the CALIPSO algorithm results and the CPL data product. The results obtained show generally good agreement between the two methods. However, of a total of 228,264 layers analyzed, approximately 5.7% are classified as different types by the CALIPSO and CPL algorithm. This disparity is shown to be due largely to the misclassification of clouds as aerosols by the CPL algorithm. The use of 3-dimensional PDFs in the CALIPSO algorithm is found to significantly reduce this type of error. Dust presents a special case. Because the intrinsic scattering properties of dust layers can be very similar to those of clouds, additional algorithm testing was performed using an optically dense layer of Saharan dust measured during the Lidar In-space Technology Experiment (LITE). In general, the method is shown to distinguish reliably between dust layers and clouds. The relatively few erroneous classifications occurred most often in the LITE data, in those regions of the Saharan dust layer where the optical thickness was the highest.
Author
Probability Distribution Functions; Backscattering; Cloud Physics; Optical Radar; Data Acquisition; Algorithms; Aerosols

20040082172 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Maryland Univ. Baltimore County, Catonsville, MD, USA
Sensitivity of Middle Atmospheric Analysis to the Representation of Gravity Wave Drag
Li, Shu-Hua; Pawson, Steven; Boville, Byron A.; Lin, S.-J.; [2004]; 35 pp.; In English
Contract(s)/Grant(s): NAG5-12162; No Copyright; Avail: CASI; A03, Hardcopy

This study examines the sensitivity of middle atmospheric analyses to the representation of gravity wave drag (GWD) in the general circulation model (GCM). A strong sensitivity of temperatures near the stratopause to the inclusion and representation of waves with non-zero phase speeds is isolated; this is consistent with the induced mean meridional circulation. The change (between a control analysis and one with no GWD) decreases with decreasing altitude and has a vertical structure with alternating positive and negative differences that are caused by the constraint on thick-layer radiances offered by near-nadir sounding radiometers. Without the non-zero phase-speed GWI), there is a large observation minus forecast residual that is substantially smaller when these waves are included, indicating the need for these waves in the GCM. Moreover, the sensitivity of analyzed temperatures to the inclusion of these waves reveals the importance of using a non-biased GCM in

regions where the observational constraint (thick-layer radiances) is indirect.
Author
Gravity Waves; Sensitivity Analysis; Middle Atmosphere; Atmospheric General Circulation Models; Interference Drag; Wave Drag

20040082174 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Florida Thunderstorms: A Faucet of Reactive Nitrogen to the Upper Troposphere
Ridley, B.; Ott, L.; Emmons, L.; Montzka, D.; Weinheimer, A.; Knapp, D.; Grahek, F.; Li, L.; Heymsfield, G.; McGill, M., et al.; [2004]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

During the NASA Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL-FACE) enhanced mixing ratios of nitric oxide were measured in the anvils of thunderstorms and in clear air downwind of storm systems on flights of a Wl3-57F high-altitude aircraft. Mixing ratios greater than l0 - 20 times background were readily observed over distances of 25-120 km due to lightning activity. In many of the Florida storms deposition of NO occurred up to near the tropopause but major deposition usually occurred 1 - 2 km below the tropopause, or mostly within the visible anvil volume formed prior to storm decay. Observations from two storms of very different anvil size and electrical activity allowed estimates of the total mass of NO, vented to the middle and upper troposphere. Using the cloud-to ground (CG) flash accumulations from the National Lightning Detection Network, climatological intra-cloud (IC) to CG ratios, and assuming that CG and IC flashes were of equivalent efficiency for NO production, the ranges of production per flash for a moderate-sized and a large storm were (0.51 - 1.0) x l0(exp 26) and (2.3 - 3.1) x 10(exp 26) molecules NO/flash, respectively. Using the recently determined average global flash rate of 44 8, a gross extrapolation of these two storms to represent possible global annual production rates yield 1.6 - 3.2 and 7.3 - 9.9 Tg(N)/yr, respectively. If the more usual assumption is made that IC efficiency is l/l0th that of CG activity, the ranges of production for the moderate-sized and large storm were (1.3 - 2.7) x l0(exp 26) and (6.0 - 8.1) x l0(exp 26) molecules NO/CG flash, respectively. The estimates from the large storm may be high because there is indirect evidence that the IC/CG ratio was larger than would be derived from climatology. These two storms and others studied did not have flash rates that scaled as approx. H(sup 5) where H is the cloud top altitude. The observed CG flash accumulations and NO(x) mass production estimate for the month of July over the Florida area were compared with a representative 3D global Chemistry-Transport Model (CTMJ that uses the Price et al. lightning parameterization. For two land grid points representing the Florida peninsula the model compared well with the observations: CG flash rates were low by only a factor of approx. 2. When the model grid points included the coastal regions of Florida the flash accumulations were lower than observed by a factor of 3.4 - 4.6. It is recommended that models using the Price et al. parameterization allow any global coastal grid point to maintain the land rather than the marine flash rate parameterization. The convection in this CTM underestimated the actual cloud top heights over Florida by 1 - 2 km and thus the total lightning flash rates and the altitude range of reactive nitrogen deposition. Broad scale (20 - 120 km) median mixing ratios of NO within anvils over Florida were significantly larger than in storms previously investigated over Colorado and New Mexico.
Author
Thunderstorms; Florida; Nitrogen; Troposphere; Nitric Oxide; Parameterization; Wind Direction

20040082176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Warm Core Structure and Mid-Level Intrusion in Hurricane Bonnie (1998) During Landfalling on 26 August 1998
Heymsfield, G. M.; Halverson, J.; [2004]; 1 pp.; In English; 26th Conference on Hurricane and Tropical Meteorology, 3 May 2004, Miami, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

On 26 August 1998 during CAMEX-3, Hurricane Bonnie was overflown by the NASA ER-2 aircraft instrumented with the EDOP X-Band radar and other instrumentation. Bonnie was an asymmetric storm on this day with several prominent features during its brush with the East coast. One of these features was strong intrusion of dry air on the west side of the storm. During the interaction of this westerly shear with the storm, the precipitation band rotates cyclonically from northwest to the south of the storm center. In this paper, we examine the structure of this dry intrusion and its effect on the storm. The EDOP observations are analyzed along with dropsondes, flight-level observations (NASA DC-8 and NOAA P3), and satellite data. The most apparent feature of the EDOP observations are the strong shears in the interface between the western eyewall updraft, and the dry intrusion. Mammatus are formed along this interface reminiscent of convective rear inflows, and suggestive of intense drying of the air through subsidence. This observation as well as other aspects of the analysis are related to recent numerical simulations of Hurricane Bonnie.
Author
Hurricanes; Storms; Vertical Air Currents

20040082179 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Validating Lidar Depolorization Calibration using Solar Radiation Scattered by Ice Clouds

Liu, Zhao-Yang; McGill, Matthew; Hu, Yong-Xiang; Hostetter, Chris; Winker, David; Vaughan, Mark; [2004]; 3 pp.; In English

Contract(s)/Grant(s): 23-622-43-03; Copyright; Avail: CASI; A01, Hardcopy

This letter proposes the use of solar background radiation scattered by ice clouds for validating space lidar depolarization calibration. The method takes advantage of the fact that the background light scattered by ice clouds is almost entirely unpolarized. The theory is examined with Cloud Physics Lidar (CPL) background light measurements.

Author

Calibrating; Depolarization; Ice Clouds; Optical Radar; Solar Radiation; Backscattering

20040082183 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Impact of Aerosols on Cloud and Precipitation Processes: Cloud-resolving Model Simulations

Tao, Wei-Kuo; Li, X.; Khain, A.; Simpson, S.; Johnson, D.; Remer, L.; 2004; 1 pp.; In English; 14th International Conference on Clouds and Precipitation, 18-23 Jul. 2004, Bologna, Italy; No Copyright; Avail: Other Sources; Abstract Only

Cloud microphysics is inevitably affected by the smoke particle (CCN, cloud condensation nuclei) size distributions below the clouds. Therefore, size distributions parameterized as spectral bin microphysics are needed to explicitly study the effects of atmospheric aerosol concentration on cloud development, r d a U production, and rainfall rates for convective clouds. Recently, two detailed spectral-bin microphysical schemes were implemented into the Goddard Cumulus Ensembe1 (GCE) model. The formulation for the explicit spectral-bin microphysical processes is based on solving stochastic kinetic equations for the size distribution functions of water droplets (i.e., cloud droplets and raindrops), and several types of ice particles [i.e. pristine ice crystals (columnar and platelike), snow (dendrites and aggregates), graupel and frozen drops/hail]. Each type is described by a special size distribution function containing many categories (i.e. 33 bins). Atmospheric aerosols are also described using number density size-distribution functions. A spectral-bin microphysical model is very expensive from a computational point of view and has only been implemented into the 2D version of the GCE at the present time. The model is tested by studying the evolution of deep tropical clouds in the west Pacific warm pool region and in the mid-latitude continent with different concentrations of CCN: a low ″c1ean″concentration and a high ″dirty″ concentration. In addition, differences and similarities between bulk microphysics and spectral-bin microphysical schemes will be examined and discussed.

Author

Aerosols; Cloud Physics; Precipitation (Meteorology); Simulation; Atmospheric Models

20040082184 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Offline GCSS Intercomparison of Cloud-Radiation Interaction and Surface Fluxes

Tao, W.-K.; Johnson, D.; Krueger, S.; Zulauf, M.; Donner, L.; Seman, C.; Petch, J.; Gregory, J.; [2004]; 1 pp.; In English; 26th Conference on Hurricane and Tropical Meteorology, 3-7 May 2004, Miami, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Simulations of deep tropical clouds by both cloud-resolving models (CRMs) and single-column models (SCMs) in the GEWEX Cloud System Study (GCSS) Working Group 4 (WG4; Precipitating Convective Cloud Systems), Case 2 (19-27 December 1992, TOGA-COARE IFA) have produced large differences in the mean heating and moistening rates (-1 to -5 K and -2 to 2 grams per kilogram respectively). Since the large-scale advective temperature and moisture ″forcing″ are prescribed for this case, a closer examination of two of the remaining external types of ″forcing″, namely radiative heating and air/sea hear and moisture transfer, are warranted. This paper examines the current radiation and surface flux of parameterizations used in the cloud models participating in the GCSS WG4, be executing the models ″offline″ for one time step (12 s) for a prescribed atmospheric state, then examining the surface and radiation fluxes from each model. The dynamic, thermodynamic, and microphysical fluids are provided by the GCE-derived model output for Case 2 during a period of very active deep convection (westerly wind burst). The surface and radiation fluxes produced from the models are then divided into prescribed convective, stratiform, and clear regions in order to examine the role that clouds play in the flux parameterizations. The results suggest that the differences between the models are attributed more to the surface flux parameterizations than the radiation schemes.

Author

Computerized Simulation; Cumulus Clouds; Atmospheric Models; Parameterization; Radiative Heat Transfer; Heat Flux; Hydrological Cycle

20040082189 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Structure of the Highly Sheared Tropical Storm Chantal During CAMEX-4

Heymsfield, G. M.; Halverson, J.; Ritchie, E.; Simpson, Joanne; Molinari, J.; Tian, L.; 2004; 41 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

NASA's 4th Convection and Moisture Experiment (CAMEX-4) focused on Atlantic hurricanes during the 2001 hurricane season and it involved both NASA and NOAA participation. The NASA ER-2 and DC-8 aircraft were instrumented with unique remote sensing instruments to help increase the overall understanding of hurricanes. This paper is concerned about one of the storms studied, Tropical Storm Chantal, that was a weak storm which failed to intense into a hurricane. One of the practical questions of high importance is why some tropical sto~ins intensify into hurricanes, and others remain weak or die altogether. The magnitude of the difference between the horizontal winds at lower levels and upper altitudes in a tropical storm, i.e., the wind shear, is one important quantity that can affect the intensification of a tropical storm. Strong shear as was present during Tropical Storm Chantal s lifetime and it was detrimental to its intensification. The paper presents an analysis of unique aircraft observations collected from Chantal including an on-board radar, radiometers, dropsondes, and flight level measurements. These measurements have enabled us to examine the internal structure of the winds and thermal structure of Chantal. Most of the previous studies have involved intense hurricanes that overcame the effects of shear and this work has provided new insights into what prevents a weaker storm from intensifying. The storm had extremely intense thunderstorms and rainfall, yet its main circulation was confined to low levels of the atmosphere. Chantal's thermal structure was not configured properly for the storm to intensify. It is most typical that huricanes have a warm core structure where warm temperatures in upper levels of a storm s circulation help intensify surface winds and lower its central pressure. Chantal had two weaker warm layers instead of a well-defined warm core. These layers have been related to the horizontal and vertical winds and precipitation structure and have helped us learn more about why this storm didn't develop.

Author

Hurricanes; Altitude; Measuring Instruments; Temperature Distribution; Thunderstorms; Tropical Storms

20040082190 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The North Pacific as a Regulator of Summertime Climate Over North America and the Asian Monsoon

Lau, William K. M.; Wang, H.; [2004]; 1 pp.; In English; International Asian Monsoon Symposium, 17-22 Feb. 2004, Honolulu, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The interannual variability of summertime rainfall over the U.S. may be linked to climate anomalies over Pacific and East Asia through teleconnection patterns that may be components of recurring global climate modes in boreal summer (Lau and Weng 2002). In this study, maintenance of the boreal summer teleconnection patterns is investigated. The particular focus is on the potential effects of North Pacific air-sea interaction on climate anomalies over the U.S. Observational data, reanalysis and outputs of a series of NASA NSIPP AGCM and AGCM coupled to NASA GSFC MLO model experiments are used. Statistical analysis of observations and NSIPP AMIP type simulations indicates that, the interannual variability of observed warm season precipitation over the U.S. is related to SST variation in both tropical and North Pacific, whereas the NSIPP AMIP simulated summertime US. precipitation variation mainly reflects impact of ENS0 in tropical Pacific. This implies the potential importance of air-sea interaction in North Pacific in contributing to the interannual variability of observed summer climate over the U.S. The anomalous atmospheric circulation associated with the dominant summertime teleconnection modes in both observations and NSIPP AMIP simulations are further diagnosed, using stationary wave modeling approach. In observations, for the two dominant modes, both anomalous diabatic heating and anomalous transients significantly contribute to the anomalous circulation. The distributions of the anomalous diabatic heating and transient forcing are quadrature configured over North Pacific and North America, so that both forcings act constructively to maintain the teleconnection patterns. The contrast between observations and NSIPP AMIP simulations from stationary wave modeling diagnosis confirms the previous conclusion based on statistical analysis. To better appreciate the role of extra-tropical air-sea interaction in maintaining the summertime teleconnection pattern, various dynamical and physical fields and their inter- linkage in the series of NSIPP AGCM and AGCM coupled to MLO model experiments are examined in-depth. Based on comparison between different model experiments, we will discuss the physical and dynamical mechanisms through which the air-sea interaction in extratropics, and transient mean flow interactions over the North Pacific, affects interannual variation of U.S. climate during boreal summer.

Derived from text

Monsoons; Summer; Teleconnections (Meteorology); Atmospheric Circulation; Climatology; Statistical Analysis

20040082200 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparison of TOMS, SBW & SBUV/2 Version 8 Total Column Ozone Data with Data from Groundstations

Labow, G. J.; McPeters, R. D.; Bhartia, P. K.; 2004; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

The Nimbus-7 and Earth Probe Total Ozone Mapping Spectrometer (TOMS) data as well as SBUV and SBUV/2 data have been reprocessed with a new retrieval algorithm (Version 8) and an updated calibration procedure. An overview will be presented systematically comparing ozone values to an ensemble of Brewer and Dobson spectrophotometers. The comparisons were made as a function of latitude, solar zenith angle, reflectivity and total ozone. Results show that the accuracy of the TOMS retrieval has been improved when aerosols are present in the atmosphere, when snow/ice and sea glint are present, and when ozone in the northern hemisphere is extremely low. TOMS overpass data are derived from the single TOMS best match measurement, almost always located within one degree of the ground station and usually made within an hour of local noon. The Version 8 Earth Probe TOMS ozone values have decreased by an average of about 1% due to a much better understanding of the calibration of the instrument. N-7 SBUV as well as the series of NOAA SBUV/2 column ozone values have also been processed with the Version 8 algorithm and have been compared to values from an ensemble of groundstations. Results show that the SBW column ozone values agree well with the groundstations and the datasets are useful for trend studies.

Author

Total Ozone Mapping Spectrometer; Solar Backscatter UV Spectrometer; Nimbus 7 Satellite; Calibrating; Algorithms; Latitude; Solar Position; Ground Stations

20040082201 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Mobile Lidar Operations at GSFC

McGee, Thomas J.; 2003; 1 pp.; In English; NDSC Lidar Working Group Meeting, 6-9 Oct. 2003, Rome, Italy; No Copyright; Avail: Other Sources; Abstract Only

Since the last meeting, the GSFC Stratospheric Ozone Lidar has participated in two campaigns at MLO - an ozone and temperature comparison and a water vapor comparison. The trailer has been returned to GSFC to begin transfer into a sea container, before deployment to Reunion Island in Spring, 2004.

Author

Water Vapor; Ozone; Atmospheric Composition; Atmospheric Temperature; Stratosphere; Optical Radar

20040082202 NASA Goddard Space Flight Center, Greenbelt, MD, USA

High-Resolution Simulation of Hurricane Bonnie (1998), Part 2, Water Budget

Braun, Scott A.; [March 15, 2004]; 51 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

The Pennsylvania State University-National Center for Atmospheric Research mesoscale model MM5 is used to simulate Hurricane Bonnie at high resolution (2-km spacing) in order to examine budgets of water vapor, cloud condensate, and precipitation. Virtually all budget terms are derived directly from the model (except for the effects of storm motion). The water vapor budget reveals that a majority of the condensation in the eyewall occurs in convective hot towers, while outside of the eyewall most of the condensation occurs in weak updrafts, indicative of a dominance of stratiform precipitation processes. The ocean source of water vapor in the eyewall region is only a very small fraction of that transported inward in the boundary layer inflow or that condensed in the updrafts. In contrast, in the outer regions, the ocean vapor source is larger owing to the larger area, counters the drying effect of low-level subsidence, and enhances the moisture transported in toward the eyewall. In this mature storm, cloud condensate is consumed as rapidly as it is produced. Cloud water peaks at the top of the boundary layer and within the melting layer, where. cooling from melting enhances condensation. Unlike squall lines, in the hurricane, very little condensate produced in the eyewall convection is transported outward into the surrounding precipitation area. Most of the mass ejected outward is likely in the form of small snow particles that seed the outer regions and enhance stratiform precipitation development through additional growth by vapor deposition and aggregation. In addition, artificial source terms for cloud and precipitation mass associated with setting negative mixing ratios, produced as a result of numerical advection errors, to zero are described. Although small at any given point and time, the cumulative effect of these terms contributes an amount of mass equivalent to 13% of the total condensation. Thus, these terms must be accounted for to balance the model budgets and the results suggest the need for improved model numerics.

Author

Hurricanes; High Resolution; Water Vapor; Moisture; Clouds (Meteorology); Precipitation (Meteorology); Atmospheric Models

20040082205 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Combined Infrared Stereo and Laser Ranging Cloud Measurements from Shuttle Mission STS-85

Lancaster, R. S.; Spinhirne, J. D.; Manizade, K. F.; 2004; 1 pp.; In English; 2004 IGARRS Meeting, 20-24 Sep. 2004, Anchorage, AK, USA; Copyright; Avail: Other Sources; Abstract Only

Multiangle remote sensing provides a wealth of information for earth and climate monitoring, such as the ability to measure the height of cloud tops through stereoscopic imaging. As technology advances so do the options for developing spacecraft instrumentation versatile enough to meet the demands associated with multiangle measurements. One such instrument is the infrared spectral imaging radiometer, which flew as part of mission STS-85 of the space shuttle in 1997 and was the first earth- observing radiometer to incorporate an uncooled microbolometer array detector as its image sensor. Specifically, a method for computing cloud-top height with a precision of +/- 620 m from the multispectral stereo measurements acquired during this flight has been developed, and the results are compared with coincident direct laser ranging measurements from the shuttle laser altimeter. Mission STS-85 was the first space flight to combine laser ranging and thermal IR camera systems for cloud remote sensing.

Author

Imaging Techniques; Infrared Imagery; Clouds (Meteorology); Remote Sensing; Bolometers

20040082207 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Polar Processes in a 50-year Simulation of Stratospheric Chemistry and Transport

Kawa, S.R.; Douglass, A. R.; Patrick, L. C.; Allen, D. R.; Randall, C. E.; 2004; 1 pp.; In English; SPARC 3rd General Assembly, 1-6 Aug. 2004, Victoria, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

The unique chemical, dynamical, and microphysical processes that occur in the winter polar lower stratosphere are expected to interact strongly with changing climate and trace gas abundances. Significant changes in ozone have been observed and prediction of future ozone and climate interactions depends on modeling these processes successfully. We have conducted an off-line model simulation of the stratosphere for trace gas conditions representative of 1975-2025 using meteorology from the NASA finite-volume general circulation model. The objective of this simulation is to examine the sensitivity of stratospheric ozone and chemical change to varying meteorology and trace gas inputs. This presentation will examine the dependence of ozone and related processes in polar regions on the climatological and trace gas changes in the model. The model past performance is base-lined against available observations, and a future ozone recovery scenario is forecast. Overall the model ozone simulation is quite realistic, but initial analysis of the detailed evolution of some observable processes suggests systematic shortcomings in our description of the polar chemical rates and/or mechanisms. Model sensitivities, strengths, and weaknesses will be discussed with implications for uncertainty and confidence in coupled climate chemistry predictions.

Author

Polar Regions; Stratosphere; Atmospheric Chemistry; Atmospheric General Circulation Models; Finite Volume Method; Climatology; Chemical Reactions

20040082208 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Assimilation of SBUV Version 8 Radiances into the GEOS Ozone DAS

Mueller, Martin D.; Stajner, Ivanka; Bhartia, Pawan K.; 2004; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

In operational weather forecasting, the assimilation of brightness temperatures from satellite sounders, instead of assimilation of 1D-retrievals has become increasingly common practice over the last two decades. Compared to these systems, assimilation of trace gases is still at a relatively early stage of development, and efforts to directly assimilate radiances instead of retrieved products have just begun a few years ago, partially because it requires much more computation power due to the employment of a radiative transport forward model (FM). This paper will focus on a method to assimilate SBUV/2 radiances (albedos) into the Global Earth Observation System Ozone Data Assimilation Scheme (GEOS-03DAS). While SBUV-type instruments cannot compete with newer sensors in terms of spectral and horizontal resolution, they feature a continuous data record back to 1978, which makes them very valuable for trend studies. Assimilation can help spreading their ground coverage over the whole globe, as has been previously demonstrated with the GEOS-03DAS using SBUV Version 6 ozone profiles. Now, the DAS has been updated to use the newly released SBUV Version 8 data. We will compare pre]lmlnarv results of SBUV radiance assimilation with the assimilation of retrieved ozone profiles, discuss methods to deal with the increased computational load, and try to assess the error characteristics and future potential of the new approach.

Author

Weather Forecasting; Brightness Temperature; Radiance; Assimilation; Earth Observations (From Space); Ozone; Remote Sensing

20040082209 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Underestimation of Deep Convective Cloud Tops by Thermal Imagery

Sherwood, Steven C.; Chae, Jung-Hyo; Minnis, Patrick; McGill, Matthew; 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The most common method of ascertaining cloud heights from space is from thermal brightness temperatures. Deep cumulus clouds of high water content are expected to radiate as black bodies. Here, cloud tops are estimated from several sensors: GOES-8, the Moderate Resolution Imaging Spectroradiometer (MODIS), the Moderate resolution Imaging Sensor (MISR), and the Goddard Cloud Physics Lidar (CPL), all collected during the CRYSTAL Florida Area Cirrus Experiment (CRYSTAL-FACE). Thermally derived cloud tops are consistently approx. 1km too low compared with independent measurements, no matter how thick the clouds are, even when the finite optical extinctions near cloud top and in thin overlying cirrus are taken into account. The bias appears to get worse for the tallest clouds. Cloud material is often present 2 km or more above the apparent cloud top. This mysterious discrepancy appears to be satellite-independent.

Author

Cloud Height Indicators; Cloud Physics; Moisture Content; Cumulus Clouds

20040082210 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Planetary-Scale Inertio Gravity Waves in the Numerical Spectral Model

Mayr, H. G.; Mengel, J. R.; Talaat, E. R.; Porter, H. S.; 2004; 27 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In the polar region of the upper mesosphere, horizontal wind oscillations have been observed with periods around 10 hours. Waves with such a period are generated in our Numerical Spectral Model (NSM), and they are identified as planetary-scale inertio gravity waves (IGW). These IGWs have periods between 9 and 11 hours and appear above 60 km in the zonal mean (m = 0), as well as in zonal wavenumbers m = 1 to 4. The waves can propagate eastward and westward and have vertical wavelengths around 25 km. The amplitudes in the wind field are typically between 10 and 20 m/s and can reach 30 m/s in the westward propagating component for m = 1 at the poles. In the temperature perturbations, the wave amplitudes above 100 km are typically 5 K and as large as 10 K for m = 0 at the poles. The IGWs are intermittent but reveal systematic seasonal variations, with the largest amplitudes occurring generally in late winter and spring. In the NSM, the IGW are generated like the planetary waves (PW). They are produced apparently by the instabilities that arise in the zonal mean circulation. Relative to the PWs, however, the IGWs propagate zonally with much larger velocities, such that they are not affected much by interactions with the background zonal winds. Since the IGWs can propagate through the mesosphere without much interaction, except for viscous dissipation, one should then expect that they reach the thermosphere with significant and measurable amplitudes.

Author

Mathematical Models; Gravity Waves; Planetary Waves; Wind Velocity

20040082320 NASA Marshall Space Flight Center, Huntsville, AL, USA

The LATEST Project: Operational Assessment of Total Lightning Data in the U.S.

Goodman, Steven; [2004]; 1 pp.; In English; 18th International Lightning Detection Conference (ILDC), 7-9 Jun. 2004, Helsinki, Finland; No Copyright; Avail: Other Sources; Abstract Only

A government, university, and industry alliance has joined forces to transition total lightning observations from ground-based research networks and NASA satellites (LIS/TRMM) to improve the short range prediction of severe weather. This interest builds on the desire of the U.S Weather Research Program to foster a national Nowcasting Test Bed, with this specific transition activity initiated through the NASA short-term Prediction Research and Transition (SPoRT) Center in Huntsville, AL. A kick-off national workshop sponsored by the SPoRT Center was held in Huntsville April 1-2 to identify the common goals and objectives of the research and operational community, and to assign roles and responsibilities within the alliance. The workshop agenda, presentations, and summary are available at the SPoRT Center Web site (h h under the ″Meetings″ tab. The next national workshop is planned for 2005 in Dallas, TX. The NASA North Alabama regional Lightning Mapping Array &MA) has been operational in the Huntsville area for 3 years, and has continuously sampled a variety of severe weather systems during that period. A gridded version of the LMA total lightning data is currently being supplied to National Weather Service offices in Huntsville, Nashville and Birmingham through the NWS AWES decision support system, for the purposes of assessing the utility of the data in the nowcasting of severe weather such as tornadoes, damaging straight line winds, flash flooding and other weather hazards (lightning induced forest fires, microbursts). While the raw LMA data have been useful to NWS forecasters, even greater utility would be realized if higher-order data products could be supplied through AWIPS along with the gridded data over a larger domain. In 2003-2004 additional LMA systems have been deployed across the southern US. from Florida to New Mexico, providing an opportunity for more than 20 NWS forecast offices to

evaluate the incremental value of total lightning data in the warning decision making process.
Author
Weather; Tornadoes; Predictions; Nowcasting; Lightning

20040082354 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview of the Convection and Moisture Experiment(CAMEX)
Kakar, Ramesh; Goodman, Michael; Hood, Robbie; Guillory, Anthony; December 20, 2003; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The goal of this paper is to present an overview of the Convection and Moisture Experiment including CAMEX-3 and CAMEX-4 field campaigns including field operations, aircraft platforms and instrumentation, aircraft missions, and data acquired during 1998 and 2001 field phases. A total of eight tropical storms and hurricanes were investigated during the CAMEX field campaigns including Bonnie, Danielle, Earl, and Georges during 1998 and Chantal, Erin, Gabrielle, and Humberto during 2001. Most of these storms were sampled with aircraft over the open ocean, but Bonnie (1998), Georges (1998), and Gabrielle (2001) also provided opportunities to monitor landfalling impacts. A few of the storms were sampled on multiple occasions during a course of several days. Most notably of these was Hurricane Humberto, which was sampled on three consecutive days during a cycle of both increasing and decreasing intensity change. Information collected for each of the eight CAMEX tropical storms as well the TRMM validation activities have been archived and are readily available for distribution at the CAMEX web site.
Author
Convection; Moisture; General Overviews; Tropical Storms

20040082387 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lightning Optical Pulse Statistics from Storm Overflights During the Altus Cumulus Electrification Study
Mach, D. M.; Blakeslee, R. J.; Bailey, J. C.; Farrell, W. M.; Goldberg, R. A.; Desch, M. D.; Houser, J. G.; [2004]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The Altus Cumulus Electrification Study (ACES) was conducted during the month of August, 2002 in an area near Key West, Florida. One of the goals of this uninhabited aerial vehicle (UAV) study was to collect time resolved optical pulse data from thunderstorms. During the month long campaign, we acquired 5294 lightning generated optical pulses. Most of these observations were made while close to the top of the storms. We divided our data into two amplitude groups based on prior NASA U2 aircraft optical data and our pulse characteristics. The group of large pulses with radiance greater than 2.1 mW /sq m sr had mean and median 10 - 10% optical pulse widths of 765 and 735 microns respectively, the 50-50% pulse widths of 396 and 355 microns respectively, and 10-90% rise times of 290 and 260 microns. These values are very similar to the previous U2 based optical results The other group of pulses consisting of slightly more than a quarter of the total pulses observed had radiances less than the minimum values detected in the U2 study. The small pulses were narrower than the large pulses with 5040% mean and median values of 198 and 160 ps respectively. Only 12 % of the flashes contained only small pulses, minimizing the impact of this data on the estimates of detection efficiencies of the orbital instruments, the Lightning Imaging Sensor and Optical Transient Detector.
Author
Lightning; Electromagnetic Pulses

20040082402 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Can Assimilation of Satellite Ozone Data Contribute to the Understanding of the Lower Stratospheric Ozone?
Stajner, I.; Wargan, K.; Pawson, S.; Hayashi, H.; Chang, L.-P.; Rood, R.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We study the quality of lower stratospheric ozone fields from a three- dimensional global ozone assimilation system. Ozone in this region is important for the forcing of climate, but its global distribution is not fully known because of its large temporal and vertical variability. Modeled fields often have biases due to the inaccurate representation of transport processes in this region with strong gradients. Accurate ozonesonde or satellite occultation measurements have very limited coverage. Nadir measurements, such as those from the Solar Backscatter Ultraviolet/2 (SBUV/2) instrument that provide wide latitudinal coverage, lack the vertical resolution needed to represent sharp vertical features. Limb measurements, such as those from the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS), provide a finer vertical resolution. We show that assimilation of MIPAS data in addition to SBUV/2 data leads to better estimates of ozone in comparison with independent high quality satellite, aircraft, and ozone sonde measurements. Other modifications to the statistical analysis that have an impact

on the lower stratospheric ozone will be mentioned: error covariance modeling and data selection. Direct and indirect impacts of transport and chemistry models will be discussed. Implications for multi-year analyses and short-tern prediction will be addressed.
Author
Atmospheric Composition; Ozone; Statistical Analysis; Stratosphere

20040082629 Army Research Lab., White Sands Missile Range, NM
Navigation Through Fog: A Mathematical Analysis of Folder Path Propagation
Tofsted, David H.; Sep. 2002; 58 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423580; ARL-TR-2648; No Copyright; Avail: CASI; A04, Hardcopy

The problem of navigation through fog was brought tragically to the fore during the summer of 1999 when John F. Kennedy Jr.'s plane crashed into the Atlantic off the coast of Martha's Vineyard. The key factor here was the inability to determine the vertical direction due to the lack of visual cues. Less catastrophic, but of more concern, are frequent delays caused by fog at America's major airports. It is estimated that one major air package carrier alone incurs yearly costs measured in millions of dollars due to delayed or rerouted flights caused by airport fog conditions. Such delays would not be necessarily if alternatives to the current methods of handling fog conditions were available. The current method of coping appears simply to involve reducing the rate of aircraft arrivals and departures such that collisions are avoided. However, such an approach does not avoid the problems encountered by John Kennedy Jr., nor does it curtail the possibility of collision with obstacles on the runway. (Incidences of wildlife appearing on runways under low visibility conditions have also been noted in the past.) Though several methods for improving the ability to see through fog have been attempted, the one of interest in this case involves the use of stereoscopic vision devices coupled with laser illumination and realtime image deblurring software. But a fundamental question remains as to the capabilities of this technology when confronting real world fog environments. While models of fog scattering properties exist, the propagation models for use of these models have often relied on Monte Carlo analysis of scattering by fog particles. This analysis is usually incomplete - it cannot adequately address the spatial and angular structure of the radiation that reaches objects within the fog volume and the return signals from objects in the fog. In particular, if corner reflectors were mounted at the sides of the airways, could such reflective objects be viewed through the f7
DTIC
Fog; Navigation; Radiative Transfer

20040082712 Maryland Univ., College Park, MD
Antarctic Operational Weather Forecasting
Keaveney, Sean R.; Jan. 2004; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423766; CI04-386; No Copyright; Avail: CASI; A05, Hardcopy

The USA Antarctic Program (USAP) has maintained three year-round research stations on Antarctica since the 1950's. Research conducted on the continent has taken advantage of the unique conditions afforded by Antarctica's location and climate; unfortunately, these characteristics have also required an immense logistics operation by the USAP to support its researchers. Operation Deep Freeze, the airlift portion of this endeavor, is supported by units of the U.S. Air Force Reserve and Air National Guard. Flights to and around the continent require accurate operational weather forecasts to minimize the threat posed by Antarctica's harsh, highly variable weather. This paper reviews literature on significant Antarctic weather features, primarily katabatic winds and mesocyclones, around McMurdo Station, the hub of USAP aviation activities. It then describes the analysis and forecasting tools, specifically, Automatic Weather Stations, space-based remote sensing, and numerical weather prediction, used by USAP forecasters to create their weather forecasts. Problems with these tools and required improvements, including the Ross Island Meteorological Experiment, are also highlighted.
DTIC
Antarctic Regions; Meteorological Parameters; Weather Forecasting; Weather Stations

20040082764 California Univ., Los Angeles, CA
Laser Transmission Through Cirrus Clouds
Liou, Kuo-Nam; May 31, 2004; 5 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0057
Report No.(s): AD-A423867; AFRL-SR-AR-TR-04-0314; No Copyright; Avail: CASI; A01, Hardcopy

Laser transmission model development. We developed a number of 2D radiative transfer models based on the successive-order-of-scattering approach for the computation of airborne high-energy laser transmission and backscattering

through homogeneous and inhomogeneous thin cirrus clouds in both plane-parallel and spherical geometries. These models took into account the relative positions of aircraft, target, and cirrus clouds in the atmospheres. We investigated the sensitivity of laser transmission and backscattering on variation of the cloud optical depth, particle size, and cloud- base height, as well as the positions of aircraft and target. We also evaluated the effects of the earth's sphericity on laser transmission and backscattering. A paper describing our detailed research findings has been published in Applied Optics (Ou, et al. 2002). Our present research involves the theoretical formulation of a three-dimensional direct and first-order transmission-backscattering model for thin cirrus.
DTIC
Cirrus Clouds; Lasers; Optical Properties

20040082832 Department of the Air Force, Washington, DC
Weather For Aircrews - Air Force Handbook 11-203, Volume 1
Mar. 1997; 183 pp.; In English
Report No.(s): AD-A423996; HB-11-203-VOL-1; No Copyright; Avail: CASI; A09, Hardcopy
No abstract available
Flight Crews; Handbooks; Weather

20040083073 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Charactering the Fabric of the Urban Environment: A Case Study of Greater Houston, Texas
Rose, L. S.; Akbari, H.; Taha, H.; Jan. 2003; In English
Report No.(s): DE2003-816533; LBNL-51448; No Copyright; Avail: National Technical Information Service (NTIS)
In this report, the materials and various surface types that comprise a city are referred to as the ''urban fabric.'' Urban fabric data are needed in order to estimate the impact of light-colored surfaces (roofs and pavements) and urban vegetation (trees, grass, shrubs) on the meteorology and air quality of a city, and to design effective urban environmental implementation programs. We discuss the results of a semi-automatic Monte-Carlo statistical approach used to develop data on surface-type distribution and city-fabric makeup (percentage of various surface-types) using aerial color orthophotography. The digital aerial photographs for Houston covered a total of about 52 km2 (20 mi2). At 0.30-m resolution, there were approximately 5.8 x 108 pixels of data. Four major land-use types were examined: (1) commercial, (2) industrial, (3) educational, and (4) residential. On average, for the regions studied, vegetation covers about 39 percent of the area, roofs cover about 21 percent, and paved surfaces cover about 29 percent. For the most part, trees shade streets, parking lots, grass, and sidewalks. At ground level, i.e., view from below the vegetation canopies, paved surfaces cover about 32 percent of the study area. GLOBEIS model data from University of Texas and land-use/land-cover (LULC) information from the USA Geological Survey (USGS) were used to extrapolate these results from neighborhood scales to Greater Houston. It was found that in an area of roughly 3,430 km2, defining most of Greater Houston, over 56 percent is residential. The total roof area is about 740 km2, and the total paved surface area (roads, parking areas, sidewalks) covers about 1000 km2. Vegetation covers about 1,320 km2.
NTIS
Aerial Photography; Land Use

20040083997 Spacehab, Inc., Houston, TX, USA
Oxygen and Breathing Air Hardware Cleaning and Verification Technique at NASA's Johnson Space Center's Neutral Buoyancy Facility
Hudnall, Patrick; Biesinger, Paul; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
The Neutral Buoyancy Facility has implemented an aqueous cleaning and Surface Quality Monitor (SQM) verification process to clean and verify its oxygen and breathing air hardware. The SQM verification process is an accepted process that was developed and implemented at the White Sands Test Facility (WSTF). The aqueous process utilizes an environmentally acceptable method using silicated non-phosphate aqueous cleaners and a citric acid deoxidizer with a purified water rinse. The process cleans the various stainless steel/metal alloy hardware to 100 A levels. The verification method developed at the WSTF uses HFE-7100 as the verification fluid. The desirable characteristic of the process is that all waste is treatable and accepted by the Municipal Waste Facility. There is no hazardous waste generated.
Author
Oxygen Breathing; Air Filters; Air Purification; Monitors

20040084065 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Tropical Tropospheric Ozone Climatology: Approaches Based on SHADOZ Observations

Thompson, Anne M.; Witte, Jacquelyn C.; Chatfield, Robert B.; Hudson, Robert D.; Andrade, Marcos; Coetzee, Geert J. R.; Posny, Francoise; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; Copyright; Avail: Other Sources; Abstract Only

The SHADOZ (Southern Hemisphere Additional Ozonesondes) ozone sounding network was initiated in 1998 to improve the coverage of tropical in-situ ozone measurements for satellite validation, algorithm development and related process studies. Over 2000 soundings have been archived at the central website, \hhttp://croc.gsfc.nasa.gov/shadoz\g, for 12 stations that span the entire equatorial zone [Thompson et al., JGR, 108,8238, 2003]. The most striking features of tropospheric ozone profiles in SHADOZ are: (1) persistent longitudinal variability in tropospheric ozone profiles, with a 10-15 DU column-integrated difference between Atlantic and Pacific sites; (2) intense short-term variability triggered by changing meteorological conditions and advection of pollution. The implications of these results for profile climatologies and trends are described along with several approaches to classifying ozone profiles: 1) Seasonal means during MAM (March-April-May) and SON (September-October-November); 2) Maxima and minima, identified through correlation of TOMS-derived TTO (tropical tropospheric ozone) column depth with the sonde integrated tropospheric ozone column; and 3) Meteorological regimes, a technique that is effective in the subtropics where tropical and mid-latitude conditions alternate.

Author

Climatology; Ozone; Sondes; Southern Hemisphere; Tropical Regions; Troposphere; Satellite Observation

20040084066 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comparisons of Observations with Results from 3D Simulations and Implications for Predictions of Ozone Recovery

Douglass, Anne R.; Stolarski, Richard S.; Strahan, Susan E.; Steenrod, Stephen D.; Polarsky, Brian C.; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium, 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

Although chemistry and transport models (CTMs) include the same basic elements (photo- chemical mechanism and solver, photolysis scheme, meteorological fields, numerical transport scheme), they produce different results for the future recovery of stratospheric ozone as chlorofluorcarbons decrease. Three simulations will be contrasted: the Global Modeling Initiative (GMI) CTM driven by a single year\'s winds from a general circulation model; the GMI CTM driven by a single year\'s winds from a data assimilation system; the NASA GSFC CTM driven by a winds from a multi-year GCM simulation. CTM results for ozone and other constituents will be compared with each other and with observations from ground-based and satellite platforms to address the following: Does the simulated ozone tendency and its latitude, altitude and seasonal dependence match that derived from observations? Does the balance from analysis of observations? Does the balance among photochemical processes match that expected from observations? Can the differences in prediction for ozone recovery be anticipated from these comparisons?

Author

Atmospheric General Circulation Models; Ozone; Photochemical Reactions

20040084081 NASA Goddard Space Flight Center, Greenbelt, MD, USA

3D Radiative Transfer in Cloudy Atmospheres

Marshak, Alexander; Davis, Anthony B.; LeBlanc, Lisa; [2004]; 1 pp.; In English; AGU Spring Annual Meeting, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

3D cloud radiative community has matured enough to prepare a volume on 3D radiative transfer in cloudy atmosphere that will be published by Springer-Verlag this year. Many leading 3D radiative transfer scientists are amongst the co-authors of the book. The book starts with the basic 3D radiative transfer problem, describes its solutions and models, discusses the effects of cloud inhomogeneity for remote sensing, addresses climate problems in realistic atmosphere and studies cloud-vegetation interactions.

Author

Radiative Transfer; Climate; Clouds (Meteorology); Remote Sensing

20040084182 Iowa Univ., Iowa City, IA, USA

Wind-driven Rivulet Break-off in Conditions Ranging from 0G to 1G

Ettema, R.; Marshall, J. S.; McAlister, G.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 71; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A study has been performed of the wind-driven breakup of rivulets on a horizontal plate subject to different normal gravitational states, ranging from zero-gravity to terrestrial gravity conditions (1g), and also including some data for partial gravity conditions (between 0.1g and 0.38g). The experiments were conducted both in our laboratory at the University of Iowa and on board the NASA KC-135, parabolic flight aircraft. The wind-driven rivulets exhibit a break-off phenomenon over a broad range of flow rates, in which a head at the tip of the rivulet breaks off periodically to form a droplet that advects down the plate. The rivulet break-off phenomena is found to be sensitive to the normal gravitational force acting on the plate. For instance, the frequency of rivulet break-off is nearly an order of magnitude greater in the 0g condition than it is for the same flow in the 1g condition. During the rivulet break-off event, a droplet detaches from the end of the rivulet and advects downstream on the plate. The detached droplet shape and behavior are observed to be quite different between the 0g and 1g cases. It is furthermore found in all cases examined that wind-driven rivulet and droplet flows are markedly different from gravitationally driven flows (e.g., flow down an inclined plate). These differences arise primarily from the role of form drag on the droplets and on the raised ridge of the rivulet head near the moving contact line.
Author
Microgravity; Wind (Meteorology); Parabolic Flight; Gravitation

20040084232 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: April 2004
April 2004; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the April 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.
CASI
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

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*.

20040081070 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Use of IRI to Model the Effect of Ionosphere Emission on Earth Remote Sensing at L-Band
Abraham, Saji; LeVine, David M.; 2004; 1 pp.; In English; Advanced in Space Research, Feb. 2004, USA; No Copyright; Avail: Other Sources; Abstract Only

Microwave remote sensing in the window at 1.413 GHz (L-band) set aside for passive use only is important for monitoring sea surface salinity and soil moisture. These parameters are important for understanding ocean dynamics and energy exchange between the surface and atmosphere, and both NASA and ESA plan to launch satellite sensors to monitor these parameters at L-band (Aquarius, Hydros and SMOS). The ionosphere is an important source of error for passive remote sensing at this frequency. In addition to Faraday rotation, emission from the ionosphere is also a potential source of error at L-band. As an aid for correcting for emission, a regression model is presented that relates ionosphere emission to the integrated electron density (TEC). The goal is to use TEC from sources such as TOPEX, JASON or GPS to obtain estimates of emission over the oceans where the electron density profiles needed to compute emission are not available. In addition, data will also be presented to evaluate the use of the IRI for computing emission over the ocean.
Author
Microwave Imagery; Remote Sensing; Salinity; Ocean Surface; Regression Analysis; Soil Moisture; Ocean Dynamics

20040082196 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Airborne Spectral Measurements of Ocean Directional Reflectance
Gatebe, Charles K.; King, Michael D.; Lyapustin, Alexei; Arnold, G. Thomas; Redemann, Jens; [2004]; 58 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy

During summer of 2001 NASA's Cloud Absorption Radiometer (CAR) obtained measurement of ocean angular distribution of reflected radiation or BRDF (bidirectional reflectance distribution function) aboard the University of Washington Convair CV-580 research aircraft under cloud-free conditions. The measurements took place aver the Atlantic Ocean off the eastern seaboard of the U.S. in the vicinity of the Chesapeake Light Tower and at nearby National Oceanic and Atmospheric Administration (NOAA) Buoy Stations. The measurements were in support of CLAMS, Chesapeake Lighthouse and Aircraft Measurements for Satellites, field campaign that was primarily designed to validate and improve NASA's Earth Observing System (EOS) satellite data products being derived from three sensors: MODIS (MODerate Resolution Imaging Spectro-Radiometer), MISR (Multi-angle Imaging Spectro-Radiometer) and CERES (Clouds and Earth s Radiant Energy System). Because of the high resolution of the CAR measurements and its high sensitivity to detect weak ocean signals against a noisy background, results of radiance field above the ocean are seen in unprecedented detail. The study also attempts to validate the widely used Cox-Munk model for predicting reflectance from a rough ocean surface.
Author
Spectrum Analysis; Radiation Measurement; Reflected Waves

20040082496 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Bio-Optical and Geochemical Properties of the South Atlantic Subtropical Gyre
Signorini, S. R.; Hooker, Stanford B.; McClain, Charles R.; December 2003; 48 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2003-212253; Rept-2004-00663-0; No Copyright; Avail: CASI; A03, Hardcopy

An investigation of the bio-optical properties of the South Atlantic subtropical gyre (SASG) was conducted using data primarily from the UK Atlantic Meridional Transect (AMT) program and SeaWiFS. The AMT cruises extend from the UK to the Falklands Islands (sailing on the RRS James Clark Ross) with the purpose of improving our knowledge of surface layer hydrography, biogeochemical processes, ecosystem dynamics and food webs across basin scales in the Atlantic Ocean. Two objectives of the AMT program relevant to this study are the characterization of biogeochemical provinces and the analysis of optical and pigment parameters in connection with remote sensing ocean color data. The primary focus of this NASA Technical Memorandum is on the variability of the vertical distribution of phytoplankton pigments and associated absorption properties across the SASG, and their relevance to remote sensing algorithms. Therefore, a subset of the AMT data within the SASG from all available cruises was used in the analyses. One of the challenges addressed here is the determination of the SASG geographic boundaries. One of the major problems is to reconcile the properties of biogeochemical provinces. We use water mass analysis, dynamics of ocean currents, and meridional gradients of bio-optical properties, to identify the SASG boundaries.
Derived from text
Gyres; Biogeochemistry; Geochemistry; Atlantic Ocean; Optical Properties

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*.

20040081071 NASA Ames Research Center, Moffett Field, CA, USA
Lipid Biomarkers for a Hypersaline Microbial Mat Community
Jahnke, Linda; Orphan, Victoria; Embaye, Tsegereda; Turk, Kendra; Kubo, Mike; Summons, Roger; March 03, 2004; 1 pp.; In English; Astrobiology Science Conference, 28 Mar. - 1 Apr. 2004, Moffett Field, CA, USA
Contract(s)/Grant(s): RTOP 344-58-92-10; No Copyright; Avail: Other Sources; Abstract Only

The use of lipid biomarkers and their carbon isotopic compositions are valuable tools for establishing links to ancient microbial ecosystems. Various lipids associated with specific microbial groups can serve as biomarkers for establishing organism source and function in contemporary microbial ecosystems (membrane lipids), and by analogy, potential relevance to ancient organic-rich sedimentary rocks (geolipids). As witnessed by the stromatolite record, benthic microbial mats grew

in shallow water lagoonal environments. Our recent work has focused on lipid biomarker analysis of a potential analogue for such ancient mats growing in a set of hypersaline evaporation ponds at Guerrero Negro, Baja California Sur, Mexico. The aerobic, surface layer of this mat (0 to 1 mm) contained a variety of ester-bound fatty acids (FA) representing a diverse bacterial population including cyanobacteria, sulphate reducers (SRB) and heterotrophs. Biomarkers for microeukaryotes detected in this layer included sterols, C-20 polyunsaturated FA and a highly branched isoprenoid, diagnostic for diatoms. Cyanobacteria were also indicated by the presence of a diagnostic set of mid-chain methylalkanes. C-28, to C-34 wax esters (WXE) present in relatively small amounts in the upper 3 mm of the mat are considered biomarkers for green non-sulphur bacteria. Ether-bound isoprenoids were also identified although in considerably lower abundance than ester-bound FA (approx. 1:l0). These complex ether lipids included archatol, hydroxyarchaeol and a C-40 tetraether, all in small amounts. After ether cleavage with boron tribromide, the major recovered isoprenyl was a C-30:1. This C(sub 30;1) yelded squalane after hydrogenation, a known geobiomarker for hypersaline environments in ancient oils and sediments. In this mat, it represents the dominant Archaeal population. The carbon isotopic composition of biomarker lipids were generally depleted relative to the bulk organic material (delta C-13 TOC -10%). Most depleted were the cyanobacterial methylalkanes at -27% with FA such as the SRB biomarker, 10- methyl C-I6, somewhat heavier at -16%, and WXE at -17%. The C-30:1 isoprenyl was most enriched with delta C-13 in the -7 to -11% range, much too heavy to represent the methanogen population responsible for mat methane values measured at -60%.
Author
Biomarkers; Lipids; Carbon Isotopes; Microorganisms; Ecosystems; Isotopic Labeling; Ocean Bottom

20040081073 NASA Ames Research Center, Moffett Field, CA, USA
Decreased Estrogen May Contribute to Osteopenia in Unloaded Bones
Tou, Janet; Arnaud, Sara; Grindeland, Richard; Wade, Charles; [2004]; 1 pp.; In English; American Society for Bone and Mineral Research, Jun. 2004
Contract(s)/Grant(s): 121-10-20; 121-10-40; 121-10-50; No Copyright; Avail: Other Sources; Abstract Only

Progressive loss of weight-bearing bone in astronauts is one of the most serious impediments to long-duration spaceflight. Estrogen deficiency in women is an established factor in bone loss. Reduced sex hormone levels have been reported in male astronauts, but no data is available regarding spaceflight effects on female sex hormones. The objective of our study was to determine the role of estrogen in disuse osteopenia. The NASA developed hindlimb suspension (HLS) model was used to simulate the unloading disuse of weight-bearing bones experienced in space. Female Sprague-Dawley rats (age 77d; n = 20/group) were HLS or kept ambulatory (AMB) for 38 d and endocrine and bone indices determined. HLS of rats resulted in lower (p less than 0.01) bone mass (9%0), bone mineral content (BMC 13%) and mechanical strength (28%) compared to AMB animals. Plasma estradiol (E2) was lower (p = 0.03) in HLS (10.1 +/- 1.4 pg/ml) compared to AMB rats (16.7 +/- 2.6 pg/ml). E2 was positively correlated to BMC r(sup 2) = 0.67 and mechanical strength r(sup 2) = 0.61. These results suggest that reduced E2 plays a role in disuse osteopenia induced by HLS. Plasma or pituitary lutenizing hormone (LH) and follicle stimulating hormone (FSH) levels were not different in HLS versus AMB rats. However, pituitary LH was correlated to E2 (r(sup 2) = 0.57), suggesting changes in E2 were exerted at the level of the hypothalamus-pituitary axis. Understanding the role of estrogen in disuse osteopenia is necessary to the development of efficacious therapies for female astronauts, bed rest patients and the increasing number of individuals in our sedentary population suffering bone loss.
Author
Estrogens; Bone Demineralization

20040081497 Hiroshima Univ., Japan
Hiroshima Journal of Medical Sciences, Volume 52, No. 1
Yoshida, Tetsuya, Editor; Chayama, Kazuaki, Editor; Kikuchi, Akira, Editor; Kurisu, Kaoru, Editor; Ogata, Nobukuni, Editor; Watanabe, Hiromitsu, Editor; Hide, Michihiro, Editor; Kojima, Tohru, Editor; Miyamae, Tamako, Editor; Ohta, Shigeru, Editor, et al.; March 2003; ISSN 0018-2052; 22 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The titles in this issue include: 1) Analysis of Cancer Mortality among Atomic Bomb Survivors in Hiroshima Prefecture, 1968-1997; 2) Inhibition by Long-term Fermented Miso of Induction of Pulmonary Adenocarcinoma by Diisopropanolnitrosamine in Wistar Rats; 3) Subsequent Rupture after Clip on Wrap Method for Ruptured Dissecting Aneurysm of the Distal Middle Cerebral Artery: A case report and review of the literature.
CASI
Medical Science; Radiation Effects; Human Beings; Cancer; Clinical Medicine

20040082181 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A New Method for Estimating Bacterial Abundances in Natural Samples using Sublimation

Glavin, Daniel P.; Cleaves, H. James; Schubert, Michael; Aubrey, Andrew; Bada, Jeffrey L.; [2004]; 31 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We have developed a new method based on the sublimation of adenine from Escherichia coli to estimate bacterial cell counts in natural samples. To demonstrate this technique, several types of natural samples including beach sand, seawater, deep-sea sediment, and two soil samples from the Atacama Desert were heated to a temperature of 500 C for several seconds under reduced pressure. The sublimate was collected on a cold finger and the amount of adenine released from the samples then determined by high performance liquid chromatography (HPLC) with UV absorbance detection. Based on the total amount of adenine recovered from DNA and RNA in these samples, we estimated bacterial cell counts ranging from approx. l0(exp 5) to l0(exp 9) E. coli cell equivalents per gram. For most of these samples, the sublimation based cell counts were in agreement with total bacterial counts obtained by traditional DAPI staining. The simplicity and robustness of the sublimation technique compared to the DAPI staining method makes this approach particularly attractive for use by spacecraft instrumentation. NASA is currently planning to send a lander to Mars in 2009 in order to assess whether or not organic compounds, especially those that might be associated with life, are present in Martian surface samples. Based on our analyses of the Atacama Desert soil samples, several million bacterial cells per gam of Martian soil should be detectable using this sublimation technique.

Author

Deoxyribonucleic Acid; Bacteria; Escherichia; Ocean Bottom; Sea Water; Soil Sampling

20040082222 NASA Marshall Space Flight Center, Huntsville, AL, USA

Purification and Crystallization of Murine Myostatin: A Negative Regulator of Muscle Mass

Hong, Young S.; Adamek, Daniel; Bridge, Kristi; Malone, Christine C.; Young, Ronald B.; Miller, Teresa; Karr, Laurel; [2004]; 1 pp.; In English; American Society for Biochemistry and Molecular Biology, 12-16 Jun. 2004, Boston, MA, USA Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Myostatin (MSTN) has been crystallized and its preliminary X-ray diffraction data were collected. MSTN is a negative regulator of muscle growt/differentiation and suppressor of fat accumulation. It is a member of TGF-b family of proteins. Like other members of this family, the regulation of MSTN is critically tied to its process of maturation. This process involves the formation of a homodimer followed by two proteolytic steps. The first proteolytic cleavage produces a species where the n-terminal portion of the dimer is covalently separated from, but remains non-covalently bound to, the c-terminal, functional, portion of the protein. The protein is activated upon removal of the n-terminal ″pro-segment″ by a second n-terminal proteolytic cut by BMP-1 in vivo, or by acid treatment in vitro. Understanding the structural nature and physical interactions involved in these regulatory processes is the objective of our studies. Murine MSTN was purified from culture media of genetically engineered Chinese Hamster Ovary cells by multicolumn purification process and crystallized using the vapor diffusion method.

Author

Purification; Crystallization; In Vitro Methods and Tests; In Vivo Methods and Tests; X Ray Diffraction; Data Acquisition

20040082384 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA

Solution-Phase Processes of Macromolecular Crystallization

Pusey, Marc L.; Minamitani, Elizabeth Forsythe; [2004]; 1 pp.; In English; 10th International Conference on the Crystallization of Biological Macromolecules, 5-8 Jun. 2004, Beijing, China; No Copyright; Avail: Other Sources; Abstract Only

We have proposed, for the tetragonal form of chicken egg lysozyme, that solution phase assembly processes are needed to form the growth units for crystal nucleation and growth. The starting point for the self-association process is the monomeric protein, and the final crystallographic symmetry is defined by the initial dimerization interactions of the monomers and subsequent n-mers formed, which in turn are a function of the crystallization conditions. It has been suggested that multimeric proteins generally incorporate the underlying multimers symmetry into the final crystallographic symmetry. We posed the question of what happens to a protein that is known to grow as an n-mer when it is placed in solution conditions where it is monomeric. The trypsin-treated, or cut, form of the protein canavalin (CCAN) has been shown to nucleate and grow crystals as a trimer from neutral to slightly acidic solutions. Under these conditions the solution is composed almost wholly of trimers. The insoluble protein can be readily dissolved by weakly basic solution, which results in a solution that is monomeric. There are three possible outcomes to an attempt at crystallization of the protein under monomeric (high pH) conditions: 1) we will

obtain the same crystals as under trimer conditions, but at different protein concentrations governed by the self association equilibria; 2) we will obtain crystals having a different symmetry, based upon a monomeric growth unit; 3) we will not obtain crystals. Obtaining the first result would be indicative that the solution-phase self-association process is critical to the crystal nucleation and growth process. The second result would be less clear, as it may also reflect a pH-dependent shift in the trimer-trimer molecular interactions. The third result, particularly for experiments in the transition pH's between trimeric and monomeric CCAN, would indicate that the monomer does not crystallize, and that solution phase self association is not part of the crystal nucleation and growth path. Results are presented for crystallization experiments of CCAN over the pH 6.8 to 9.6 range.
Author
Crystallization; Molecular Interactions; Protein Crystal Growth

20040082643 Civil Aeromedical Inst., Oklahoma City, OK
Simultaneous Determination of Cocaine, Cocaethylene, and Their Possible Pentafluoropropylated Metabolites and Pyrolysis Products by Gas Chromatography/ Mass Spectrometry
Cardona, Patrick S.; Chaturvedi, Arvind K.; Soper, John W.; Canfield, Dennis V.; Dec. 2003; 19 pp.; In English
Report No.(s): AD-A423601; DOT-FAA-AM-03-24; No Copyright; Avail: CASI; A03, Hardcopy

During the investigation of fatal transportation accidents, samples from victims are also analyzed for drugs including cocaine (COC), COC is abused by smoking, nasal insufflantion, and intravenous injection, and it is also taken with ethanol. Therefore, it is important to determine concentrations of COC and its metabolites ethanol analogs, and pyrolysis products for establishing the degree of toxicity that possible ingestion of ethanol, and the possible route of administration. In this study a sensitive and selective procedure is developed for the simultaneous analyses of COC, benzoylecgonine norbenzoylecgonine norcocaine, ecgonine ecgonine ethyl ester, in blood, urine, and muscle homogenate. In the analysis, available deuterated analogs of these analytes were used as internal standards. Proteins from blood and muscle homogenate were precipitated with cold acetonitrile. After the removal of acetonitrile by evaporation the supernatants and urine were extracted by solid-phase chromatography. The eluted analytes were converted to hydrochloride salts and derivatized with pentafluoropropionic anhydride and 2,2,3,3,3-pentafluoro-1 propanol.
DTIC
Gas Chromatography; Mass Spectroscopy; Metabolites; Narcotics; Pyrolysis; Toxicology

20040082649 Rush-Presbyterian-Saint Luke's Medical Center, Chicago, IL
Noninvasive Detection of Microdamage in Bone
Sumner, Dale R.; Oct. 2003; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0811
Report No.(s): AD-A423612; No Copyright; Avail: CASI; A03, Hardcopy

This concept exploration proposal seeks to determine if a novel x-ray technique called diffraction enhanced imaging, which provides dramatic gains in contrast over conventional radiography, can be used to identify microdamage in bone non-invasively. This technique has been used successfully in soft tissues, including recent studies by our group to detect damage in articular cartilage. Here, we plan to extend our work to studies relevant to microdamage accumulation and repair in bone. Interest in microdamage in bone comes in part from its likely role in the etiology of stress fractures. In addition, microdamage accumulation may contribute to osteoporotic fractures and loosening of dental or orthopedic implants. Our working hypothesis is that microdamage in bone can be detected non-invasively by diffraction enhanced imaging because this imaging modality expands the ability of x-rays to record refraction and scatter rejection (extinction) as well as absorption. No matter the spatial scale of the fracture feature, diffraction enhanced imaging has a contrast mechanism suited to make the feature visible. We outlined two specific aims, with initiation of specific aim 2 dependent upon successful completion of specific aim 1. Although there were some positive indications in a series of six experiments, it is not yet clear that microdamage can be detected by DEI. Our conclusion is that a number of technical limitations, especially the resolution of the detector, inhibited our ability to give the hypothesis the best test.
DTIC
Bones; Fractures (Materials); X Ray Diffraction

20040082650 Pennsylvania Univ., Philadelphia, PA
Quality of Life and Cost of Care of Prostate Cancer Patients
Jayadevappa, Ravishankar; Jan. 2004; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0126
Report No.(s): AD-A423613; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study is to assess the effects of differential treatments for PC on quality of life and cost of care for the elderly across ethnic groups. Another issue of interest is the comparison of cost and quality of care for PC provided in two distinct health care systems: Veterans Affairs (VA) and non-VA. Three specific study aims are: (1) to analyze and compare the quality of life and satisfaction with care of PC patients across two ethnic (African Americans and Caucasians) groups, controlling for stage at diagnosis and co-morbidity; (2) to analyze and compare the average cost of care of PC patients across two ethnic groups, controlling for the stage at diagnosis and co- morbidity; and (3) to analyze and compare resource utilization, treatment modalities, and cost of PC care between VA and non- VA hospital. During the first two years of this prospective cohort study, we recruited 316 patients form the Urology and Radiation Oncology clinics, University of Pennsylvania Health System and VA medical center. Of these, 209 have completed 3- month follow-up survey and 151 have completed the 12 month follow-up surveys. The preliminary results have helped the PI in securing a Prostate Cancer scholar award from the DOD and a R03 grant from the NIH.
DTIC
Cancer; Cost Analysis; Life (Durability); Life Cycle Costs; Medical Science; Patients; Prostate Gland

20040082652 Chicago Univ., Chicago, IL
Characterization of a Dopaminergic Stimulatory Factor Derived From Monoclonal Cell Lines of Striatal Origin
Heller, Alfred; Oct. 2003; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0819
Report No.(s): AD-A423626; No Copyright; Avail: CASI; A03, Hardcopy

Unique dopaminergic modulatory polypeptide factors have been obtained form the lysate of an immortalized monoclonal cell derived for the mouse striatum (X61). Partially purified preparations of the lysate are capable of increasing the dopamine content of hybrid monoclonal dopaminergic cells of mesencephalic origin and preventing the loss of primary dopaminergic neurons in the absence of target cells. The monoclonal derived dopaminergic stimulatory factor has undergone a 50,000-fold purification sufficient to permit mass spectrographic and amino acid sequence analysis of the purified fractions. Based on this data, polypeptide fractions of known amino acid composition have been synthesized and are being examined for stimulatory activity in monoclonal dopaminergic cells and for the ability to prevent loss of primary dopaminergic neurons in the absence of striatal target cells. The availability of polypeptides of know molecular structure will also permit assessment of whether such agents are capable of preventing of reversing the motor deficits seen in experimental models involving loss of the dopaminergic neurons of the nigrostriatal projection. Polypeptide factors of low molecular weight which modulate neuronal monoaminergic function are of considerable interest in terms of their therapeutic potential in a variety of neurologic disorders including Parkinson's disease.
DTIC
Antibodies; Diseases; Dopamine; Nervous System; Neurophysiology; Peptides

20040082653 Air Force Logistics Management Center, Gunter AFS, AL
Air Force Journal of Logistics. Volume 14, Number 3, Summer 1990
Jan. 1990; 44 pp.; In English
Report No.(s): AD-A423627; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force Journal of Logistics provides an open forum for the presentation of issues, ideas, research, and information of concern to logisticians who plan, acquire, maintain, supply, transport, and provide supporting engineering and services for military aerospace forces. It is a non-directive, quarterly periodical published under AFR 5-1. This particular issue concern military medicine. Some of the topics include: Operation Just Cause: A Medical Logistics Perspective; Waste Management in Air Force Medical Facilities; Technology Explosion in Healthcare; Specialized Medical Contracting Activity; Medical Logistics in Vietnam; Integer of Logistics: A Productivity and Quality of Work Life Initiative and current research, logistics policy insight, career and personnel information.
DTIC
Logistics; Medical Services; Military Operations; Summer

20040082657 Assistant Secretary of Defense (Nuclear and Chemical and Biological Defense Programs), Washington, DC
Biological Weapons and Bioterorism Threats: The Role of Vaccines in Protecting the Military and Civilian Sectors
Johnson, Anna; Apr. 2, 2002; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423650; No Copyright; Avail: CASI; A03, Hardcopy

These viewgraphs are concerned with biological weapons and bioterrorism threats and the role of vaccines in protecting

the military and civilian sectors. The viewgraphs show threats, DoD medical biological defense capabilities, and civilian and military responses to the threats.
DTIC
Biological Weapons; Health; Vaccines

20040082664 Michigan Univ., Ann Arbor, MI
Defining Decision Support for Women With Recurrent Breast Cancer
Pierce, Penny F.; Oct. 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0565
Report No.(s): AD-A423661; No Copyright; Avail: CASI; A03, Hardcopy

The intention of this study is to close the gaps in our knowledge regarding the decision-making experiences, challenges, and frustrations of women when breast cancer recurs. Therefore, the specific aims of this project are to: (1) provide a robust description of decision making processes of women faced with recurrent disease, (2) to describe preferences and values instrumental in the selection of treatment options (e.g., clinical trials, alternative therapies, adjuvant therapies, or no treatment), (3) to describe the manner in which previous treatment decision making experiences are, or are not influential, and lastly, (4) to describe the appraisals of decision processes and outcomes to identify those factors that contribute to, or impede, quality decision making. Approximately 50 women recently diagnosed with recurrent disease will be recruited to participate in a semi-structured qualitative interview to describe her decision making experiences including her values and preferences regarding treatment. Major Findings : A Post- Award Change Approval was granted to modify the performance period to 10 Sep 2003 to 9 Sep 2004 due to extenuating circumstances surrounding the events of September 11, 2001 (PI is Commander of an Aeromedical Evacuation Squadron heavily involved in OEF and OIF activities) and the process of obtaining approval of 3 IRPs.
DTIC
Cancer; Decision Support Systems; Females; Mammary Glands; Stress (Psychology)

20040082669 Wayne State Univ., Detroit, MI
Development of Pro-Peptide Immunotherapy for Breast Cancer
Wei, Wei-Zen; Jul. 2003; 28 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9244
Report No.(s): AD-A423668; No Copyright; Avail: CASI; A03, Hardcopy

The proposed study will test the hypothesis that solid tumors can be eliminated by immunizing the host with specific foreign peptides and by delivering these peptides to the tumors in the form of pro-peptides which are activated at the tumor sites. This immunotherapy approach takes advantage of the potent tumor destruction capacity of T cells and is independent of self tumor-antigens. The therapeutic peptides will be conjugated to glucuronide through a spacer to form pro- peptides which will have increased aqueous solubility and no longer bind the MHC. Glucuronidase liberated by the tumor cells and tumor infiltrating inflammatory cells is expected to convert the pro-peptides to the active, MHC binding peptides in the vicinity of the tumor mass. The potent peptide specific CTL in vivo are expected to kill the tumor cells or the stromal/endothelial cells surrounding the tumor bed when these cells are marked on their MHC by the liberated peptides, achieving the goal of immunotherapy with foreign peptides. The technical objectives are to (1) Establish an in vitro assay to measure tumor growth inhibition by peptide specific T cells and pro-peptides, (2) synthesize and test the activity of pro- peptides to be activated by beta-glucuronidase at the tumor site and (3) Develop human anti- MP58 CTL line and measure pro- peptide activity with anti-MP58 CTL.
DTIC
Cancer; Mammary Glands; Neoplasms; Peptides

20040082670 Texas A&M Univ., College Station, TX
Inhibitory Ah Receptor - Androgen Receptor Crosstalk in Prostate Cancer
Safe, Stephen H.; Feb. 2004; 29 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0147
Report No.(s): AD-A423669; No Copyright; Avail: CASI; A03, Hardcopy

Treatment for prostate cancer depends on multiple factors including the stage of the tumor and expression of the androgen receptor (AR). Endocrine therapy can be used for treatment of early stage androgen-responsive tumors, whereas chemotherapy for later stage androgen- nonresponsive tumors is problematic. We have investigated the aryl hydrocarbon receptor (AhR) as

a potential target for treating prostate cancer using a new series of relatively non-toxic selective AhR modulators (SAhRMs). Initial studies show that 22RV1, PC3 and LNCaP prostate cancer are Ah-responsive and 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD) induces CYplAl-dependent activities in all three cell lines. Moreover, two SAhRMs, namely diindolylmethane (DIM) and 6-methyl-l,3,8- trichlorodibenzofuran (6-MCDF) inhibit growth of AR-positive 22RVl and AR-negative PC3 prostate cancer cells. In addition, AhR ligands inhibit dihydrotestosterone-induced upregulation of AR protein in 22RV1 cells suggesting a possible mechanism for inhibitory AhR-AR crosstalk. The growth inhibitory effects of SAhRMs in PC3 cells suggests that AhR ligands also inhibit growth of androgen- nonresponsive cells.
DTIC
Cancer; Crosstalk; Hormones; Males; Prostate Gland

20040082671 Assistant Secretary of Defense (Nuclear and Chemical and Biological Defense Programs), Washington, DC
Anthrax and Other Vaccines: Use in the U.S. Military
Aug. 5, 2001; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423670; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Infectious Diseases; Vaccines

20040082672 Northwestern Univ., Evanston, IL
Enhancement of Intermittent Androgen Ablation Therapy by Finasteride Administration in Animal Models
Wang, Zhou; Feb. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0113
Report No.(s): AD-A423671; No Copyright; Avail: CASI; A03, Hardcopy
One critically important problem in prostate cancer research is to find new approaches to slow down the transition of prostate cancer from an androgen-dependent state to a lethal androgen-refractory state. Intermittent androgen ablation therapy may slow down the development of androgen refractory tumors because intermittent recovery of androgens can induce differentiation of prostatic epithelial cells. However, the advantage of inducing differentiation of prostate cancer cells by intermittent recovery of androgens is compromised by the disadvantage of androgenic induction of prostate cancer cell proliferation. The biologically most active androgen is dihydrotestosterone (DHT) which is converted from testosterone (T) by Sa-reductase. Our recent studies showed that T is more potent than DHT in enhancing differentiation but weaker in stimulating proliferation, which led to our hypothesis that intermittent androgen suppression (IAS) can be enhanced by finasteride, an inhibitor of T to DHT conversion. We have worked out conditions to deliver T and finasteride over a long time period in nude mice, which allowed us to test our hypothesis. Our experiments recently showed that finasteride administration during IAS significantly slowed the growth of LNCaP tumors.
DTIC
Ablation; Animals; Augmentation; Cancer; Hormones; Males; Prostate Gland; Therapy

20040082673 California Univ., Berkeley, CA
Expression Profiling of Tyrosine Kinase Genes
Weier, Heinz-Ulrich; Aug. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9250
Report No.(s): AD-A423672; No Copyright; Avail: CASI; A03, Hardcopy
The expression of genes involved in signal transduction (e.g. protein kinases) is often altered in tumors. The aberrant expression of several of these genes typically parallels the progression toward a more malignant phenotype. We developed a cDNA micro-array based screening system to measure the level of expression of tyrosine kinase (tk) genes. The hardware for preparation of cDNA micro-arrays and basic protocols for hybridization were developed in the first year. In the second year, we finished isolating RNA and cDNA synthesis from 16 breast cancer cell lines and 10 frozen tissues. We optimized protocols for tk-specific PCR amplification and cloning. We continued our DNA sequencing effort and added additional targets to our micro-arrays. Using well-characterized breast cancer cell lines, the system delivered reproducible results about tk gene expression during cell transformation and progression toward a more malignant phenotype. Comparing the absolute expression levels from cDNA micro-arrays with data from Northern blot analyses suggested that our initial approach using mixed-based oligonucleotide primers led to lowered representation of highly abundant transcripts. This problem has been addressed with a new oligonucleotide primer design based on known gene sequences and a two step DNA amplification

protocol that now allows to investigate the tk gene expression in small tissue samples.
DTIC
Cancer; Genes; Mammary Glands; Tyrosine

20040082674 Harvard Medical School, Boston, MA
Characterization of Two Novel Oncogenic Pathways Collaborating With Loss of p53 or Activated Neu in Mouse Models of Breast Cancer
Lu, Jiangrong; Leder, Philip; Sep. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0402
Report No.(s): AD-A423676; No Copyright; Avail: CASI; A02, Hardcopy

Cancer is a complex multi step disease and progresses through successive accumulation of genetic mutations. Loss of tumor suppressor gene p53 and activation of oncogene Neu/ErbB2 are among the most frequent genetic alterations in human breast cancer. We performed a retroviral insertional mutagenesis screen to identify gene 5 that my contribute to mammary tumor formation in conjunction with deregulated p53 or Neu. Multiple proviral insertions form independent tumors were identified to be located within introns of the F-Box gene Fbw4, suggesting that the structural alteration at this locus may provide selective growth advantage. The viral integrations result in marked overexpression of a novel Fbw4 short isoform, which is also spontaneously enriched in several mouse and human breast cancer cell lines and thus appears to be associated with tumor formation. Overexpression of this short isoform in the normal' mouse mammary epithelial cell line NMuMg enable these cells to grow in soft agar. Taken together, these findings suggest that Fbw4 in a novel cancer- relevant gene. We propose a mechanism related to Fbw4's oncogenic properties.
DTIC
Cancer; Carcinogens; Losses; Mammary Glands; Mice; Tumors

20040082675 Stanford Univ., Stanford, CA
Development of Gutless Adenoviral Vectors Encoding Anti Angiogenic Proteins for Therapy of Prostate Cancer
Kuo, Calvin J.; Feb. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0143
Report No.(s): AD-A423678; No Copyright; Avail: CASI; A03, Hardcopy

The current work describes the development of technologies for long-term viral expression of soluble VEGF receptor anti-angiogenic proteins for therapeutic use in prostate cancer. Two technologies are described, ″Gutless″ adenoviruses and Adeno-associated viruses (AAV). Gutless adenoviruses have been reported to be capable of \g 1 year trans gene expression but their large-scale production is severely limited by helper virus and replication-competent adenovirus contamination. Several approaches for generation for pure gutless adenoviruses expressing the anti-angiogenic soluble Flk-l VEGF receptor, towards achieving therapeutic responses which are more durable than conventional adenoviruses: (1) generation of a gutless adenoviral production method using 1-Scel-dependent packaging signal deleting and viral genome recombination to inactivate helper virus, (2) generation of completion cell lines for gutless vectors using episomal or stable expression of helper genomes. Additionally, the use of adeno-associated viruses encoding either conventional soluble VEGF receptors or new variants with superior pharmacokinetic properties is described.
DTIC
Cancer; Coding; Prostate Gland; Proteins; Therapy

20040082676 Washington Univ., Saint Louis, MO
Chromatin Structure and Breast Cancer Radiosensitivity
Pandita, Tej K.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0356
Report No.(s): AD-A423679; No Copyright; Avail: CASI; A02, Hardcopy

The hMOF protein is a chromatin-modifying factor. Chromatin structure plays a critical role in gene expression. Since hMOF has a chromodomain region as well as acetyl trasferase activity, its inactivation can influence modification of chromatin during DNA metabolism. The proposed experiments of this grant proposal will determine functions of hMOF gene. This will be achieved by generating isogenic cells with and without hMOF function. Both in vivo and in vitro experiments will be performed to determine the function of liMOF in context with radioresponsiveness and oncogene transformation. If hMOF proves to be involved in the radioresponsiveness and neoplastic transformation, then the clinical implications of this proposal are highly significant. It may, in the future, be prudent to screen each breast cancer patient prior to any final therapeutic

decision. This will be accomplished through the use of quantitative RT-PCR and the test results can be obtained within a day. There are several benefits of identifying an individual's normal tissue with loss of hMOF gene expression. First, it will allow us to prospectively identify the sensitive subset of patients. Second, the radiosensitive patients will be taken for an alternative therapy if exist and would be spared a great deal of suffering. Third, it will be possible that once we identify a subset of patients that show a genetic basis of radiation sensitivity, the radiation dose to the remaining breast patients could be increased to be more effective for local tumor control. Fourth, it will provide health professionals a molecular diagnostic approach to predict the suitability of an individual for radiotherapy.
DTIC
Cancer; Mammary Glands; Proteins; Radiation Tolerance

20040082677 Texas Univ., Houston, TX
Targeting Human Breast Cancer Cells that Overexpress HER-2/neu mRNA by an Antisense Iron Responsive Element
Yan, Duen-Hwa; Dec. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9270
Report No.(s): AD-A423682; No Copyright; Avail: CASI; A03, Hardcopy

In this project, we attempt to establish the utility of an antisense iron-responsive element (AS-IRE) - mediated gene expression system to targeting HER-2/ neu- overexpressing breast cancer cells. During the funding period, we have finished the proposed goal stated in Task 1 by identifying the optimal″ HER-2/ neu antisense IRE, i.e., AS- IRE4. Moreover, we showed preferential cell killing in HER- 2/neu-overexpressing MDA-MB-453 cells using hTERT-AS-IRE4-Bax as opposed to in low HER-2/neu-expressing MDA-MB-468 cells (Task 2).
DTIC
Cancer; Iron; Mammary Glands

20040082678 Jackson (Henry M.) Foundation, Rockville, MD
Molecular Biology and Prevention of Endometrial Cancer
Maxwell, George L.; Jul. 2003; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0183
Report No.(s): AD-A423688; No Copyright; Avail: CASI; A03, Hardcopy

To increase our understanding of the molecular aberrations associated with endometrial carcinogenesis and the biologic mechanisms underlying the protective effect of oral contraceptive therapy. Methods: 1) Both cDNA and oligonucleotide microarray analysis was performed on a panel of endometrial cancers. 2) A subset of adenocarcinomaa cases from the International DES Registry was analyzed for MSI and the poor quality of the DNA from many of these cases prohibited an adequate analysis of the entire set. The cases are currently being evaluated for PTEN expression. 3) We analyzed the Cancer and Steroid Hormone (CASH) database to determine if higher progestin potency confers a more protective effect against endometrial cancer. 4) Finally, we are in the process of analyzing the endometrium form cymologous macaques that were exposed to long term progestins as part of the three year randomized controlled trial. Results: 1) Different histological types of endometrial cancer have unique genomic expression patterns. 2) The rate of MSI in cancers that develop after a perinatal exposure to DES is lower than previously reported. 3) The potency of the progestin in most oral contraceptives appears adequate to provide a protective effect against endometrial cancer.
DTIC
Cancer; Molecular Biology; Prevention; Reproductive Systems

20040082686 Israel Inst. for Biological Research, Ness-Ziona
Generation of Recombinant Human Ache Op-Scavengers With Extended Circulatory Longevity
Shafferman, Avigdor; Apr. 2004; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-C-0012
Report No.(s): AD-A423711; No Copyright; Avail: CASI; A05, Hardcopy

The use of recombinant human acetylcholinesterase as an effective bioscavenger of organophosphorus compounds requires that it reside in the circulation for sufficiently long periods of time. We have demonstrated in the past that extension of the circulatory lifetime of AChE can be achieved either by optimizing post-translation-related enzyme processing or by chemical conjugation of polyethylene glycol (PEG) moieties to the enzyme. To delineate the interrelationship between these two modes of AChE modulation with regard to pharmacokinetic behavior, an array of AChE molecules differing in their post-translation-related processing was subjected to PEG-conjugation and monitored for their pharmacokinetic performance.

In all cases tested to date, PEG-conjugation was found to give rise to enzyme species which reside for very long periods of time in the circulation of mice in a nearly equal manner. We have now found a novel mode of AChE circulatory elimination based on the recognition of specific amino acid-related epitopes. This unique clearance mechanism can also be efficiently overcome by enzyme PEGylation. These findings indicate that the circulatory residence is dictated primarily by the PEG appendage, and that cost-effective microorganisms-based production systems which do not support animal-cell-related enzyme processing, may be utilized for large-scale AChE production. In line with this notion, we have constructed a synthetic human AChE gene designed for optimal expression in microorganism-based production systems, which will now be tested for its ability to sustain human AChE production.
DTIC
Acetyl Compounds; Cholinesterase; Circulation; Scavenging

20040082689 Scripps Research Inst., La Jolla, CA
Novel Combination Therapy for Prostate Carcinoma
Xiang, Rong; Feb. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0137
Report No.(s): AD-A423719; No Copyright; Avail: CASI; A03, Hardcopy

We established for the first time that an oral DNA minigene vaccine encoding muring vascular endothelial growth factor receptor-2 (FLK-l)-derived nonapeptides with H-2Db anchor residues can evoke a CD8+ cytotoxic T-cell response. These CTLs effectively kill proliferating endothelial cells int eh neovasculature of RM-9 murine prosate carcinoma cells leading to the effective suppression of tumor growth and hepatic as well as pulmonary metastases in syngeneic C57BL/6J mice. These data strongly support the contention that the murine vascular endothelial growth factor receptor-2 (FLK-l), overexpressed on proliferating endothelial cells in the tumor vasculature, is an effective target for DNA-minigene vaccines against prostate cancer.
DTIC
Cancer; Prostate Gland; Therapy

20040082690 New Jersey Medical School, New Brunswick, NJ
A Phase I/II Trial of 13-Cis Retinoic Acid, Alpha Interferon Taxotere, and Estramustine (R.I.T.E.) for the Treatment of Hormone Refractory Prostate Cancer
DiPaola, Robert S.; Weiss, Robert; Shih, W. J.; Feb. 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0229
Report No.(s): AD-A423723; No Copyright; Avail: CASI; A02, Hardcopy

Advanced prostate cancer is only temporarily controlled with androgen ablation therapy. In order to overcome tumor resistance, we developed a epithelial cell line model to dissect out important mechanisms of resistance such as mutations in p53 and bcl-2 overexpression. In an attempt to sensitize these cells to paclitaxel (TAX), we found that 13- cis retinoic acid and alpha interferon (CRA/IFN) was capable of overcoming bcl-2 mediated resistance and reduced the expression of bcl-2 in human prostate cancer cells. We hypothesized that drugs, which could overcome bcl-2 mediated resistance, would improve chemotherapy response or duration of response in the clinic. We then translated these results to the clinic in a series of clinical trials. Recently, our phase II study with CRA/IFN/TAX was acceped as a National trial and is ongoing in the Eastern Cooperative Oncolo%y Group. Given recet studies demonstrating that the combination of estramustine and docetaxes (ET) has increased response against HRPC in the clinic, but limited median duration of response, and our studies of CRA/IFN in the laboratory and clinic, we hypothesized that CRA/IFN will improve the response rate, or duration of response, of ET in patients with HRPC. We will treat patients with HRPC with R.I.T. E. therapy in a phase I and II trial.
DTIC
Cancer; Epithelium; Hormones; Interferon; Prostate Gland; Refractories

20040082691 Queens Univ., Kingston, Ontario
Identification of Hepatocyte Growth Factor Autocrine Loops in Breast Carcinomas: Possible Target for Therapeutic Intervention
Wright, Theodore G.; Aug. 2003; 55 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9360
Report No.(s): AD-A423724; No Copyright; Avail: CASI; A04, Hardcopy

Hepatocyte growth factor (HGF) binding to its transmembrane receptor, Met, results in an increase in breast epithelial cell

motility, morphogenesis and metastasis. ELISA methods have been used to assess the role of divalent metal cations on HGF/Met-IgG binding. Copper (11) and Zinc (11) significantly inhibited HGF/Met-IgG binding with IC50 values of 230 to 270 M each, while manganese (11) and magnesium (11) were less inhibitory with IC50 values between 5 to 15 mM and 30 to 70 mM, respectively. A concentration of 1 mM copper (11) incubated with HGF resulted in an HGF mobility shift in non-denatruing PAGE, indicating direct interaction of copper (11) with HGF, while 1 mM manganese (11) exhibited no effect. The activation of Met and cell scatter, functions both induced by exogenous HGF, were inhibited upon addition of HGF in the presence of 1 mM and 500 M copper (IT), respectively. Chemical protonation, with DEPC, of HGF histidine residues impeded the ability of 500 M copper (11) to inhibit HGF/ Met-IgG binding. A proposed ribbon diagram indicates that the HGF copper (11)- binding domain contains two histidine and these histidine are in close proximity to some key residues implicated in the Met binding domain. HGF-immunoreactive secretion products, 55 kDa and 32 kDa, of the human breast epithelial carcinoma cell line, MCFl0AlT3B, were purified and inhibited HGF/Met-IgG binding. Sequencing of these products may also identify key residues implicated in the inhibition of HGF/Met binding.
DTIC
Cancer; Carcinogens; Chemotherapy; Drugs; Loops; Mammary Glands; Targets; Therapy

20040082692 Jackson (Henry M.) Foundation, Rockville, MD
Interstitial Metabolic Monitoring During Hemorrhagic Shock
Pamnani, Motilal B.; Apr. 2004; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0263
Report No.(s): AD-A423725; No Copyright; Avail: CASI; A03, Hardcopy

Decompensation in hemorrhagic shock is the critical stage after which resuscitative efforts may prove futile. We hypothesize that decompensation results from potassium-mediated vasodilation and/or loss of cardiac contractility, and thus a method of measuring interstitial potassium should be a crucial part of future metabolic monitoring efforts. Anesthetized rats underwent controlled hemorrhage to a constant mean arterial pressure of 40 mmllg. Microdialysis probes were implanted in skeletal muscle, vein, and liver for continuous assessment of potassium, glucose, lactate, pyruvate, and glycerol concentrations. Arterial blood samples were drawn at 30- minute intervals. Animals were sacrificed in early (pre-decompensatory) and late (decompensatory) hemorrhagic shock and tissues analyzed for ex vivo Na+,K+-ATPase activity. Potassium concentrations in muscle interstitium were significantly higher in hemorrhaged animals than controls (2.34 times baseline vs. 1.24, p \h 0.05), this difference was not reflected in blood values. Na+,K+- ATPase activity in late hemorrhagic shock was increased vs. controls (p\h0.05) in kidney, skeletal muscle, cardiac muscle, diaphragm, and red blood cells. ATPase activity was also increased in early hemorrhagic shock in skeletal and cardiac muscle. These data may provide clues into new ways to monitor and treat victims of hemorrhagic shock on the battlefield.
DTIC
Interstitials; Metabolism; Shock (Physiology)

20040082693 Seattle Univ., WA
Novel Functional Screen for New Breast Cancer Genes
King, Mary-Claire; Jun. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0615
Report No.(s): AD-A423726; No Copyright; Avail: CASI; A02, Hardcopy

All cells are subject to continual DNA damage. For this reason, elaborate pathways have been developed to monitor DNA damage and to coordinate cell cycle progression with DNA repair. To date, over 70 genes involved in DNA damage surveillance and repair have been identified (Wood, Mitchell et al. 2001). These genes include those involved in mismatch repair, homologous recombination, non-homologous end joining, and signaling cascades that respond to DNA damage. However, only a few of these genes have been shown to be associated with breast tumor development. The very large number of genetic alterations in breast tumors, and genetic heterogeneity even within a single breast tumor, strongly suggest that other repair genes must play a role in breast tumorigenesis.
DTIC
Cancer; Genes; Mammary Glands; Oncogenes

20040082694 Civil Aeromedical Inst., Oklahoma City, OK
Ethanol Origin in Postmortem Urine: An LC/MS Determination of Serotonin Metabolites
Johnson, Robert D.; Lewis, Russell J.; Canfield, Dennis V.; Blank, C. L.; Nov. 2003; 18 pp.; In English
Report No.(s): AD-A423727; No Copyright; Avail: CASI; A03, Hardcopy

Specimens from fatal aviation accident victims are submitted to the FAA civil Aerospace Medical Institute for toxicological analysis. During toxicological evaluations, ethanol analysis is performed on all cases. Care must be taken when interpreting a positive ethanol result due to the potential for postmortem ethanol formation. Several indicators of postmortem ethanol formation exist; however, none are completely reliable. The consumption of ethanol has been shown to alter the concentration of two major serotonin metabolites, 5-hydroxytryptophol (5-HTOL) and 5-hydroxyindole-3-acetic acid (5-HIAA). While the 5-HTOL/5-HIAA ratio is normally very low, previous studies using live subjects have demonstrated that the urinary 5-HTOL/5-HIAA ratio is significantly elevated for 11 19 hours after acute ethanol ingestion. The authors investigated the 5-HTOL/5-HIAA ratio as a potential indicator of ethanol origin in postmortem urine samples. They developed and validated a method for the simultaneous determination of 5- HTOL and 5-HIAA in forensic urine samples using a simple liquid/liquid extraction and LC/MS/MS and LC/MS/MS/MS. A typical recovery of approximately 80% was achieved for both compounds. The LC/MS method proved highly selective and sensitive, having an LOD of 0.1 ng/mL for both compounds. The accuracy and precision also were very good. Utilizing their LC/MS method, they examined the 5-HTOL/5-HIAA ratio in 21 ethanol-negative and 23 true ethanol-positive postmortem urine specimens. They found that all ethanol-negative specimens had 5-HTOL/5-HIAA ratios below 15 pmol/nmol, a previously established antemortem urine cutoff for recent ethanol ingestion. All ethanol-positive urine samples had 5-HTOL/5- HIAA ratios above 15 pmol/nmol. These results validated the antemortem cutoff for use with postmortem urine specimens. This method was then applied to cases where postmortem ethanol formation was suspected. (10 figures, 41 refs.)
DTIC
Chemical Indicators; Ethyl Alcohol; Metabolites; Serotonin; Toxicology; Urinalysis

20040082698 Maryland Univ., College Park, MD
Structural Characterization of Lipopeptides Isolated from Bacillus Globigii Spores
Williams, Bruce H.; Jan. 2001; 66 pp.; In English
Report No.(s): AD-A423738; No Copyright; Avail: CASI; A04, Hardcopy

Several species of Bacillus spores produce surface- active antibiotic and antifungal lipopeptides, phospholipids, and polypeptides. Some of these are detected as biomarkers when intact spores are analyzed by Matrix Assisted Laser Desorption/Ionization time-of-flight (MALDI-TOF) mass spectrometry. Bacillus globigil spores, grown in new sporulation media (NSM), were suspended and then analyzed using a MALDI-TOF mass spectrometer to screen for biomarkers with 4-methoxycinnamic acid as matrix. Spores, vegetative cells, and the culture supernatant show a biomarker cluster composed of six molecules and centered at a molecular mass of 1478 Da. The biomarker was isolated from the cell-free culture supernatant by solid phase extraction to yield a crude product. Its components were concentrated, separated by reverse-phase high-pressure liquid chromatography, and then eluted as a cluster of three peaks. The three peaks were collected separately and preliminary analysis was conducted with a MALDI- TOF. A Fourier Transform Mass Spectrometer (MALDI source) instrument was used to determine the monoisotopic protonated masses to be 1463.8,1477.8, and 1505.8 Da, respectively to their order of elution. The mass differences of 14 and 28 Da, suggest that they are homologous molecules. Acid hydrolysis of each molecule showed it to contain an ester linkage. Methyl esterification, using methanolic HCl, of the open form of the molecule at m/z 1477.8 resulted in a product 56 Da higher, indicating the presence of four carboxylic acid moieties. A quadripole-time-of-flight instrument with nanospray source (Q- star) was used to sequence the reaction products. The purified compounds have identical amino acid sequences to previously identified lipopeptides in Bacillus subtilis.
DTIC
Bacillus; Cells (Biology); Fungi; Peptides; Spores

20040082699 California Univ., San Francisco, CA
Engineering Protease-Specific Human Antibodies and Discovering Novel Serine Proteases Expressed in Prostate Cancer Using Phage Display
Sun, Jeonghoon; Jan. 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0030
Report No.(s): AD-A423741; No Copyright; Avail: CASI; A03, Hardcopy

Quantitative RT-PCR and immunohistochemistry (IHC) experiments revealed that membrane-type serine protease 1 (MT-SPl), a member of the TTSP family, is specifically overexpressed in epithelial cancer cells and tissue samples. It was reported that in advanced stages of prostate, breast, and ovarian cancers MT-Spl is not regulated by its endogenous inhibitor HAI-l. MT-Spl plays diverse roles by activating pro- uPA, pro-HGF, and PAR-2. Taken together, MT-SPl may be a key upstream factor involved in the ECM remodeling plasminogen activation cascade and in signal transduction cascades involved in cell transformation. Dysregulated MT-SPl expression could promote the proteolytic activity of MT-SPl resulting in a more invasive

phenotype. We postulated that inhibition of its proteolytic activity might curtail the invasive phenotype. As MT-SPl is a cell surface protein, we chose to target the protease with anti-MT-SPl single chain monoclonal antibodies (scFvs) that we isolated using phage display. These scFvs potently and selectively inhibit the protease activity of MT-SPl. Our initial in vivo studies revealed the sizes of xenografted human ovarian tumors in nude mice were significantly reduced following treatment with the inhibitory scFvs, indicating the therapeutic potential of these scFvs for the treatment of epithelial cancers in ovary, prostate and breast.
DTIC
Antibodies; Bacteriophages; Cancer; Exploration; Prostate Gland; Protease

20040082700 Rockefeller Univ., New York, NY
Role of Casein Kinase 1 and DARPP-32 in Parkinson's Disease
Greengard, Paul; Sep. 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0705
Report No.(s): AD-A423742; No Copyright; Avail: CASI; A02, Hardcopy

Parkinson's disease affects 1% of the population above the age of 65. The major neurological impairments are intimately related to the progressive degeneration of dopaminergic neurons. In order to develop improved treatments for Parkinson's disease, it is crucial to increase our fundamental understanding of dopaminergic neurotransmission. By using mice with targeted deletion of the gene encoding DARPP-32, we have demonstrated that DARPP-32 plays a key role in the actions of dopamine. The present proposal is devoted to studies of the effects of dopamine and other neurotransmitters acting via DARPP-32 in CK- 1 mutant mice and animal models of Parkinson's disease.
DTIC
Cells (Biology); Diseases; Dopamine; Nervous System; Neurotransmitters; Proteins

20040082701 Virginia Commonwealth Univ., Richmond, VA
Lysophosphatidic Acid Regulation and Roles in Human Prostate Cancer
Spiegel, Sarah; Jan. 2004; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0060
Report No.(s): AD-A423743; No Copyright; Avail: CASI; A04, Hardcopy

Originally known for its pedestrian role as an intermediate in intracellular lipid metabolism, LPA is now recognized as a potent lipid mediator that evokes growth- factor-like responses and regulates an array of cellular processes related to pathogenesis of cancer. These include stimulating proliferation by increasing cell cycle progression, enhancing cell survival, stimulating motility and inducing tumor cell invasion, and regulating neovascularization. Progress in understanding LPA actions has accelerated with the discovery that it is a ligand of several G protein coupled cell surface receptors (GPCRs), previously identified as members of the endothelial differentiation gene (EDG) family. To date, three LPA receptors have been identified, EDG-2/LPA1, EDG-4/LPA2, and EDG-7/LPA3. The LPA receptors are differentially expressed, coupled to a variety of O-proteins, and thus regulate diverse cellular responses. Intriguingly, expression of LPA receptors correlates with more advanced prostate cancer cell lines and LPA2 and LPA3 are aberrantly expressed in ovarian cancer cells, indicating a potential role in the pathophysiology of cancer. Recently, a fourth LPA receptor was described (LPA4/ GPR23/P2Y9), which is distinct from the other LPA receptors. Moreover, LPA has a novel intracellular function as a high- affinity ligand for peroxisome proliferating activating receptor-gamma, a transcription factor that regulates genes controlling energy metabolism.
DTIC
Cancer; Lipid Metabolism; Prostate Gland; Receptors (Physiology)

20040082702 New South Wales Univ., Sydney
The Role of p53 Mutations in Metastasis of Prostate Cancer to Bone
Russell, Pamela J.; Jan. 2004; 56 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0108
Report No.(s): AD-A423747; No Copyright; Avail: CASI; A04, Hardcopy

The mortality and morbidity of prostate cancer (CaP), the commonest cancer in men in Western society, are largely caused by the spread of Cap to bone. How this occurs, and the interactions between Cap cells and bone are poorly understood. Specific mutations of the tumor suppressor gene, p53, that occur in CaP may cause disease progression. To test this, we have generated

cell lines derived from the human LNCaP cell line that stably express wild type or mutantp53.
DTIC
Bones; Cancer; Cells (Biology); Metastasis; Mutations; Prostate Gland

20040082704 Vanderbilt Univ., Nashville, TN
The Role of B-Catenin in Androgen Receptor Signaling
Truica, Cristina I.; Feb. 2004; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0063
Report No.(s): AD-A423750; No Copyright; Avail: CASI; A03, Hardcopy

We have previously shown that the cell adhesion molecule beta-catenin can form a complex with the androgen receptor (AR) and modulate its transcription. The cross talk between 13-catenin and AR signaling can play an important, role in AR transcriptional in prostate cancer progression. The objective of this study is to determine the mechanisms by which beta-catenin modulates AR signaling. We show that beta- catenin can increase AR transcriptional activation, and can also restore the transcriptional activity of loss-of-function AR (507-919). We find that amino acid 716 is required for the interaction between AR and beta-catenin. To better understand AR-dependent transcription in vivo and the dynamics of AR/beta catenin interaction at gene promoters we used chromatin immunoprecipitation assays (ChIP assay) for the prostate- specific antigen (PSA) gene, the best- characterized androgen- responsive gene in the prostate gland. The results indicate that the dynamic loading of beta-catenin to the PSA promoter and enhancer shares the same pattern with AR in presence of dihydrotestosterone (DHT) and this loading is inhibited by the AR competitive antagonist, bicalutamide (Casodex). In the absence of DHT, bicalutamide can recruit both AR coactivators and corepressors to PSA gene.
DTIC
Cancer; Hormones; Males; Prostate Gland; Receptors (Physiology); Transcription (Genetics)

20040082705 Baylor Coll. of Medicine, Houston, TX
Hormonal Regulation of Mammary Gland Development and Breast Cancer
Xian, Wa; Rosen, Jeffrey; Dec. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0285
Report No.(s): AD-A423751; No Copyright; Avail: CASI; A02, Hardcopy

One of the principal objectives of our laboratory is to understand the mechanisms by which hormones and growth factors regulate normal mammary gland development and how these same regulatory pathways become altered in breast cancer. Specific emphasis has been placed upon studying the mechanisms by which the lactogenic hormones, prolactin, hydrocortisone and insulin, regulate milk protein gene expression. The CCAAT/enhancer binding protein B (c/EBPB), Yin Yang-i (YY- 1), signal transducers and activators of transcription S (STATS), and the glucocorticoid receptor (OR) all have been shown to mediate the hormonal and developmental regulation of B-casein gene expression. However, the mechanism by which these transcription factors as well as coactivator proteins coordinately function to promote normal mammary gland development and breast cancer remains undefined. To understand the role of C/EBPj3, STATS, OR and comodulatory factors in hormonally-regulated chromatin remodeling at the 3-casein promoter and enhancer, we have initiated chromatin immunoprecipitation assays in HCl 1 cells and in the mammary gland and liver from lactating mice. In addition, we have analyzed mammary gland development in several specific mouse knockouts. The examination of mammary transplants from OR* and CBP mice suggested that MR may compensate for the loss of OR in mammary gland development during pregnancy, lactation and involution, and that haploinsufficiency of CBP does not appear to affect mammary gland development.
DTIC
Cancer; Mammary Glands

20040082711 Jackson (Henry M.) Foundation, Rockville, MD
Novel Role of ANX7 in Breast Cancer Progression
Srivastava, Meera; Jun. 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0407
Report No.(s): AD-A423765; No Copyright; Avail: CASI; A03, Hardcopy

The ANX7 gene codes for a Ca(2+) -activated GTPase, and is a tumor suppressor gene ANX7 expression has prognostic value for predicting survival of breast cancer patients. Our objective in this proposal is to determine the mechanism and the signaling pathway by which the ANX7 gene induces death of breast cancer cells. To this end, we have generated and identified the dominant negative mutants against calcium and GTP in the anx7 coding domain which are necessary for biochemical

functions of ANX7. We also have generated the effective adenoviral constructs containing the dominant negative mutants and wt-ANX7 and have shown that altered ANX7 expression during breast cancer cell growth involves calcium. Additionally, we confirmed the role of calcium by determining ANX7's control on all three subtypes' of 11)3 Receptor expression. Using eDNA microarray and Western blot analysis, we have identified the downstream targets and signaling pathway, of ANX7 in apoptosis and suppression of breast cancer cell growth. Taken together, these data indicate that ANX7 suppresses breast cancer cell growth and calcium plays a role via 11)3-Receptor. In addition, we have identified the members of the ANX7 signaling pathway. Comprehensive effort is underway to validate the results that will further elucidate the ANX7 dependent calcium signaling pathway in breast cancer cells.
DTIC
Cancer; Genes; Mammary Glands

20040082713 Jackson (Henry M.) Foundation, Rockville, MD
Vietnam Head Injury Study Phase III: A 30-Year Post-Injury Follow-Up Study
Grafman, Jordan H.; Oct. 2003; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0675
Report No.(s): AD-A423767; No Copyright; Avail: CASI; A01, Hardcopy

Implementation of the Vietnam Head Injury Study Phase III (VHIS3) has begun. In Oct 2002, an understanding was reached with the National Naval Medical Center (NNMC), and the necessary administrative and testing space has been obtained. We received approval for a funding supplement to cover the costs of the CT and EEG procedures and reports. We have hired all study staff. A protocol to study subjects at NNMC has been approved. The test battery to be administered to the participants has been finalized, a database created, eligible participants have been contacted to send an updated address to us with good compliance, programmatic procedures for the evaluation week have been developed, equipment purchased, and staff is being trained. Thus, we are only awaiting final protocol approvals and inter-agency cooperative agreement signatures before we begin to directly contact and invited participants to be studied.
DTIC
Head (Anatomy); Injuries; Vietnam

20040082714 Kansas Univ., Kansas City, KS
The Role of Akt in Androgen-Independent Progression of Human Prostate Cancer
Li, Benyi; Feb. 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0121
Report No.(s): AD-A423768; No Copyright; Avail: CASI; A03, Hardcopy

To define the causative role of the active Akt in androgen-independent progression of prostate cancer, an inducible Akt (iAKT) is used in this proposal. In this first- year period, androgen-dependent human prostate cancer LNCaP cells Were transfected with vectors carrying iAKT system or the control vectors (empty and kinase-dead mutant iAKTkm) to establish stable sublines. We established multiple LNCaP sublines expressing the iAKT system construct, as well as the control vectors. We demonstrated that the established LNCaP. iAKT cells showed a promising ability that the iAKT can be activated after the cells were treated by the dimerization inducer AP22783, and the activated iAKT (F(pk) 3-delta phAKT) is functionally capable to perform its physiological task, phosphorylating the downstream target OSK-3. In the next year or step, we will used those LNCaP subline cells to determine whether CID-mediated activation of iAKT promotes survival/proliferation of prostate cancer LNCaP cells after androgen withdrawal.
DTIC
Cancer; Hormones; Males; Prostate Gland

20040082721 Washington Univ., Seattle, WA
First Trimester Breastfeeding Education: Can Early Education Improve Duration in the Military Community?
Koehler, Winifred G.; May 2004; 52 pp.; In English
Report No.(s): AD-A423783; CI04-387; No Copyright; Avail: CASI; A04, Hardcopy

The intent of this proposed course is to increase opportunities for learning the advantages of breastfeeding initiation and duration for the military family. This is to be accomplished by breastfeeding education during the first trimester of pregnancy or pre-conception with a monthly breastfeeding support group offered. This will introduce breastfeeding to families early and offer social support through the group meetings. The benefits of breastfeeding are many and very well reported. According to the Department of Health and Human Services, 2000, the benefits include: fetal resistance to infectious diseases, enhanced

immune system, balanced nutrition and growth, reduced risk for chronic diseases, developmental benefits, improved maternal health, and many socioeconomic benefits. (Department of Health and Human Services, 2000). According to Healthy People 2010, the goal for the USA is that 75% of mothers in the early postpartum period will breast feed their infants, at six months 50% will continue to breastfeed, and at one year 25% will continue (Healthy people 2010). Although breastfeeding in the USA is at an all time high, it has not reached the Healthy People 2010 goal. The intention of offering the proposed course is to increase breastfeeding duration in the military community to approach, or even reach the goals of Healthy People 2010 in the future. This increase should result in a commensurate decline in babies with health issues related to human milk substitutes. DTIC

Education; Health; Nutrition; Pregnancy

20040082723 Washington Univ., Saint Louis, MO

Air Mobility Research for Undergraduates

Rodin, Ervin Y.; May 19, 2003; 33 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0172

Report No.(s): AD-A423791; AFRL-SR-AR-TR-04-0296; No Copyright; Avail: CASI; A03, Hardcopy

This report deals with the simulation of medical systems, both within the military and the civilian world, complete with scheduling problems and employment of optimal techniques to improve clinic performance based upon several criteria, including time in clinic per patient and assets required to serve the patient population. Problems of this sort fall into a category known as hybrid systems, which are characterized as problems having both discrete and continuous elements. Additionally, hybrid systems are characterized by having large numbers of interlocking subsystems, and changes made to any one of these causes rippling effects to all. In the case of a medical system, such interactive subsystems include the doctors, nurses, technicians, and patients in concert with record keeping, layout, other hospital clinics, lab work, medications, and tools used in the clinic, such as EKG machines and portable X-ray machines. The paper describes simulations of emergency services provided at the 375th Medical Group Emergency Department at Scott Air Force Base and the Missouri Baptist Hospital emergency department in St. Louis, MO. The 375th Medical Group simulation included a medium-to-large mass casualty situation. A third simulation involved the scheduling of medical residents' workload at a group of hospitals associated with the Duke University Medical System. (5 figures)

DTIC

Computerized Simulation; Emergencies; Medical Services; Mobility

20040082726 Baylor Coll. of Medicine, Houston, TX

The Role of Maspin in Prostate Tumorigenesis and Development

Zhang, Ming; Feb. 2004; 37 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0006

Report No.(s): AD-A423802; No Copyright; Avail: CASI; A03, Hardcopy

The object of this proposal is to understand the tumor suppressor function of maspin in prostate, and to explore maspin's role in normal prostate development. Maspin knockout mouse model will be employed to study the effects of loss of maspin function on mouse prostate tumorigenesis and development. We hypothesize that the presence of maspin (by stable transfection or by adenovims mediated maspin gene delivery) will prevent or delay prostatic tumorigenesis and metastasis, while loss of maspin in mouse model will render it more susceptible to tumor formation and metastasis. We will take advantage of the powerful tool of mouse genetics by crossing maspin knockout mice with a well characterized mouse prostate cancer model (TRAMP) to test this hypothesis. Prostatic tumorigenesis and normal prostate development will be studied using a variety of established techniques, including organ culture, histopathology, and molecular biology.

DTIC

Cancer; Enzyme Activity; Inhibitors; Neoplasms; Prostate Gland

20040082727 Army Medical Dept. Center and School, Fort Sam Houston, TX

U.S. Army Medical Department Journal, April-June 2004

Nelson, Bruce; Jun. 2004; 69 pp.; In English

Report No.(s): AD-A423803; No Copyright; Avail: CASI; A04, Hardcopy

Clinical and nonclinical professional information designed to keep U.S. Army Medical Department Personnel informed

of healthcare, research, and combat and doctrine development information.
DTIC
Clinical Medicine; Medical Services; Military Operations

20040082729 Army Engineer Research and Development Center, Vicksburg, MS
Phosphorus Forms and Export from Four Sub- Watersheds in the Upper Eau Galle River Basin Exhibiting Differing Land-Use Practices
James, William F.; Eakin, Harry L.; Barko, John W.; Apr. 2004; 17 pp.; In English
Report No.(s): AD-A423808; ERDC WQTN-PD-15; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this research was to quantify biologically labile and refractory phosphorus constituents, transformations, and export from four sub-watersheds in the Upper Eau Galle River basin exhibiting both differing percentages of land-use practice and differing spatial distribution of land uses within the watershed. Land-use practices included livestock containment areas, agricultural fields, grass hay or meadows, CRP, and woodlots. Information from this demonstration will be important in calibrating and improving watershed models to forecast the impacts of land-use practice and BMP's (Best Management Practices) on water quality in Corps receiving waters.
DTIC
International Trade; Land Use; Phosphorus; Procedures; River Basins; Structural Basins; Water Quality; Watersheds

20040082731 California Univ., San Francisco, CA
Killing Prostate Cancer Cells and Endothelial Cells With a VEGF-Triggered Cell Death Receptor
Quinn, Timothy P.; Feb. 2004; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423810; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project is to use a novel chimeric cell death receptor (termed R2Fas) that is triggered by vascular endothelial growth factor (VEGF), as a means to kill prostate cancer ells and vascular endothelial cells. The scope of this project involves: (i) creating adenoviral reagents to express the R2Fas receptor in prostate cancer cells and endothelial cells; (ii) determining if the R2Fas receptor kills cells in a VEGF-dependent manner; and (iii) identifying methods for increasing the killing activity of R2Fas. The major findings to date include: (i) we have generated adenoviral reagents to express R2Fas as well as control adenoviruses; (ii) we have demonstrated that adenoviral-mediated expression of R2Fas in prostate cancer cells that overexpress VEGF activates apoptotic signaling and induces cell death; (iii) we have demonstrated that adenoviral-mediated expression of R2Fas in human endothelial cell is non- toxic, but renders the cells sensitive to killing when treated with VEGF and (iv) we have demonstrated that R2Fas- mediated apoptosis can be potentiated by addition of several pharmacologic agents.
DTIC
Cancer; Cells (Biology); Death; Prostate Gland

20040082736 Minnesota Univ., Minneapolis, MN
Easing the Pressure of Migraines: Impact of Migraine Prophylaxis on Future Consumption of Healthcare Services in the Department of Defense
Devine, Joshua W.; Jan. 2004; 2 pp.; In English
Report No.(s): AD-A423820; AFIT-CI04-355; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this study is to determine if consumption of pharmacologic prophylactic therapy for migraine headaches reduces the cost and utilization of disease-related, healthcare services in the Department of Defense. Migraine headache is a widespread and disabling neurological disorder manifested by bouts of severe headache classified by the presence or absence of an aura. Patients suffering from this debilitating illness are more likely to access the healthcare system, consume greater amounts of health resources, and experience diminished productivity in the workplace compared to patients without migraines. Preventative therapy with prescription medication is recommended in patients with more advanced disease. Current research suggests preventative therapy can reduce the frequency of migraine headaches by 50 percent. However, it is unclear what impact preventative therapy has on a patient's overall healthcare utilization. This study will employ a retrospective observational cohort design of pharmacy and medical claims data within the Military Health System Mart (M2) database. Study enrollment will target newly diagnosed patients with migraine headaches identified by diagnosis, procedure, and prescription history. Outcome measures will consist of migraine-related expenditures, including costs of prescription utilization, physician visits, neuroimaging procedures, and emergency room use. Independent variables will be derived from the Anderson Model of Health Services Utilization. These variables include the use of pharmacologic prophylaxis, age, gender,

Tricare enrollment status, Tricare region, location of care, branch of service, patient comorbidities, and provider specialty. Relationships will be examined using multiple regression models. This exploratory research should provide a better understanding of migraine treatment, including the impact of preventative therapy, on overall healthcare utilization in the Department of Defense.
DTIC
Defense Program; Drugs; Headache; Health; Medical Services; Prophylaxis; Therapy

20040082737 Stanford Univ., Stanford, CA
Interaction Between a Novel p21 Activated Kinase (PAK6) and Androgen Receptor in Prostate Cancer
Sun, Zijie; Feb. 2004; 32 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0145
Report No.(s): AD-A423821; No Copyright; Avail: CASI; A03, Hardcopy

The androgen-signaling pathway is important for the growth and progression of prostate cancer. The cell cycle signaling regulated by the mitogen activated protein/extracellular-signal-regulated kinase (MAPK/ERK) have been linked to tumorigenesis and tumor progression. The p2l- activated kinases (PAKs) are members of a growing class of Rac/Cdc42-associated Ste20-like ser/thr protein kinases. Recent studies have shown that MAPK/ERK signaling can be mediated via Cdc42/Rac-stimulation of PAK activity. Recently, we demonstrated a specific interaction between a novel PAK protein, PAK6, and AR. This finding provided the first link between I PAK-mediated signaling to the steroid hormone receptor pathway. In this study, we propose to assess the biological roles of PAK6 in prostate cancer cells, and to examine the expression of PAK6 in prostate tissues. We anticipate that by completing the objectives proposed in this grant, we will obtain fresh insight into the regulatory processes of AR and PAK6 that may contribute to the development of new targets for the treatment of prostate cancer.
DTIC
Cancer; Hormones; Males; Prostate Gland

20040082744 Army Research Inst. of Environmental Medicine, Natick, MA
Biotelemetry Transmitter Implantation in Rodents: Impact on Growth and Circadian Rhythms
Leon, Lisa R.; Walker, Larry D.; DuBose, David A.; Stephenson, Lou A.; Jan. 13, 2004; 9 pp.; In English
Report No.(s): AD-A423837; M03-39; No Copyright; Avail: CASI; A02, Hardcopy

The implantation of a biotelemetry transmitter for core body temperature (Tc) and motor activity (MA) measurements is hypothesized to have effects on growth and circadian rhythmicity depending on animal body:transmitter (B: T) size ratio. This study examined the impact of transmitter implantation (TM) on body weight (BW), food intake (FI), water intake (WI), and circadian Tc and MA rhythms in mice (23.8+ 0. 04g) and rats (311.5+ 5.1g) receiving no treatment (NT) , anesthesia (ANEST), laparotomy (LAP), and TM. The B:T size ratio was 6:1 and 84:1 for mice and rats, respectively. In mice, BW required 14 days to recover to pre-surgical levels and never attained the level of the other groups. FI recovered in 3 days but WI never reached pre-surgical levels. Rat BW did not decrease below pre-surgical levels. FI and WI recovered to pre-surgical levels in rats by day 2 post-surgery. Anesthesia decreased mouse BW for 1 week, but was without effect in rats. LAP significantly decreased BW for 5 days in mice and 1 day in rats, showing a significant effect of the surgical procedure in the absence of TM in both species. Circadian Tc and MA rhythms were evident within the first week in both species, indicating dissociation between circadian rhythmicity and recovery of growth variables. Cosinor analysis showed a TM effect on Tc min, Tc max, mesor, amplitude, and period of mice, while only the amplitude of the rhythm was affected in rats. These data indicate that a large B:T size ratio is associated with minimization of the adverse effects of surgical implantation. The authors recommend that B:T size ratio, recovery of pre-surgical BW, and display of a robust circadian Tc and MA rhythm be established prior to collection of biotelemetry data under an experimental paradigm. (2 tables, 5 figures, 22 refs.)
DTIC
Biotelemetry; Circadian Rhythms; Implantation; Physiological Effects; Telemetry; Transmitters

20040082759 Colorado Univ., Denver, CO
Role of the Adherens Junction Protein Fascin in the Regulation of Tight Junction Permeability in the Mouse Mammary Gland
Beeman, Neal E.; Neville, Margaret C.; Aug. 2003; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0210
Report No.(s): AD-A423862; No Copyright; Avail: CASI; A03, Hardcopy

An adenovirus gene delivery system was developed allowing target gene delivery to the mouse mammary gland and cultured cells. This system was used to express a truncation mutant of the tight junction protein occludin in the mouse mammary gland and in cultured epithelial cells. The expression of truncated occludin caused programmed cell death in the mouse mammary gland epithelium and in cultured epithelial cells. Occludin and the apical junction complex proteins ZO-1 and beta-catenin left the tight junction following transgene expression. The beta-catenin binding, actin remodeling protein fascin was upregulated in transgene expression cells. The fluorescent staining of fascin was brilliant and cytoplasmically diffuse. Fascin upregulation was proposed to be an inherent part of the programmed cell death process. Recent work demonstrated an upregulation of fascin during cell death downstream of topoisomerase inhibition. That fascin is apparently upregulated downstream of such divergent apoptotic stimuli as loss of cell/cell contact and DNA strand breaks suggests that actin plays a fundamental role in apoptosis. The apical junction proteins beta-catenin, AF-6 and P-120 thought to interact molecularly with fascin, were shown to leave the apical junction complex and distribute to the perinuclear region. Monomeric actin was shown to increase during apoptosis.
DTIC
Cancer; Mammary Glands; Mice; Permeability; Proteins

20040082769 Assistant Secretary of Defense (Nuclear and Chemical and Biological Defense Programs), Washington, DC
Department of Defense Biological Defense Program Needs for Strategic Biotechnology Development
Johnson, Anna; Apr. 30, 2002; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423877; No Copyright; Avail: CASI; A03, Hardcopy

These viewgraphs are concerned with biological weapons and bioterrorism threats and the Biological Defense Program needs for Strategic biotechnical development.
DTIC
Biotechnology; Defense Program; Vaccines; Warfare

20040082772 Office of Naval Research, Arlington, VA
Information Content in Medline Record Files
Kostoff, Ronald N.; Block, Joel A.; Stump, Jesse A.; Pfeil, Kirstin; Jan. 2003; 42 pp.; In English
Report No.(s): AD-A423900; No Copyright; Avail: CASI; A03, Hardcopy

Background: The authors have been conducting text mining analyses (extraction of useful information from text) of Medline records, using Abstracts as the main data source. For literature-based discovery, and other text mining applications as well, all records in a discipline need to be evaluated for determining prior art. Many Medline records do not contain Abstracts, but typically contain Titles and Mesh terms. Substitution of these fields for Abstracts in the non- Abstract records would restore the missing literature to some degree. Objectives: Determine how well the information content of Title and Mesh fields approximates that of Abstracts in Medline records. Approach: Select historical Medline records related to Raynaud's Phenomenon that contain Abstracts. Determine the information content in the Abstract fields through text mining. Then, determine the information content in the Title fields, the Mesh fields, and the combined Title- Mesh fields, and compare with the information content in the Abstracts. Results: Four metrics were used to compare the information content related to Raynaud s Phenomenon in the different fields: total number of phrases; number of unique phrases; content of factors from factor analyses; content of clusters from multi-link clustering. The Abstract field contains almost an order of magnitude more phrases than the other fields, and slightly more than an order of magnitude more unique phrases than the other fields. Each field used a factor matrix with fourteen factors, and the combination of all 56 factors for the four fields represented 27 separate, but not unique, themes. These themes could be placed in two major categories, with two sub-categories per major category: Auto-immunity (antibodies, inflammation) and circulation (peripheral vessel circulation, coronary vessel circulation). All four sub-categories i In the cluster comparison phase of the study, the phrases used to create the clusters were the m
DTIC
Information

20040082786 National Museum of Civil War Medicine, Frederick, MD
The Connection Between the NMCWM and the USAMRMC - How the Early Development of Military Medicine During the American Civil War Paved the Way for the Research and Development of New and Improved Methods/Battlefield Medicine
Wunderlich, George C.; Jun. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0523
Report No.(s): AD-A423919; No Copyright; Avail: CASI; A03, Hardcopy

The exhibit: ″Building on the Past: Military Medicine for the 21st Century, now on display at the National Museum of Civil War Medicine is an example of the continuing educational partnership between the NMCWM and the USAMRMC. The partnership allows both institutions to develop programs and exhibits that engage diverse audiences. The exhibit reveals how the early development of military medicine during the Civil War paved the way for the research of innovative methods for delivering medical care to the battlefield and to the homeland. The exhibit underscores the many contributions the USAMRMC has made to the military and private sector medical community. The exhibit highlights how the operations of Fort Detrick and the National Museum of Civil War Medicine are important parts of the Frederick community.
DTIC
Medical Services; Military Operations; United States; Warfare

20040082808 West Virginia Univ., Morgantown, WV
Bone Marrow Function in Development of Childhood Asthma
Hogan, Mary B.; Mar. 2004; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0203
Report No.(s): AD-A423965; No Copyright; Avail: CASI; A03, Hardcopy

Asthma is the most common reason for hospitalization of children in both military and civilian hospitals. In children with asthma, pulmonary exposure to allergen results in damage to bronchioles by invasion of eosinophils. Eosinophils are inflammatory cells, have limited life spans, and must be continually renewed from hematopoietic tissue. We adapted an animal model of asthma to our laboratory for studies of the effect of pulmonary allergen exposure on eosinophil progenitor cells (CFU-eo) . These studies have revealed that CFU-eo numbers are elevated in the bone marrow of asthmatic mice following pulmonary allergen exposure. IL-5 is the primary cytokine that regulates eosinophil production and was originally thought to be synthesized exclusively by T lymphocytes. We demonstrated that fibroblastic bone marrow stromal cells produce IL-5 and that stromal cells regulate eosinophil production in vitro. Our working hypothesis is that eosinophil production in asthma is regulated by both bone marrow stromal cells and T lymphocytes. The primary objective of this proposal is to determine the relative role of stromal cells and T lymphocytes. The primary objective of this proposal is to determine the relative role of stromal cells and T lymphocytes in normal and asthmatic eosinophil production. In addition, the effect of inflammatory mediators on stromal cell support of eosinophilopoiesis and the durability of these responses will also be investigated.
DTIC
Asthma; Bone Marrow; Children

20040082810 Brentwood Biomedical Research Inst., Los Angeles, CA
Interactions of Subsymptomatic Doses of Sarin with Pyridostigmine -Neurochemical Behavioral and Physiological Effects
Scremin, Oscar U.; Shih, Tsung-Ming; Jenden, Donald J.; Mar. 2004; 156 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-2-0015
Report No.(s): AD-A423970; No Copyright; Avail: CASI; A08, Hardcopy

This report describes the effects of treatment with low levels of the cholinesterase (ChE) inhibitors Sarin (0.5 LD5O s.c. 3 times weekly) and pyridostigmine bromide (PB, 80 mg/L in drinking water) alone or in combination for 3 weeks as compared with untreated controls. At 2, 4 and 16 weeks after exposure, we studied neurochemical, behavioral and physiological parameters. The main findings have established: Neurochemical cholinergic markers (AChE, ChAT, and QNB binding) were not altered, except for a decrease in the expression of muscarinic receptors in some regions 2 weeks after treatment. Passive and conditioned avoidance responses as well as water maze tests showed no difference between treatments. Baroreceptor responses tested by pharmacological manipulation of arterial blood pressure were not affected by treatments. Exploration of an open field showed decrease in total distance walked in sarin treated animals 2 weeks after treatment that was not present with simultaneous PB and sarin administration. Enhancement of auditory startle was found with sarin 2 weeks after treatment, a phenomenon absent in the group in which PB was administered simultaneously with sarin. PB administration induced delayed bradycardia and decreased of heart rate variability, that were not explained by changes in locomotor activity or AChE inhibition at the time. Cerebral blood flow but not glucose utilization was enhanced 2 weeks after treatment with sarin+PB and 4 weeks after treatment with sarin. The expected regional variations in ACh, ACh synthesis rate, and D4Ch, similar to the distribution of other cholinergic markers, or characteristics of the blood-brain barrier reported in the literature were found, but no treatment related effects were detected in ACh synthesis rate. In conclusion, no consistent adverse effects of PB, or sarin, alone or in combination, have been detected following 2 to 16 weeks after low-dose chronic administration of these compounds.
DTIC
Bromides; Cholinesterase; Dosage; Physiological Effects

20040082826 New York Hospital-Cornell Medical Center, New York, NY
Oxidation Damage in Parkinson's Disease
Beal, M. F.; Jan. 2003; 21 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8619
Report No.(s): AD-A423990; No Copyright; Avail: CASI; A03, Hardcopy

The overall goal of the proposal was to provide a detailed assessment of the role of oxidative damage in Parkinson's Disease (PD) postmortem brain tissue, body fluids of PD patients and in the MPTP model. There were trends towards increased oxidative damage markers in post mortem brain tissue of PD patients and a number of specific genes linked to oxidative stress were reduced in expression. There was increased lipid peroxidation in progressive supranuclear palsy brains. There were no significant alterations in 8- hydroxy-2-deoxyguanosine in the plasma of PD patients. We found that overexpression of manganese superoxide dismutase attenuated MPTP toxicity whereas its deficiency exacerbated detoxicity. Similarly, a deficiency of glutathione peroxidase exacerbated MPTP neurotoxicity. Overexpression of Bcl2 or a dominant-negative mutant of interleukin-l converting enzymes significantly attenuated MPTP toxicity. We found increases in oxidative damage markers in the substantia nigra of MPTP treated baboons. A number of free radical spintraps as well as a selective inhibitor of neuronal nitric oxide synthase protected against MPTP neurotoxicity. In summary, our studies showed further evidence linking oxidative damage to dopaminergic neurons in the substantia nigra as well as in the MPTP model of PD.
DTIC
Cells (Biology); Damage; Diseases; Nervous System; Oxidation

20040082827 New Mexico Univ., Albuquerque, NM
Identification of the Types Properties and Functional Characteristics of Telomerase Expressing Cells in Breast Cancer
Hines, William C.; Griffith, Jeffrey K.; May 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0514
Report No.(s): AD-A423991; No Copyright; Avail: CASI; A02, Hardcopy

The aims of this study are to identify the types and properties of telomerase producing cells within breast tumors, and further, to isolate these cells from breast tumors so that their biochemical and functional properties may be characterized. Through examining the role of telomerase in cancer, this project also fosters the education of the candidate through the interaction with several experts in breast cancer pathology, epidemiology, biostatistics, and clinical and basic research. The experiments involved require the interaction with professionals from several different fields of the biomedical sciences and the mastery of several challenging laboratory techniques. To date, all tasks; as outlined in the Statement of Work, are on schedule. The research is in progress.
DTIC
Cancer; Cells (Biology); Clinical Medicine; Epidemiology; Mammary Glands

20040082828 National Indian Health Board, Inc., Denver, CO
National Native American Breast Cancer Survivor's Network
Burhansstipanov, Linda; Sep. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9310
Report No.(s): AD-A423992; No Copyright; Avail: CASI; A03, Hardcopy

The Native American Breast Cancer Survivors' Support Network (DAMDl7-99-1-931O) is a three year-project supported by the Department of Defense. This project is being conducted by Native American Cancer Research in collaboration and partnership with the National Indian Health Board. The purpose of this project is to improve the survival from breast cancer and quality of life after being diagnosed with breast cancer for both the patient and loved ones of the cancer patient. The study objectives follow: (a)using key and well organized Native American cancer leaders form geographically diverse regions of the country, identify, and recruit Native American breast cancer patients into the survivor's network and database; and (b) refine, and evaluate the survivor's database to determine patterns of disease and patterns of care experienced by Native American breast cancer survivors. The intended population is Native American breast cancer patients, both genders, ages 20 and older, living anywhere on the North American continent. Preliminary findings include documentation that Native breast cancer survivors are not receiving quality care, less than one-third have access to insurance (and thus access to improved quality of care) and standard protocols used with other survivors are ineffective with Native cancer survivors%.
DTIC
American Indians; Cancer; Mammary Glands; Medical Science; Personnel; Survival

20040082829 Vanderbilt Univ., Nashville, TN

Physical Mental Social and Family Health Outcomes of Gulf War Veterans

Breda, Carolyn S.; Mar. 2004; 48 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0221

Report No.(s): AD-A423993; No Copyright; Avail: CASI; A03, Hardcopy

This research uses secondary, longitudinal data to assess the physical, mental, social, and familial health status of Persian Gulf War/Desert Storm veterans (GWVs) relative to the health status of otherwise comparable groups of active military personnel. The sample included 565, largely married males with families, between 19-58 years of age. Most (72%) were white, 19% were black, and 9% were Hispanic or of other (or mixed) ethnicity. The majority were enlisted and served in the Army. At the time of baseline data collection, 25% had recently deployed to or returned form the Gulf; 15% had recently deployed to some other, noncombat region or returned from it; and 60% had not recently been deployed or returned. Analyses show that the demographic (e.g., age, education) and military (e.g., rank, branch of service) backgrounds of these groups did not vary significantly, thus any effects associated with deployment status are not likely attributable to such potentially confounding factors. Results identify two significant effects of Gulf deployment, both associated with family well being. Spouses of GWVS had significantly greater psychopathology than others, and the pile up of potentially stressing life events was significantly greater among the families of GWVS than of others.

DTIC

Abnormalities; Disorders; Gulfs; Health; Mental Health; Psychology; Warfare

20040082831 California Univ., Berkeley, CA

Framework for Open Source Software Development for Organ Simulation in the Digital Human

Fearing, Ronald S.; May 2004; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0588; Proj-BI0C

Report No.(s): AD-A423995; AFRL-IF-RS-TR-2004-128; No Copyright; Avail: CASI; A03, Hardcopy

This effort provides an open source/open architecture framework for organ level simulations that facilitates shared development and reuse of models. This framework provides an intuitive API for interfacing dynamic models defined over spatial domains. In addition, it is independent of the specifics of modeling methods and thus facilitates seamless integration of heterogeneous models and processes. Furthermore, each model has separate geometries for visualization, simulation, and interfacing. This lets the modeler choose the most natural geometric representation for each.

DTIC

Anatomy; Computer Programming; Computer Programs; Computerized Simulation; Organs; Simulation; Software Engineering

20040082837 Texas Univ., Houston, TX

The Importance of ATM Mutations and Polymorphisms in Breast Cancer and Radiation Sensitivity

Buchholz, Thomas A.; Oct. 2003; 364 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9260

Report No.(s): AD-A424001; No Copyright; Avail: CASI; A16, Hardcopy

The objective of my 4-year Career Development Award was to determine whether ATM heterozygosity contributes to breast cancer development and radiation injury. We sequenced the ATM cDNA of 93 breast cancer patients and found 4 repetitive single-base genetic variants in the ATM cDNA. We then compared the frequency of these variants to that of a control set of samples from 996 individuals without cancer. We found that a Ser49Cys variant was more commonly represented in the breast cancer patients (6.%% vs 1.3%, p=O.006). In addition, we found that a Prol954Arg variant was more common in a group of 27 Caucasian patients who experienced a significant normal tissue injury after radiation treatments compared to the Caucasian controls (18.5% vs 6.6%, p=O.037) - We also developed an in vitro assay that isolated protein complexes that bind double-strand breaks in order to study the role of ATM protein in double-strand break repair. We identified that ATM and at least ten other proteins make up a clinically relevant protein complex. We found that the amount of this complex in both normal and tumor cells strongly correlated with their radiosensitivity. We feel this assay may prove to have significant clinical relevance as a predictor of both tumor and host radiosensitivity.

DTIC

Cancer; Mammary Glands; Mutations; Polymorphism; Radiation Effects; Sensitivity

20040082838 Michigan Univ., Ann Arbor, MI
Prostate Cancer Skeletal Metastases: Pathobiology and Inventions
Keller, Evan T.; Feb. 2004; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0092
Report No.(s): AD-A424002; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer skeletal metastases are considered osteoblastic; however, histopathological examination usually reveals underlying osteoclastic activity. A key molecule required for induction of osteoclastic activity is receptor activator of NFkB ligand (RANKL). RANKL activity is opposed by osteoprotegerin (OPG). Thus, the balance of RANKL and OPG in the prostate cancer tissue may regulate the overall phenotype of the metastatic lesion. We are testing the hypothesis that an increase in the RANKL:OPG ratio contributes to the development of CaP skeletal metastases and a corollary hypothesis is that restoring the RANKL:OPG axis through inhibition of RANKL activity will diminish progression of skeletal metastases. In this report, we summarize our work that demonstrates blocking RANKL with sRANK-Fc diminishes progression of human prostate cancer in human bone implanted in mice. Additonally, we demonstrate that the RANKL promoter is active in bone and induced by transforming growth factor- beta (TGF-beta).
DTIC
Cancer; Inventions; Musculoskeletal System; Pathology; Physical Examinations; Prostate Gland

20040082842 Beth Israel Deaconess Medical Center, Boston, MA
Roles of Mitotic Checkpoint Regulators Pin1 and Pin2 in Breast Cancer
Wulf, Gerburg M.; Lu, Kun P.; Jul. 2003; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9081
Report No.(s): AD-A424006; No Copyright; Avail: CASI; A03, Hardcopy

Our laboratory has recently identified a new protein, Pinl, that is involved in checkpoint control. Pinl interacts with mitotic phosphoproteins and helps to orchestrate the timing of mitotic events. We found that Pin1 is highly overexpressed in breast cancer. Pinl levels correlate with the levels of cyclin Dl protein as well as with cyclin Dl mRNA levels in human breast tumors. We have shown that Pin1 is a transcriptional activator of cyclin Dl. Activation occurs indirectly through the binding of phosphorylated c-jun. Our data indicate that Pinl may contribute to neoplastic transformation by causing accumulation of cyclin Dl. In addition, Pinl contributes to cyclin Dl overexpression by regulating the turnover and subcellular localization of beta-catenin and inhibiting its interaction with APC. In Pinl knock-out mice, mammary epithelial cells fail to undergo the usual proliferative burst during pregnancy, a phenotype that is very similar to the cyclin Dl knock-out. Finally, the PINl gene itself is an E2F target gene and essential for Neu/Ras induced transformation of mammary epithelial cells. Crossbreeding experiments have shown that Pinl knock-out mice are largely protected from breast cancers induced by the Her2/neu or Ras oncogenes.
DTIC
Cancer; Mammary Glands; Mitosis; Regulators

20040082846 Duke Univ., Durham, NC
Mechanistic Basis of Sensitivity/Resistance Towards Anti-Cancer Drugs Targeting Topoisomerase II
Collins, Tammy R.; Hsieh, Tao-Shih; Apr. 2004; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0189
Report No.(s): AD-A424021; No Copyright; Avail: CASI; A02, Hardcopy

Human topoisomerase Ila (hstopo Ila) is an essential enzyme that is the target of a number of anticancer drugs in clinical use, making the understanding of its catalytic mechanism very important. Clinically, resistance to anticancer drugs develops through various mechanisms, one of which can be found in a class of a typical multidrug resistant mutants (at-MDR) that has been identified. We will attempt to further clarify the biochemical basis of at-MDR among hstopo Ila mutants to shed more light on the topo II enzymatic mechanism. Additionally, we will identify sites of drug binding on hstopo Ila and the consequences of this action. To this end, we have probed the mechanism of hstopo Ila using cysteine footprinting and endoproteinase/mass spectrometry footprinting. With the cysteine footprinting technique, we have shown that menadione may induce conformational changes in hstopo Ila that cause it to remain in a configuration that is different from the wild-type populated state. Additionally, using an endoporteinase/mass spectrometry footprinting approach, we have located a potential cysteine residue on hstopo Ila that may be modified by menadione. These preliminary results provide the first direct evidence that menadione may act as an anticancer drug by binding to a specific position(s) on hstopo Ila causing it to adopt a conformation contrary to the wild-type form.
DTIC
Cancer; Chemotherapy; Clinical Medicine; Drugs; Enzymes; Sensitivity

20040082847 Purdue Univ., West Lafayette, IN
Regulation of Prostate Tumor Cell Line Proliferation and Tumorigenicity by ErbB4
Riese, David J.; Feb. 2004; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0130
Report No.(s): AD-A424025; No Copyright; Avail: CASI; A03, Hardcopy

ErbB4 is a member of the ErbB family of receptor tyronsine kinases, a family that also includes the Epidermal Growth Factor Receptor (EGFR.ErbBl), ErbB2/HER2/Neu, and ErbB3/HER3. In small pilot studies, ErbB4 expression was detected in normal prostate epithelium but was absent in prostate tumor samples. Thus, we have hypothesized that ErbB4 is a potential prostate tumor suppressor. We have tested this hypothesis using constitutively-active ErbB4 mutants. The constitutively-active Q646C ErbB4 mutant inhibits drug- resistant colony formation by human PC-3 and DU-l45 prostate tumor cell lines. Analyses of additional ErbB4 mutants indicate that growth inhibition by the Q646C ErbB4 mutant appears to require phosphorylation of ErbB4 Tyr984 and Tyr1O56 as well as ErbB4 tyronsine kinase activity.
DTIC
Activity (Biology); Cancer; Cells (Biology); Colonies; Microorganisms; Prostate Gland; Regeneration (Physiology); Tumors

20040082848 Queens Univ., Kingston, Ontario
Role of Nitric Oxide as a Chemosensitizer in Prostate Cancer
Graham, Charles H.; Feb. 2004; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0070
Report No.(s): AD-A424026; No Copyright; Avail: CASI; A03, Hardcopy

Most patients who die of prostate cancer do so because of therapy failure. Regional hypoxia is a prevalent feature of prostate carcinomas and hypoxia contributes to chemoresistance in various types of cancer. Thanks to the funding provided by the US Army Medical Research and Material Command (Award no. DAMDl7-03-l-OO7O), we have shown that hypoxia increases resistance to more than one class of chemotherapeutic agents in human and rodent prostate cancer cells. Specifically, our studies reveal that incubation of human (PC-3 and DU-l45) as well as mouse (TRAMP-C2) prostatic adenocarcinoma cells under hypoxia (O.5%02) significantly increases their resistance to chemotherapeutic drugs that exert their cytotoxic effects via different mechanisms, i.e. doxorubicin and paclitaxel. Moreover, we have also demonstrated that the effect of hypoxia on chemoresistance of prostate cancer cells can be prevented by very low concentrations of nitric oxide mimetic agents (Task 1). As initially proposed in the Statement of Work, we were able to accomplish these objectives within the first 12 months of funding. These findings suggest that it may be feasible to use NO mimetics as adjuvants to chemotherapy in prostate cancer patients.
DTIC
Cancer; Chemotherapy; Drugs; Nitric Oxide; Prostate Gland

20040082849 California Univ., Los Angeles, CA
Molecular Engineering of Vector-Based Oncolytic and Imaging Approaches for Advanced Prostate Cancer
Wu, Lily; Feb. 2004; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0095
Report No.(s): AD-A424027; No Copyright; Avail: CASI; A03, Hardcopy

Hormone refractory and metastatic prostate cancer are not well understood. Better animal models, diagnostic and treatment modalities are sorely needed for these advanced stages of disease. We have coupled non-invasive optical imaging to develop metastatic prostate cancer animal models, and vector-based diagnostic and therapeutic approaches. A highly potent and prostate-specific transcriptional regulatory system (TSTA) has been utilize dot restrict the expression of our adenoviral vector specifically to prostate or prostate cancer cells. In the diagnostic approach, this TSTA system will be applied to express optical imaging reporter gene. Alternatively, the TSTA system will be applied to regulate the expression of viral replication proteins in the therapeutic approach. In doing so, the viral amplification and cell lysis will be directed in a prostate-specific manner. The progress of this project has been interesting and according to plan in the first year. Several human prostate xenograft models have been marked with the optical luciferase reporter gene. This approach allows facile monitoring of cancer dissemination. We observed distinctly different metastatic potentials in different models. These metastatic animal models will be the bases for us to investigate the efficacy of our diagnostic and oncolytic therapeutic viral vectors.
DTIC
Cancer; Diseases; Imaging Techniques; Metastasis; Prostate Gland

20040082850 George Washington Univ., Washington, DC
Consequences of Cyclin D1/BRCA1 Interaction in Breast Cancer Progression
Kehn, Kylene; Kashanchi, Fatah; Apr. 2004; 70 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0198
Report No.(s): AD-A424028; No Copyright; Avail: CASI; A04, Hardcopy

The inheritance of one defective BRCAl or BRCA2 allele predisposes an individual to developing breast, ovarian and T-cell cancers. In addition, in breast cancers where BRCAl is not mutated, it is often functionally inactivated. Furthermore, cyclin Dl has been shown to be overexpressed in many cancers including breast cancer and its associates with BRCAl. Because of the crucial role of both of these proteins in cancer, it is reasonable to expect that this interaction has a significant role in tumor cells. The understanding of when this interaction occurs during cell cycle progression will help to determine the role of cyclin Dl/BRCAl binding in breast cancer cells. Therefore, I hypothesize that the direct interaction of cyclin Dl with BRCAl results in the cell cycle dependent regulation of the activity of BRCAl. In this study, I wish to identity and confirm the cell cycle dependent cyclin Dl/BRCAl interaction in breast cancer cells, determine the biochemical consequence of cyclin Dl/BRCAl interaction in breast cancer cells, and determine the functional consequence of BRCAl phosphorylation in breast cancer. BRCAl s phosphorylation by cyclin Dl/cdk complexes may help to regulate BRCAl's localization to the nucleus, since BRCAl has been shown to have a cytoplasmic expression pattern, but acts primarily in the nucleus. Phosphorylation may also be important in modulating BRCAl'1 ability to bind DNA, either as a transcription factor or as part of a DNA damage repair complex. Determining the consequences of the interaction of cyclin Dl/BRCAl could lead to a more complete understanding of how breast cancer occurs, thus leading to new treatment options.
DTIC
Cancer; Cells (Biology); Deoxyribonucleic Acid; Genes; Lymphocytes; Mammary Glands

20040082851 Northern California Inst. for Research and Education, San Francisco, CA
The Roles of the Y Chromosome Genes in Prostate Cancer
Lau, Yun-Fai C.; Feb. 2004; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0039
Report No.(s): AD-A424029; No Copyright; Avail: CASI; A03, Hardcopy

Currently, we lack information on the role of the men-only chromosome, the Y chromosome, on prostate cancer. This project is designed to address this problem and to identify candidate gene s on the Y chromosome involved in this male-specific cancer. The objectives are: 1) to study the expression of Y chromosome genes in prostate cancer and 2) to evaluate their effects in over-expression in the prostate of transgenic mice. We have completed a survey on the expression of 31 Y chromosome genes in prostate cancer and have identified TSPY gene to be the most likely one to play a role in male oncogenesis. We have isolated and sequenced several polymorphic TSPY transcripts in normal and cancerous prostate samples, demonstrated that over-expression of TSPY potentiates cell proliferation in vitro and tumor formation in vivo. TSPY interacts with the mitotic cyclin B. Its expression is influenced by androgen. These studies have provided important information on the role of the TSPY gene and the Y chromosome on prostate cancer development and treatments.
DTIC
Cancer; Chromosomes; Genes; Prostate Gland

20040082852 Howard Univ., Washington, DC
Psychological and Neuropsychological Predictors of Non-Compliance to Mammography Screening Among High-Risk African American Women
Steele, Sharon L.; Apr. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0190
Report No.(s): AD-A424030; No Copyright; Avail: CASI; A03, Hardcopy

The breast cancer death rate is high for African American women compared to U.S. National figures and an explanation is that African American women are more likely to be diagnosed with advanced breast cancer disease. Regular mammography screening reduce the number of deaths from breast cancer by helping to detect the disease at an early stage. Although effective, the number of women engaging in repeat screening is low, and this is the case for women with a family history of breast cancer. Improving use of mammography screening and subseguently reducing breast cancer deaths will involve an understanding of psychological and neuropsychological factors impacting repeat mammography screenings. This project proposed to evaluate the relationship between psychological distress (anxiety and intrusive thoughts about breast cancer) and neuropsychological functioning (executive cognitive functioning) responsible for behavioral self-regulation on adherence to repeat use of screenings. To meet the objective, 112 women were proposed to be selected to participate in the study. The study

has currently enrolled 37 participants, 18 adherers to mammography screening and 19 non- adherers. These participants completed a series of guestionnaires evaluating anxiety and intrusive thoughts and test of neuropsychological functioning. Once the full complement of participants has been tested, the scores on the psychological and neuropsychological instruments will be analyzed for both groups to assess relationships between executive cognitive functioning, anxiety, and adherence to repeat screenings.
DTIC
Africa; Cancer; Females; Mammary Glands; Neurology; Predictions; Psychology

20040082853 California Univ., Los Angeles, CA
Integrating Molecular Imaging Approaches to Monitor Prostate Targeted Suicide and Anti-Angiogenic Gene Therapy
Sato, Makoto; Feb. 2004; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0094
Report No.(s): AD-A424031; No Copyright; Avail: CASI; A03, Hardcopy

Our goal of this awarded study is to develop combined approach of prostate-targeted suicide and anti- angiogenic gene therapy into a new effective treatment for prostate cancer (Cap). To accomplish these two distinct approaches, three recombinant adenoviruses, AdTSTA-tk, AdCM
DTIC
Adenoviruses; Antigens; Cancer; Gene Therapy; Imaging Techniques; Prostate Gland

20040082854 Georgetown Univ. Hospital, Washington, DC
3D Structure Determination of a Human Prostate- Specific Homeoprotein, NKX3. 1: The Mechanism of Autoregulation Through its Terminal Domains
Tomita, York; Feb. 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0124
Report No.(s): AD-A424032; No Copyright; Avail: CASI; A03, Hardcopy

NKX3.l, a member of the NK class of homeodomain (HD) proteins, is expressed primarily in the adult prostate and has growth suppression and differentiating effects in prostate epithelial cells. NKX3.l consists of three domains having the HD in the middle. The NKX3.l HD is known to binds to DNA for its transcriptional activity and other transcriptional factors such as serum response factor (SRF). Our goal is to determine 3D structure of NKX3.l to elucidate the mechanism of its functions and regulations. During the first year, full-length as well as various truncation constructs of NKX3.l, including N-terminal deletions, C- terminal deletions, and HD only, were made and purified in a sufficient quantity for the structural characterization by NMR and circular dichroism (CD). The interaction between NKX3.l HD and DNA was confirmed by EMSA and NNR, and the binding of SRF to NKX3.l HD was confirmed by NMR. Using the L3C/l5N double labeled NKX3.l HD in complex with DNA, a suite of 3D NMR experiments were recorded for the backbone and sidechain resonance assignments. The spectral analysis is in progress and soon we will be able to calculate 3D NNR structures of the complex. We will continue our structural study with full- length NKX3.l.
DTIC
Automatic Control; Blood; Cancer; Deoxyribonucleic Acid; Domains; Prostate Gland; Serums

20040082855 University of Southern California, Los Angeles, CA
Genetic Determinants of Aromatase Expression and Susceptibility to Postmenopausal Breast Cancer
Ingles, Sue A.; Dec. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9376
Report No.(s): AD-A424034; No Copyright; Avail: CASI; A02, Hardcopy

The major source of estrogen in postmenopausal women is conversion of androstenedione in adipose tissue to estrone by the enzyme aromatase. In adipose tissue, the aromatase gene, CYP19, is regulated by the cytokines TNF-alpha and IL-6. The objective of this study was to determine whether polymorphism in the TNF-alpha gene, in the IL-6 gene, or in the regulatory region of the CYP19 gene is associated with the plasma estrone (El) to androstenedione (A) ratio, a measure of peripheral estrogen production, or with risk of post- menopausal breast cancer. This investigation was carried out using DNA and serum samples from women enrolled in the Hawaii- Los Angeles Multiethnic cohort study. We found that among African-American women, but not among other women, polymorphisms in both the TNF-alpha and IL-6 genes were associated with increased breast cancer risk after stratification on obesity. Increasing weight also appeared to be associated with increased peripheral estrogen production among women with high-inducibility TNF alpha genotypes but not among other women. Because our

findings were not consistent across ethnic groups and because they were based on relatively small numbers of women within each ethnic group, we are attempting to confirm these results in a second multi-ethnic population.
DTIC
Cancer; Genetics; Hormones; Mammary Glands

20040082953 Army War Coll., Carlisle Barracks, PA
Contagion and Stability
Reynolds, Jeffrey C.; Butts, Kent H.; May 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423881; No Copyright; Avail: CASI; A01, Hardcopy

The Contagion and Stability Game provided a forum% for discussing the military, economic, informational, political, and medical aspects of contagion in an environmentally stressed region of the less-developed world- South Asia. Conference planners developed a scenario set in contemporary India that incorporated natural disaster, the growing local population and the concurrent presence of HIV/AIDS, cholera and plague. Ensuing negotiations clarified environment, health, and population issues that are central to the stability of the region and of priority interest to the USA, regional states, international organizations, and the non-governmental organizations (NGO) community. Conference participants included senior representatives of USA Agency for International Development (USAID), the Department of State, Office of the Secretary of Defense, and the Environmental Protection Agency; public health experts from the Centers for Disease Control, the U.S. Pacific Command, the U.S. Army Medical Research Institute of Infectious Diseases, and the Commonwealth of Pennsylvania; diplomatic representatives from India, Switzerland, and Egypt; leaders of population, health and environment NGOs; academics from leading universities and think tanks; and representatives of the sponsoring organizations.
DTIC
Disasters; Environmental Surveys; Infectious Diseases; International Relations; Medical Science; Organizations; Public Health; Stability

20040082963 Defence Research and Development Suffield, Suffield, Alberta
Enzyme-Linked Immunosorbant Assays for Identification of Biological Agents in Sample Unknowns: NATO SIBCA Exercise IV
Thompson, H. G.; Fulton, R. E.; Dec. 2003; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423945; DRDC-SUFFIELD-TR-2003-120; No Copyright; Avail: CASI; A04, Hardcopy

In January 2002, the NATO Panel VII Subgroup on Sampling and Identification of Biological and Chemical Agents (SIBCA) conducted the fourth international training exercise on identification of biological agents. Fourteen NATO/Partners for Peace national laboratories participated: Austria, Bulgaria, Canada, Denmark, France, Germany (two laboratories), Italy, the Netherlands, Norway, Poland, Sweden, the UK, and the USA. The designated laboratory for Canada was Defence R&D Canada - Suffield (DRDC Suffield). Participant laboratories were sent six swabs. Participants were advised that samples would contain any one of the following gamma-irradiated organisms: Bacillus anthracis, Yersinia pestis, Brucella melitensis, Francisella tularensis, Vibrio cholerae, Burkholderia mallei, Venezuelan equine encephalitis (VEE) virus, vaccinia virus, Coxiella burnetii, or yellow fever virus. A number of immunologically-based technologies were used at DRDC Suffield for screening of sample unknowns, one of which was the enzyme-linked immunosorbant assay (ELISA). Antigen capture ELISAs were developed for all 10 possible biological agents and were used to screen the samples and a heterologous agent panel included as a control for specificity. Five biological agent unknowns were identified by ELISA, three at the species level: B. melitensis, F. tularensis, and Y: pestis, and two at the genus level: Bacillus spp. One sample containing V cholerae produced a false negative reaction. A comparison of the ELISA results with the identity of organisms in SIBCA sample unknowns, as revealed by Dugway Proving Ground following the exercise, indicated correct identification of three of the samples, a partially correct identification of two samples, and an incorrect false negative for one sample.
DTIC
Assaying; Enzymes; North Atlantic Treaty Organization (NATO); Physical Exercise

20040084138 California Univ., Santa Barbara, CA, USA
Interactions, Deformations and Biolubrication of Liquid-liquid and Biofluid Interfaces
Israelachvili, Jacob; Leal, Gary; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 17; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recent experiments have allowed for the molecular forces and deformations of liquid-liquid and biofluid-soft solid

interfaces to be visualized and measured with unprecedented precision in real time. This report will describe recent measurements and new theoretical treatments of the interactions and deformations of liquid-liquid interfaces such as suspended droplets during collisions, coalescence and detachment, and the implications of the results to predictions of droplet coalescence and biological cell-cell interactions in general. The effects of van der Waals and other short-range molecular and thermal fluctuation forces on droplet coalescence and film instability will be described, as will the role of buoyance forces and dissolved gases on the hydrophobic interaction between oil droplets and gas bubbles in water, this interaction being one of the major forces between biological molecules and surfaces in aqueous solutions. Current work is also focusing on the role of surfactants and other amphiphilic molecules at the liquid-liquid interfaces. Preliminary results on the thin film theology (″lubricity″ and ″wear″) of model biological and real cartilage surfaces in various model biofluids and synovial fluid will also be presented, with a discussion of the implications of the results to cartilage, bone and joint degeneration.
Author
Liquid-Liquid Interfaces; Coalescing; Cartilage; Body Fluids

20040084153 Stanford Univ., Stanford, CA, USA
DNA Configurations in the Flow Through Arrays with Application to Biosensors
Shaqfeh, Eric S. G.; Beck, Victor; Teclemeriam, Nerayo; Muller, Susan J.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 39-40; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The miniaturization of lab analysis via microfluidics now allows one to consider designing devices for the manipulation of individual molecules. Manipulation of DNA in microfluidic devices has now received an enormous attention in this context, primarily through sieving and sorting applications. However, new results in flow suggest that reactions in flow including concatenation or hybridization may be many times faster than under equilibrium conditions and thus flow can be used to control the access to the chain for any number of sequence specific linkers. Such a scheme could form the basis for a sensor for DNA damage either for military or space applications. At the heart of this the molecule to a significant fraction of its extensibility, keep it stretched to allow hybridization to linker groups, and then sieve any unlinked species from the mixture for analysis of hybridization downstream. Engineering of such a sensor is most efficiently done if large scale simulation of DNA in flow is used as an engineering tool to narrow the possible designs. A suggested device design is shown.
Author (revised)
Deoxyribonucleic Acid; Microfluidic Devices; Bioinstrumentation

20040084174 California Univ., Berkeley, CA, USA
A Biosensor for Single-molecule DNA Sequencing
Teclemariam, Nerayo P.; Muller, Susan J.; Beck, Victor A.; Shaqfeh, Eric S. G.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 167-168; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

This project is a collaborative effort to develop a biosensor for obtaining sequence information from single DNA molecules. The sensor will allow rapid screening for specific genes which may be indicators of susceptibility to space radiation damage. The basic concept is to use hydrodynamics to fully extend genomic DNA in a microfluidic device. Fluorescent beads with surface-bound, complementary oligonucleotide probe sequences (corresponding to genes or sequences of interest) will be introduced and hybridized to the stretched DNA. Any unhybridized beads will be separated from the DNA-bead complexes. Imaging of the bead positions along the stretched, linear DNA backbone will then provide sequence information since the beads act as position and sequence sensitive markers. Realization of the device will require both detailed experiments and simulations aimed at designing flow geometries to stretch the DNA, optimizing the hybridization and transport of the DNA-bead complexes, and determining the resolution and limits of this sequencing method.
Author
Deoxyribonucleic Acid; Bioinstrumentation; Hydrodynamics; Molecules; Microfluidic Devices; Sequencing

20040084198 Louisville Univ., KY, USA
Computer Modeling of Cardiovascular Responses to Gravity
Sharp, M. Keith; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 153; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A recently initiated computer modeling project will investigate a possible contributing factor to postflight orthostatic intolerance (POI) that has to date received little attention. POI compromises crew safety and could have disastrous consequences in emergency situations during landing. A potentially revealing characteristic of POI is that even susceptible

astronauts are able to stand postflight for several minutes without symptoms. Many astronauts become dizzy only after 5-10 minutes of standing. Therefore, compensatory reflexes are apparently sufficient to prevent symptoms initially. While many factors, including a well-documented decrease in postflight blood volume, may increase sensitivity, the final cause of POI must have a delayed action consistent with the range of times astronauts are able to tolerate standing. Onset of symptoms during orthostatic stress in non-astronauts is correlated with the gradual rate of loss of blood volume by capillary filtration, which provides a potential explanation for the delayed occurrence of POI. Furthermore, astronauts have increased lower body capillary permeability in space. If permeability remains elevated, then capillary transport may also be responsible for the reduced tolerance of astronauts to upright posture postflight. Accordingly, it is hypothesized that capillary filtration explains the delayed onset, as well as the increased postflight incidence of dizziness. The hypothesis will be tested with a computer model of the cardiovascular system that incorporates fundamental biomechanical responses and reflex control. Posture-dependent capillary filtration will be represented with local permeability values and models of local intra- and extra-vascular pressure. A model of cerebral circulation will be included to provide a prediction of dizziness by direct comparison with established thresholds for cerebral flow. Because data is currently unavailable in astronauts, the model will be validated with heart rate, stroke volume and arterial pressure measurements and capillary filtration estimates derived from experiments on nonastronauts. Finally, the plausibility of the hypothesis will be tested by comparing the permeability required in the model to cause dizziness during simulated stand tests to the preliminary inflight values. This modeling effort will elucidate the potential importance of capillary filtration in producing POI and may guide the design of experiments to investigate this mechanism in astronauts.
Author
Cardiovascular System; Gravitation; Physiological Effects; Orthostatic Tolerance; Heart Function; Computerized Simulation; Brain Circulation

20040084211 NASA Marshall Space Flight Center, Huntsville, AL, USA
Microfluidic Biochip Design
Panzarella, Charles; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 127-128; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

As humans prepare for the exploration of our solar system, there is a growing need for miniaturized medical and environmental diagnostic devices for use on spacecrafts, especially during long-duration space missions where size and power requirements are critical. In recent years, the biochip (or Lab-on-a-Chip) has emerged as a technology that might be able to satisfy this need. In generic terms, a biochip is a miniaturized microfluidic device analogous to the electronic microchip that ushered in the digital age. It consists of tiny microfluidic channels, pumps and valves that transport small amounts of sample fluids to biosensors that can perform a variety of tests on those fluids in near real time. It has the obvious advantages of being small, lightweight, requiring less sample fluids and reagents and being more sensitive and efficient than larger devices currently in use. Some of the desired space-based applications would be to provide smaller, more robust devices for analyzing blood, saliva and urine and for testing water and food supplies for the presence of harmful contaminants and microorganisms. Our group has undertaken the goal of adapting as well as improving upon current biochip technology for use in long-duration microgravity environments.
Author (revised)
Bioinstrumentation; Microfluidic Devices

20040084216 Cleveland Clinic Foundation, Cleveland, OH, USA
Extracorporeal Shock Wave Therapy as a Countermeasure for Bone Loss on Earth and in Space
Knothe, Ulf R.; Berglund, Ryan; OLeary, Jare; Ziegler, Jennifer; KnotheTate, Melissa L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 23-24; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this study is to apply extracorporeal shock waves in an ex vivo rat model with the intent to mimic naturally occurring microdamage that stimulates bone tissue to rebuild. Our working hypothesis is that prophylactic application of shock waves will cause microdamage in bone that will stimulate the repair, remodeling, and renewal cascade. extracorporeal shock waves were applied to the anterior surface of the femoral middiaphysis or the prone rat, using the Lithiotriptor Modulith (trademark) SLX. Waves were applied toward the periosteal surface of the bone in the planar direction.Wave number and peak pressures wre varied.In six of nine groups, more cracks were visible in femoral cross sections from the treated side. The mean microcrack length was comparable to that occurring in respone to mechanical loading in physiological and fatigue studies.
Author (revised)
Bone Demineralization; Therapy

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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*.

20040081418 NASA Johnson Space Center, Houston, TX, USA
Radiation Dose from Reentrant Electrons
Badhwar, G.D.; Cleghorn, T. E.; Watts, J.; Radiation Measurements; [2003], pp. 121-126; In English; No Copyright; Avail: CASI; A02, Hardcopy

In estimating the crew exposures during an EVA, the contribution of reentrant electrons has always been neglected. Although the flux of these electrons is small compared to the flux of trapped electrons, their energy spectrum extends to several GeV compared to about 7 MeV for trapped electrons. This is also true of splash electrons. Using the measured reentrant electron energy spectra, it is shown that the dose contribution of these electrons to the blood forming organs (BFO) is more than 10 times greater than that from the trapped electrons. The calculations also show that the dose-depth response is a very slowly changing function of depth, and thus adding reasonable amounts of additional shielding would not significantly lower the dose to BFO.
Author
Radiation Dosage; Astronauts; Electron Energy

20040082651 Uniformed Services Univ. of the Health Sciences, Bethesda, MD
Anxiety Sensitivity, Body Vigilance, Interoceptive Acuity, and Cardiovascular Reactivity in the Genesis of Panic
Storey, Julie M.; Jan. 2000; 46 pp.; In English
Report No.(s): AD-A423616; No Copyright; Avail: CASI; A03, Hardcopy

Cognitive conceptualizations of panic require both the experience of arousal symptoms and their catastrophic interpretation. The tendency to interpret arousal symptoms as threatening is known as anxiety sensitivity (AS), but it is unclear if increased vigilance, greater physiological reactivity, or enhanced perception are responsible for reported physiological symptoms. Each of these mechanisms has been empirically supported in clinical, but not nonclinical, populations. The current investigation examined the ability of AS, body vigilance, cardiovascular reactivity, and interoceptive acuity to predict fearful responding to a 35% CO2 inhalation in a nonclinical population. A main effect was found for AS (R2 = .13;p \h.01). Two interaction effects were found (AS x Heart Rate, AR2 = .05,p \h.05; AS x Diastolic Blood Pressure, AR2 = .05, p \h.05). Results support cognitive theories of panic and suggest physiological reactivity combined with AS elicit more fearful responses than either alone.
DTIC
Acuity; Anxiety; Cardiovascular System; Panic; Reactivity; Sensitivity; Stress (Physiology)

20040082659 Uniformed Services Univ. of the Health Sciences, Bethesda, MD
Acute and Chronic Stress: The Effects of Loss of Control
Weiss, Linda; Jul. 31, 1996; 272 pp.; In English
Report No.(s): AD-A423652; No Copyright; Avail: CASI; A12, Hardcopy

Long-term unemployment often accompanied by homelessness, has been identified as a chronic stressor affecting the health and well-being of the unemployed and their families. This study was designed to test how loss of control associated with chronic unemployment generalized to, and affected response subsequent acute stressors increasing the likelihood of the development or exacerbation of stress- related physical and emotional distress. Eighty four male subjects participated in this study forming three groups based on current employment status: short-term (unemployed for less than two months); long-term (unemployed for longer than two months); and employed controls. Perceptions of control over the laboratory stressor were manipulated by randomly assigning half the men in each group into no control or perceived control conditions resulting in a 2 X 3 factorial design. Subjects were exposed to loud intermittent noise while working on three types of tasks; the effects of exposure to this stressor were assessed by performance and persistent on a cognitive task. Blood pressure and heart rate were used as measures of cardiovascular responses to stress and self-report provided data on somatic complaints psychological response and distress. Chronic stress associated with long-term unemployment was hypothesized to be related to elevated

psychophysiological symptoms and that attendant loss of control would generalize to the laboratory stressor resulting in performance deficits and helpless behavior
DTIC
Cardiovascular System; Losses; Stress (Physiology)

20040082734 New Mexico Univ., Albuquerque, NM
99HRT Prenatal Alcohol Exposure Damages Brain Signal Transduction Systems
Caldwell, Kevin K.; Sep. 2003; 36 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0582
Report No.(s): AD-A423814; No Copyright; Avail: CASI; A03, Hardcopy

This report details our progress during the third year of a three-year proposal. The proposal's overall goal is to uncover biochemical mechanisms that underlie learning and memory. These studies have yielded novel information about the effects of fear conditioning on brain phospholipase C-Betala (PLC-Betala), indicating that PLC-bla may play an important role in the biochemical processes underlying fear-conditioned learning and memory formation. We have uncovered the molecular basis of the observed association between PLC isozymes and extracellular signal-regulated protein kinase. In addition to increasing our understanding of the biochemical basis of learning and memory, these studies have yielded important information about the neurochemical mechanisms that underlie fear and stress, and, consequently, may provide insight into the neurochemical basis of posttraumatic stress syndrome.
DTIC
Alcohols; Brain; Damage; Exposure; Genetics; Psychology; Transferring

20040084147 NASA Glenn Research Center, Cleveland, OH, USA
Biophotonics and Bone Biology
Zimmerli, Gregory; Fischer, David; Asipauskas, Marius; Chauhan, Chirag; Compitello, Nicole; Burke, Jamie; Tate, Melissa Knothe; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 43; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

One of the more serious side effects of extended space flight is an accelerated bone loss. Rates of bone loss are highest in the weight-bearing bones of the hip and spine regions, and the average rate of bone loss as measured by bone mineral density measurements is around 1.2% per month for persons in a microgravity environment. It is well known that bone remodeling responds to mechanical forces. We are developing two-photon microscopy techniques to study bone tissue and bone cell cultures to better understand the fundamental response mechanism in bone remodeling. Osteoblast and osteoclast cell cultures are being studied, and the goal is to use molecular biology techniques in conjunction with Fluorescence Lifetime Imaging Microscopy (FLIM) to study the physiology of in-vitro cell cultures in response to various stimuli, such as fluid flow induced shear stress and mechanical stress. We have constructed a two-photon fluorescence microscope for these studies, and are currently incorporating FLIM detection. Current progress will be reviewed. This work is supported by the NASA John Glenn Biomedical Engineering Consortium.
Author (revised)
Photonics; Aerospace Medicine; Bone Demineralization

20040084163 Tulane Univ., New Orleans, LA, USA
Investigation of Pulmonary Epithelial Cell Damage Due to Air-liquid Interfacial Stresses in a Microgravity Environment
Gaver, Donald P., III; Bilek, A. M.; Kay, S.; Dee, K. C.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 11-12; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Pulmonary airway closure is a potentially dangerous event that can occur in microgravity environments and may result in limited gas exchange for flight crew during long-term space flight. Repetitive airway collapse and reopening subjects the pulmonary epithelium to large, dynamic, and potentially injurious mechanical stresses. During ventilation at low lung volumes and pressures, airway instability leads to repetitive collapse and reopening. During reopening, air must progress through a collapsed airway, generating stresses on the airway walls, potentially damaging airway tissues. The normal lung can tolerate repetitive collapse and reopening.. However, combined with insufficient or dysfunctional pulmonary surfactant, repetitive airway collapse and reopening produces severe lung injury. Particularly at risk is the pulmonary epithelium. As an important regulator of lung function and physiology, the degree of pulmonary epithelial damage influences the course and outcome of lung injury. In this paper we present experimental and computational studies to explore the hypothesis that the mechanical

stresses associated with airway reopening inflict injury to the pulmonary epithelium.
Derived from text
Damage; Microgravity; Stresses; Epithelium; Cells

20040084204 NASA Glenn Research Center, Cleveland, OH, USA
Microminiature Monitor for Vital Electrolyte and Metabolite Levels of Astronauts
Tohda, Koji; Gratzl, Miklos; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 41; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ions, such as proton (pH) and potassium, play a crucial role in body fluids to maintain proper basic functioning of cells and tissues. Metabolites, such as glucose, control the energy available to the entire human body in normal as well as stress situations, and before, during, and after meals. These molecules diffuse easily between blood in the capillaries and the interstitial fluid residing between cells and tissues. We have developed and approach to monitoring of critical ions (called electrolytes) and glucose in the interstitial fluid under the human skin. Proton and potassium levels sensed using optode technology that translates the respective ionic concentrations into variable colors of corresponding ionophore/dye/polymeric liquid membranes. Glucose is monitored indirectly, by coupling through immobilized glucose oxidase with local pH that is then detected using a similar color scheme. The monitor consists of a tiny plastic bar, 100-200 microns wide and 1-2 mm long, placed just under the skin, with color changing spots for each analyte as well as blanks. The colors are read and translated into concentration values by a CCD camera. Direct optical coupling between the in vivo sensing bar and the ex vivo detector device requires no power, and thus eliminates the need for wires or optical fibers crossing the skin. The microminiature bar penetrates the skin easily and painlessly, so that astronauts could insert it themselves. The approach is fully compatible with telemetry in space, and thus, in vivo clinical data will be available real time in the Earth based command center once the device is fully developed. The information provided can be used for collecting hitherto unavailable vital data on clinical effects of space travel. Managing clinical emergencies in space with the sensor already in place should also become much more efficient than without a continuous monitor, as is currently the case. Civilian applications may include better glucose control of patients with moderate to severe diabetes: a growing health problem in the US and World-wide.
Author (revised)
Astronauts; Bioinstrumentation; Microinstrumentation

20040084205 NASA Marshall Space Flight Center, Huntsville, AL, USA
Studying Biological Rhythms of Person's Skin-galvanic Reaction and Dynamics of Light Transmission by Isomeric Substance in Space Flight Conditions
Glushko, Vladimir; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 79-80; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Intensity and amplitude of human functional systems and human most important organs are wavelike, rhythmic by nature. These waves have constant periodicity, phase and amplitude. The mentioned characteristics can vary, however their variations have a pronounced reiteration in the course of time. This indicates a hashing of several wave processes and their interference. Stochastic changes in wave processes characteristics of a human organism are explained either by 'pulsations' associated with hashing (superposition) of several wave processes and their interference, or by single influence of environmental physical factors on a human organism. Human beings have respectively periods of higher and lower efficiency, state of health and so on, depending not only of environmental factors, but also of 'internal' rhythmic factor. Sometimes peaks and falls periodicity of some or other characteristics is broken. Disturbance of steady-state biological rhythms is usually accompanied by reduction of activity steadiness of the most important systems of a human organism. In its turn this has an effect on organism's adaptation to changing living conditions as well as on general condition and efficiency of a human being. The latter factor is very important for space medicine. Biological rhythmology is a special branch of biology and medicine, it studies rhythmic activity mechanisms of organs, their systems, individuals and species. Appropriate researches were also carried out in space medicine.
Author
Rhythm (Biology); Human Beings; Galvanic Skin Response

20040084212 NASA Glenn Research Center, Cleveland, OH, USA
Detection and Prevention of Cardiac Arrhythmias During Space Flight
Pillai, Dilip; Rosenbaum, David S.; Liszka, Kathy J.; York, David W.; Mackin, Michael A.; Lichter, Michael J.; Strategic

Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 129-130; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

There have been reports suggesting that long-duration space flight might lead to an increased risk of potentially serious heart rhythm disturbances. If space flight does, in fact, significantly decrease cardiac electrical stability, the effects could be catastrophic, potentially leading to sudden cardiac death. It will be important to determine the mechanisms underlying this phenomenon in order to prepare for long-term manned lunar and interplanetary missions and to develop appropriate countermeasures. Our hypothesis is that prolonged exposure to microgravity will alter T wave alternans measurements, decrease heart rate variance, increase QT dispersion, decrease heart rate recovery and alter QT restitution curve. A recently published study has shown that long duration spaceflights prolong cardiac conduction and repolarization. They concluded that long duration flight is associated with QT interval prolongation and may increase arrhythmia susceptibility. We propose using computer technology as a noninvasive clinical tool to detect and study clinically significant TWA during standard exercise testing using electrode systems specifically adapted for the purpose of obtaining and measuring TWA. A population of approximately 15 healthy men and 5 healthy women subjects, representative of the astronaut cohort will be asked to voluntarily participate in this study. Their blood pressure and ECG/TWA will be measured pre-flight and in-flight. Prior to flight, subjects will be asked to participate in an orientation session. Still photos will be taken of the skin where the conductive gel is used for the multi-segment sensors. Photos will be recorded preflight, immediately postflight, and several times during the proceeding week until it has been determined that any skin reaction has disappeared or that no rash is present and will not appear.

Author (revised)

Electrocardiography; Arrhythmia; Gravitational Physiology; Manned Space Flight

20040084214 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Earth-based Model of Microgravity Pulmonary Physiology

Hirschl, Ronald B.; Bull, Joseph L.; Grotberg, James B.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 15; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There are currently only two practical methods of achieving microgravity for experimentation: parabolic flight in an aircraft or space flight, both of which have limitations. As a result, there are many important aspects of pulmonary physiology that have not been investigated in microgravity. We propose to develop an earth-based animal model of microgravity by using liquid ventilation, which will allow us to fill the lungs with perfluorocarbon, and submersing the animal in water such that the density of the lungs is the same as the surrounding environment. By so doing, we will eliminate the effects of gravity on respiration. We will first validate the model by comparing measures of pulmonary mechanics, to previous space flight and parabolic flight measurements. After validating the model, we will investigate the impact of microgravity on aspects of lung physiology that have not been previously measured. These will include pulmonary blood flow distribution, ventillation distribution, pulmonary capillary wedge pressure, ventilation-perfusion matching and pleural pressures and flows. We expect that this earth-based model of microgravity will enhance our knowledge and understanding of lung physiology in space which will increase in importance as space flights increase in time and distance.

Author

Microgravity; Pulmonary Functions; Models; Respiratory Physiology; Earth (Planet)

20040084228 NASA Glenn Research Center, Cleveland, OH, USA

A Dual Track Treadmill in a Virtual Reality Environment as a Countermeasure for Neurovestibular Adaptations in Microgravity

DAndrea, Susan E.; Kahelin, Michael W.; Horowitz, Jay G.; OConnor, Philip A.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 9-10; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

While the neurovestibular system is capable of adapting to altered environments such as microgravity, the adaptive state achieved in space in inadequate for 1G. This leads to giant and postural instabilities when returning to a gravity environment and may create serious problems in future mission to Mars. New methods are needed to improve the understanding of the adaptive capabilities of the human neurovestibular system and to develop more effective countermeasures. The concept behind the current study is that by challenging the neurovestibular system while walking or running a treadmill can help to read just the relationship between the visual, vestibular and proprioceptive signals that are altered in a microgravity environment. As a countermeasure, this device could also benefit the musculoskeletal and cardiovascular systems and at the same time decrease

the overall time spent exercising. The overall goal of this research is to design, develop, build and test a dual track treadmill, which utilizes virtual reality, VR, displays.
Author
Cardiovascular System; Musculoskeletal System; Virtual Reality; Display Devices; Vestibules

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040081501 Institute for Human Factors TNO, Soesterberg, Netherlands
Training Critical Thinking for Tactical Command
vandenBosch, Karel; Helsdingen, Anne S.; deBeer, Marlous M.; Advanced Technologies for Military Training; April 2004; 10 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Military missions are more and more focused upon peace enforcing operations in regional conflicts. There is often uncertainty about the intentions, capabilities and strategies of the parties involved. Successful operations under such unstable and complex conditions require competent commanders and staff personnel. Recent studies have shown that experts in military tactical command treat decision making as a problem-solving process. Experts have large collections of schemas, enabling them to recognise a large number of situations as familiar. Another capacity of experts are their problem solving skills if an immediate match between the actual problem situation and available schemas in memory cannot be established. When faced with an unfamiliar tactical problem, experts collect and critically evaluate the available evidence, seek for consistency, and test assumptions underlying an assessment. They then integrate results in a comprehensive story. This expert s approach has been used to develop critical thinking training. This paper presents empirical studies into the effects of critical thinking training. Individual commanders and commanding teams played scenario-based exercises in both simplified and high-fidelity task environments. Half of the participants received instruction, guidance, and feedback in critical thinking. The other half received the same scenarios, but without specific support. After training, test scenarios were administered to all groups. Results showed positive effects on the process of tactical command (i.e. better argumentation for situation assessment) as well as on the outcomes (i.e. more and better contingency plans). In addition, members of critical thinking training teams were more inclined to clarify their perspective of the situation to each other. Critical thinking training supports commanders in situation assessment and decision making, and stimulates team members to engage in activities required to develop a shared mental model and to co-ordinate actions. For the Netherlands Navy and Army, the results of the studies are now being used to implement critical thinking into tactical decision games in order to develop new military training programs that will enhance the acquisition of sophisticated domain knowledge and decision making skills.
Author
Military Personnel; Decision Making; Problem Solving

20040081506 BAE Systems, Bristol, UK
Airmanship Training for Modern Aircrew
Ebbage, Louise; Spencer, Phil D.; Advanced Technologies for Military Training; April 2004; 12 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is widely accepted within aviation circles that airmanship is key to modern aviation, yet there is considerable confusion as to what airmanship actually comprises. To some it is the ‘stick and rudder’ skills associated with manual flying; to others it is the cognitive skills associated with decision-making and judgement. There is also a common belief that airmanship cannot formally be trained and is simply acquired through experience. None of these are completely true on their own. Instead, airmanship is a mixture of all of these attributes and much more besides. This paper explores the concept of airmanship - its definition and basic components, and explains the importance of taking a holistic view of airmanship training as the necessary foundation for the creation of competent and professional aviators. It also presents a series of practical guidelines that can be applied in the training and assessment of airmanship skills.
Author
Aircraft Pilots; Flight Safety; Pilot Performance; Flight Crews

20040081519 Central Military Hospital, Tbilisi, Georgia

Correlation Between the System of Values and the Stressful Factors (Anxiety Level) Among the Group of Georgian Soldiers

Avazashvili, Z.; Bjalava, T.; Chanturishvili, T.; Chanturishvili, S.; Morbedadze, T.; Advanced Technologies for Military Training; April 2004; 5 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The anxiety level and the system of values have been studied with help of the situational anxiety test and the scale of values among 180 Georgian soldiers. As a basis to this investigation there served a preliminary supposition that social problems, existing in the country, experiencing hardships at the early stages of its independence, would reveal very high anxiety level and a motley spectrum of the scale of values among the soldiers to be investigated. The results of the study showed an absence of the extreme high anxiety level. They also showed a system of values, not very relevant to military persons preferences to those ones, which (as the examined persons thought) would guarantee for them a comfortable life: love, good friends, happy family life. On the contrary, such values, as discipline, active and productive life, serving and the like were disregarded.

Author

Military Personnel; Anxiety; Georgia (Eurasia); Social Factors

20040081520 Air Force Research Lab., Mesa, AZ, USA

Advanced Training Technologies and Their Impact on Human Performance Improvement

Andrews, Dee H.; Advanced Technologies for Military Training; April 2004; 11 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This NATO symposium is focused on advanced training technologies that can have a significant impact on the way NATO member nations prepare their personnel for peace and wartime duties. There have been some remarkable developments in our ability to better train personnel. However, merely improving training is not enough to assure that our military organizations are optimized for their duties. We must help our militaries to become 'learning organizations' that wisely make use of a variety of technologies, including training, as we seek to optimize human performance improvement. Conceptual underpinnings that are requisite to forming learning organizations are examined. Strategic planning tools, knowledge management systems, and the Learning Management Maturity Model are among the topics explored. Those who seek to transform our militaries into learning organizations should view training and training technologies as two important arrows in the entire quiver of human performance improvement technology.

Author

Training Simulators; Human Performance

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*.

20040081516 ESE Associates, Yately, UK

Training Issues in Current UK In-Service Military Equipment

Davies, Jo; Ward, George; Advanced Technologies for Military Training; April 2004; 8 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents the findings of a survey carried out during 2001/2002 to identify Human Factors issues and concerns associated with in-service equipment. Training was one of the topics under investigation and 15 of the projects interviewed out of a total of 24 projects highlighted specific training related concerns. The types of issues found were categorized as follows: 1) Degree of trainer fidelity; 2) Maintainer training aids; 3) Trainer utility/utilization; 4) Documentation support; 5) Training gaps/conflicts; 6) Scenario definitions. The paper will discuss the specific issues to determine which ones present future challenges in terms of training needs.

Author

Human Factors Engineering; Training Devices

20040082236 NASA Ames Research Center, Moffett Field, CA, USA
Effects of Symbol Brightness Cueing on Attention During a Visual Search of a Cockpit Display of Traffic Information
Johnson, Walter W.; Liao, Min-Ju; Granada, Stacie; June 2003; 11 pp.; In English
Contract(s)/Grant(s): 711-51-42
Report No.(s): NASA/TM-2003-212266; IH-040; No Copyright; Avail: CASI; A03, Hardcopy

This study investigated visual search performance for target aircraft symbols on a Cockpit Display of Traffic Information (CDTI). Of primary interest was the influence of target brightness (intensity) and highlighting validity (search directions) on the ability to detect a target aircraft among distractor aircraft. Target aircraft were distinguished by an airspace course that conflicted with Ownship (that is, the participant's aircraft). The display could present all (homogeneous) bright aircraft, all (homogeneous) dim aircraft, or mixed bright and dim aircraft, with the target aircraft being either bright or dim. In the mixed intensity condition, participants may or may not have been instructed whether the target was bright or dim. Results indicated that highlighting validity facilitated better detection times. However, instead of bright targets being detected faster, dim targets were found to be detected more slowly in the mixed intensity display than in the homogeneous display. This relative slowness may be due to a delay in confirming the dim aircraft to be a target when it it was among brighter distractor aircraft. This hypothesis will be tested in future research. Funding for this work was provided by the Advanced Air Transportation Technologies Project of NASA's Airspace Operation Systems Program.
Author
Air Traffic Control; Brightness; Cockpits; Display Devices; Symbols; Cues; Attention

20040082667 Civil Aeromedical Inst., Oklahoma City, OK
FAA Strategies for Reducing Operational Error Causal Factors
Pounds, Julia; Ferante, Anthony S.; Nov. 2003; 14 pp.; In English
Report No.(s): AD-A423665; DOT/FAA/AM-03/19; No Copyright; Avail: CASI; A03, Hardcopy

The FAA has historically tried to understand and mitigate the incidence of operational errors (OEs), focusing on the critical component of the system-the closest person to the air traffic situation and the last point of prevention-the air traffic controller. With the human element as the foundation of such a complex system, several initiatives by the FAA Office of Evaluations and Investigations Staff include: have focused on human performance within, and interacting with, the larger system. These have included implementing a coordinated system of investigations to identify causal factors, fielding automation to re-create events, developing metrics to categorize OE severity, and sponsoring unique performance enhancement programs.
DTIC
Air Traffic Control; Errors; Human Factors Engineering

20040082771 Army War Coll., Carlisle Barracks, PA
An Argument for the Use of Biometrics to Prevent Terrorist Access to the USA
Graham, Ray A.; Dec. 6, 2003; 30 pp.; In English
Report No.(s): AD-A423892; No Copyright; Avail: CASI; A03, Hardcopy

This paper considers measures that should be taken by the USA government to implement policies for a standardized personal identification system that includes the use of chip technology and biometrics to positively identify the bearer. The paper considers and expands upon the following discussion points: -Terrorism has changed significantly in recent years requiring different tactics techniques and procedures to meet this asymmetric threat. -Terrorist groups have expanded globally and groups operate around the world without regard to borders or national boundaries. This has made it more difficult to track and apprehend terrorists. - There has been an increase in the practice of identity theft by terrorist organizations as a technique to infiltrate agents and operatives into the USA. - Biometric technology offers a significantly improved method for positively identifying travelers entering the USA. The paper recommends the following: - -That the USA adopt a standard for a biometric identification card which is required for international travel. Include iris scanning and smart card technology to make use of embedded chip data storage encryption and biometrics to positively identify the bearer. - That automation architects develop a single shared international database of terrorist suspects violent dissidents and criminals which is accessible by world-wide agencies.
DTIC
Biometrics; Terrorism; United States

20040084043 NASA Marshall Space Flight Center, Huntsville, AL, USA

Colossal Tooling Design: 3D Simulation for Ergonomic Analysis

Hunter, Steve L.; Dischinger, Charles; Thomas, Robert E.; Babai, Majid; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 8 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The application of high-level 3D simulation software to the design phase of colossal mandrel tooling for composite aerospace fuel tanks was accomplished to discover and resolve safety and human engineering problems. The analyses were conducted to determine safety, ergonomic and human engineering aspects of the disassembly process of the fuel tank composite shell mandrel. Three-dimensional graphics high-level software, incorporating various ergonomic analysis algorithms, was utilized to determine if the process was within safety and health boundaries for the workers carrying out these tasks. In addition, the graphical software was extremely helpful in the identification of material handling equipment and devices for the mandrel tooling assembly/disassembly process.

Author

Computerized Simulation; Tooling; Human Factors Engineering; Aerospace Engineering; Manufacturing; Three Dimensional Models

20040084079 Old Dominion Univ., VA, USA

A Comparison of a Brain-Based Adaptive System and a Manual Adaptable System for Invoking Automation

Bailey, Nathan R.; Scerbo, Mark W.; Freeman, Frederick G.; Mikulka, Peter J.; Scott, Lorissa A.; [2004]; 24 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG1-02062; No Copyright; Avail: CASI; A03, Hardcopy

Two experiments are presented that examine alternative methods for invoking automation. In each experiment, participants were asked to perform simultaneously a monitoring task and a resource management task as well as a tracking task that changed between automatic and manual modes. The monitoring task required participants to detect failures of an automated system to correct aberrant conditions under either high or low system reliability. Performance on each task was assessed as well as situation awareness and subjective workload. In the first experiment, half of the participants worked with a brain-based system that used their EEG signals to switch the tracking task between automatic and manual modes. The remaining participants were yoked to participants from the adaptive condition and received the same schedule of mode switches, but their EEG had no effect on the automation. Within each group, half of the participants were assigned to either the low or high reliability monitoring task. In addition, within each combination of automation invocation and system reliability, participants were separated into high and low complacency potential groups. The results revealed no significant effects of automation invocation on the performance measures; however, the high complacency individuals demonstrated better situation awareness when working with the adaptive automation system. The second experiment was the same as the first with one important exception. Automation was invoked manually. Thus, half of the participants pressed a button to invoke automation for 10 s. The remaining participants were yoked to participants from the adaptable condition and received the same schedule of mode switches, but they had no control over the automation. The results showed that participants who could invoke automation performed more poorly on the resource management task and reported higher levels of subjective workload. Further, those who invoked automation more frequently performed more poorly on the tracking task and reported higher levels of subjective workload. and the adaptable condition in the second experiment revealed only one significant difference: the subjective workload was higher in the adaptable condition. Overall, the results show that a brain-based, adaptive automation system may facilitate situation awareness for those individuals who are more complacent toward automation. By contrast, requiring operators to invoke automation manually may have some detrimental impact on performance but does appear to increases subjective workload relative to an adaptive system.

Author

Automatic Control; Brain; Manual Control; Human Factors Engineering

20040084105 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Conservation Quality FM 12 Respirator

vanderGijp, S.; Albers, T.; Steenweg, L. A. W. M.; Schimmel, R. J.; March 2004; 33 pp.; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A99/KL/433; A02/KL/421; TNO Proj. 014.14292

Report No.(s): PML- 2004-A20; TD-2004-0020; Copyright; Avail: Other Sources

After the introduction of the FM 12 respirator and the AMF 12 canister it is important to monitor the quality of both products. In this report a statistic evaluation is described of respirators which were returned to the gas mask refurbishment

shop, currently located in Soesterberg. In addition assembled masks were evaluated. Finally, several practical questions in relation to the respirators were answered, amongst others the influence of RSDL and donning procedures.
Author
Respirators; Quality Control; Cans; Statistical Analysis

20040084175 Washington State Univ., Pullman, WA, USA
Supported Capillary Pipes
Thiessen, David B.; Marston, Philip L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 169; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Preliminary experiments have been conducted in a Plateau tank on supported capillary structures, which might have application to chemical separations and other processes in zero gravity including those associated with life support. Countercurrent flow of gas and liquid or of two liquids is ubiquitous in chemical processing. Examples include distillation, absorption, stripping, and extraction. A large amount of surface area is necessary for efficient operation of such processes. On earth, gravity drives the countercurrent flow because of a density difference between the two phases. Various support structures are used to create large amounts of surface area between the two phases such as structured or dumped packings or bubble-cap trays. In zero gravity, free-surface liquid flow can be inertial or driven by capillary forces or applied forces. It is proposed that supported capillary pipes can sustain sufficient pressure gradients to drive flow over significant distances for liquid-gas or liquid-liquid contacting. Liquid tubes of arbitrary length can be supported by parallel wires with the proper wetting characteristics arranged in regular polygonal arrays or by a helical coil of wire. The static stability of these structures has recently been investigated theoretically.
Author
Pipes (Tubes); Gravitation; Life Support Systems; Free Flow

20040084220 Northwestern Univ., Evanston, IL, USA
Rotating Reverse Osmosis for Wastewater Reuse
Lueptow, Richard M.; Yoon, Yeomin; Pederson, Cynthia; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 31-32; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Membrane filtration such as Reverse Osmosis (RO) removes ions, proteins, and organic chemicals which are generally very difficult to remove using conventional treatment. Moreover, membrane is an absolute filtration method, so its treatment efficiency and performance are stable and predictable. We are currently working on the development of rotating RO membrane system. Dynamic rotating membrane filtration, which can produce a high shear rate, may be helpful to obtain high rejection of organic pollutants.The goal of our current work is to improve the flux of the device by increasing pressure by a factor of 3 to 4. In addition, the rejections for a wider variety of inorganic and organic compounds typically found in space mission wastewater are measured.
Author (revised)
Reverse Osmosis; Waste Water

20040084221 NASA Marshall Space Flight Center, Huntsville, AL, USA
Past, Present and Future Advanced ECLS Systems for Human Exploration of Space
Mitchell, Kenny; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 33; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper will review the historical record of NASA's regenerative life support systems flight hardware with emphasis on the complexity of spiral development of technology as related to the International Space Station program. A brief summary of what constitutes ECLSS designs for human habitation will be included and will provide illustrations of the complex system/system integration issues. The new technology areas which need to be addressed in our future Code T initiatives will be highlighted. The development status of the current regenerative ECLSS for Space Station will be provided for the Oxygen Generation System and the Water Recovery System. In addition, the NASA is planning to augment the existing ISS capability with a new technology development effort by Code U/Code T for CO2 reduction (Sabatier Reactor). This latest ISS spiral development activity will be highlighted in this paper.
Author
Oxygen Production; Life Support Systems; Carbon Dioxide; Complex Systems; Regeneration (Engineering)

20040084226 Ames Lab., IA, USA

Colorimetric Solid Phase Extraction: A Method for the Rapid, Low-level Determinations of Biocide Levels in Spacecraft Water

Gazda, Daniel B.; Fritz, James S.; Lipert, Robert J.; Porter, Marc D.; Mudgett, Paul; Rutz, Jeff; Schultz, John; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 13; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Monitoring and maintaining biocide concentrations is vital for assuring safe drinking water both in ground and spacecraft applications. Currently, there are no available methods to measure biocide concentrations (i.e., silver ion or iodine) on-orbit. Sensitive, rapid, simple colorimetric methods for the determination of silver(I) and iodine are described. The apparatus consists of a 13-mm extraction disk (Empore (trademark) membrane) impregnated with a colorimetric reagent and placed in a plastic filter holder. A Luer tip syringe containing the aqueous sample is attached to the holder and a predetermined volume of sample is forced through the disk in approx. 30 s. Sliver(I) is retained by a disk impregnated with 5-(p-dimethylaminobenzylidene)-rhodanine (DMABR), and iodine is retained as a yellow complex on a membrane impregnated with polyvinylpyrrolidone (PVP). After passage of a water sample, the colorimetric response generated by the interaction between analyte and reagent is measured by use of a hand-held, commercial reflectance spectrophotometer. This simple solid-phase extraction (SPE) method gives a high concentration factor. The sensitivity for both measurements is excellent: 0.005 mg/L for Ag(I) and 0.1 mg/L for I2. Furthermore, the methodology minimizes sample handling and potential contamination events, produces only a small volume of waste, and requires only approx. 60 s for completion. Details related to membrane impregnation, calibration, and interferences are presented, as well as the results of ground-based analysis of samples of actual Space Shuttle and International Space Station (ISS) drinking water. Findings from KC-135 microgravity flight simulations and challenges for the eventual deployment on ISS will also be described.

Author

Colorimetry; Water Color; Spacecraft Environments; Water Sampling; Pollution Monitoring

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*.

20040081069 NASA Ames Research Center, Moffett Field, CA, USA

Titan Ice and Dust Experiment (TIDE): Detection and Analysis of Compounds of Interest to Astrobiology in the Lower Atmosphere and Surface of Titan

Kojiro, Daniel R.; Holland Paul M.; Stimac, Robert M.; Kaye, William J.; Takeruchi, Noreshige; February 09, 2004; 1 pp.; In English; Astrobiology Science Conference, 28 Mar. - 1 Apr. 2004, Moffett Field, CA, USA

Contract(s)/Grant(s): RTOP 344-52-50-37; No Copyright; Avail: Other Sources; Abstract Only

The Titan Orbiter Aerorover Mission (TOAM) is a proposed concept for the Solar System Exploration Visions Mission, Titan Explorer, a follow-on to the Cassini-Huygens mission. TOAM would use a Titan polar orbiter and a lighter-than-air aerorover to investigate the surface and atmosphere of Titan. Astrobiology issues will be addressed though TOAM investigations including, for example: Distribution and composition of organics (atmospheric, aerosol, surface); Organic chemical processes, their chemical context and energy sources; and Seasonal variations and interactions of the atmosphere and surface. The TIDE instrument will perform in-situ analyses to obtain comprehensive and sensitive molecular and elemental assays of volatile organics in the atmosphere, oceans and surface. TIDE chemical analyses are conducted by a Gas Chromatograph-Ion Mobility Spectrometer (GC-IMS). This TIDE GC-IMS was a component of the mini-Cometary Ice and Dust Experiment (mini-CIDEX) developed for the chemical analysis of a cometary environment. Both the GC and helium IMS of mini-CIDEX have been further developed to better meet the analytical and operational requirements of the TOAM. application. A Micro-ElectroMechanical System (MEMS) GC and Mini-Cell helium IMS are under development to replace their respective mini-CIDEX components, providing similar or advanced analytical capabilities.

Author

Dust; Exobiology; Ice; Titan; Planetary Atmospheres; Lower Atmosphere; Chemical Analysis; Organic Compounds; Detection

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*.

20040081076 NASA Ames Research Center, Moffett Field, CA, USA
Lattice Duality: The Origin of Probability and Entropy
Knuth, Kevin H.; [2004]; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Bayesian probability theory is an inference calculus, which originates from a generalization of inclusion on the Boolean lattice of logical assertions to a degree of inclusion represented by a real number. Dual to this lattice is the distributive lattice of questions constructed from the ordered set of down-sets of assertions, which forms the foundation of the calculus of inquiry-a generalization of information theory. In this paper we introduce this novel perspective on these spaces in which machine learning is performed and discuss the relationship between these results and several proposed generalizations of information theory in the literature.
Author
Entropy; Probability Theory; Duality Theorem; Lattices (Mathematics)

20040081349 Technical Research Centre of Finland, Espoo, Finland
Baltics as a Business Location for Information Technology and Electronics Industries
Nissinen, M.; 2002; In English
Report No.(s): PB2004-106096; VTT/RN-2169; No Copyright; Avail: National Technical Information Service (NTIS)

This study examines the current state of the ICT and electronics industries in the three Baltic States. In doing this, it implicitly highlights the opportunities for co-operation between Baltic and Finnish firms. The study consists of three parts: 1 a sector analysis of the industry, 2 a review of the education and research system in the field under consideration, and 3 an analysis of the business culture and the business environment. The first section is based on extensive surveys among ICT and electronics enterprises in Estonia, Latvia and Lithuania. It sheds light on the following areas:the size and the growth prospects of the ICT and electronics industries, their focus of production and core competence, the significance of exports and subcontracting as well as the prevailing interest in Finland. Higher education is examined from the perspective of the availability of workforce; research from that of innovation capacity. Finally, the report discusses the qualities of Baltic employees, specialities of the local business culture and appropriate ways to approach a Baltic company.
NTIS
Commerce; International Trade

20040081356 Technical Research Centre of Finland, Espoo, Finland
Information Technologies for Value Network Integration
Hemila, J.; 2002; In English
Report No.(s): PB2004-106323; VTT-RN-2149; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this study is to define which kind of applications are suitable for managing networked enterprises and supply chains, and how application integration can be achieved. Information sharing for the company's use and with the business partners improves the transparency of a dynamic business environment. The objective is to create a hypothetical model for value network integration in practice by combining the research results of this study. The research is focused on electronic contract manufacturing industry but the technologies and models are applicable also to other industries. The supply chain and network management and management tools are studied in the literature survey and by using www-material from the Internet. The supply chain and network management and tools are studied also by interviewing software vendors. Information about supply chain management in practice is studied in a joint project by VTT and the customer company by interviews and discussions with the parties involved.
NTIS
Computer Networks; Information

20040081357 Technical Research Centre of Finland, Espoo, Finland
Requirements for Medical Device Software
Poyhonen, I.; Kylmala, K.; Harju, H.; Kemppainen-Kajola, P.; Kuhakoski, K.; 2002; 184 pp.; In Finnish
Report No.(s): PB2004-106324; VTT-RN-2150; No Copyright; Avail: CASI; A09, Hardcopy

The performance and complexity of devices and systems used in health care increase year by year. Changes are partly result from technological changes but also methods of treatment are developing and adding pressure for changes of performance and safety of devices. Regularly, the systems used to support methods of treatment and examination include a computer or a client, an operating system and a large amount of different kind of application programs and drivers. In this publication, EU and FDA requirements for medical device software are integrated and a model for demonstration of compliance with the requirements is introduced. In addition, risk management processes and methods are largely concerned. With these processes and methods one is able, in addition to identify and estimate risks, also improve the development processes and assure the succeed access to the market. The publication is intended to the manufacturers of medical devices to guide different sectors of software engineering aim to integrate product risk management and risk analysis to the compact part of design. In this way the design process will produce more reliable and safer products at a shorter product development time. In addition, the manufacturer is able to effectively demonstrate the compliance with the requirements of standards and directives for the authorities.
NTIS
Software Engineering; Management Analysis; Product Development

20040082407 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Performance Evaluation and Enhancement of Super LU DIST 2.0
Li, X. S.; Wang, Y.; 2003; In English
Report No.(s): DE2003-817631; No Copyright; Avail: National Technical Information Service (NTIS)

We present the runtime comparison of the two versions of Super LU(-)DIST, using up to 128 processors of the IBM SP at NERSC. One version provides the global input interface, and another provides the distributed input interface. The comparison includes the total runtime of the solver with both 32-bit and 64-bit addressing modes, the time breakdown for different phases of the solver. We also present an in-depth comparison off our sparse matrix-vector multiplication methods in the context of iterative refinement. Finally, we describe our Fortran 90 interface that enhances the usability of the software.
NTIS
Fortran; Vectors (Mathematics); Matrices (Mathematics)

20040082415 Lockheed Martin Corp., Syracuse, NY, USA
Spatial Differencing and Mesh Sensitivity in Two- and Three- Dimensional Discrete Ordinates Codes
Davidson, C. S.; Burre, C. A.; Oct. 2002; In English
Report No.(s): DE2004-821863; LM-02K104; No Copyright; Avail: National Technical Information Service (NTIS)

Errors due to spatial differencing methods and mesh size in two-dimensional and three-dimensional discrete ordinate solutions of a typical gamma ray shielding problem are illustrated by comparing results from the DORT, TORT, and PARTISN codes. using a model geometry that is typical of spent fuel transfer and storage casks these errors were systematically investigated by varying the mesh size and differencing method. The results of this study show that the fixed-weighted and adaptive weighted diamond differencing methods in 2D problems require mesh intervals of about 0.25 mfp's for reasonable accuracy in deep penetration. The number of mesh cells required for weighted diamond difference methods severely limit the size of 3D problems that can be solved. The linear discontinuous method in PARTISN is shown to maintain numerical accuracy in 3D problems while reducing the overall computational effort by allowing larger mesh intervals. it is also shown that 3D problems exhibit differencing errors that may not readily be inferred from 2D results. Comprehensive displays of the magnitudes of spatial differencing errors in a practical shielding problem provide valuable guidance for the shielding practitioner using today's computational tools.
NTIS
Shielding; Spent Fuels

20040082417 Swedish Defence Research Establishment, Linkoeping, Sweden
Trust and Policies for Mobile Code in Heterogenous Networks
Persson, M.; Nov. 2003; 24 pp.; In Swedish
Report No.(s): PB2004-104634; FOI-R-1019-SE; No Copyright; Avail: CASI; A03, Hardcopy

The requirements on the future military command and control system and its technical architecture differ somewhat from the available commercial technology. The command and control system should be flexible in the meaning of dynamic, decentralized, interoperable and mobile. This means that different methods for trust and security policy management must be utilized. This is especially important when concerning the different forms of mobile code. The outline discussed in this report

shows how a special component that acts like a trusted guard, is inserted in each node in the net. This component decides which other components it should trust, decides which policies are in force and controls the traffic between the node and network.
NTIS
Computer Networks; Security

20040082420 Rutherford Appleton Lab., Oxford, UK
HSL MC73: A Fast Multilevel Fiedler and Profile Reduction Code
Hu, Y.; Scott, J.; Jan. 2004; 26 pp.; In English
Report No.(s): PB2004-105318; RAL-TR-2003-036; Copyright; Avail: National Technical Information Service (NTIS)

In recent years, multilevel algorithms have been used for the efficient computation of the eigenvector corresponding to the smallest positive eigenvalue of the Laplacian matrix associated with a graph of a symmetric matrix (the Fiedler vector). Multilevel algorithms have also been proposed for computing profile-reducing orderings for sparse symmetric matrices. In this paper, these multilevel algorithms are described within a unified framework. This is then used in the design of a new FORTRAN 95 code HSL-MC73 that implements a multilevel algorithm for the computation of an approximate Fiedler vector as well as a number of multilevel profile-reducing algorithms. HSL-MC73 is used to compute spectral orderings for a class of undirected random graphs and its performance is compared with obtaining the Fiedler vector using a state-of-the-art sparse eigensolver.
NTIS
Matrices (Mathematics); Applications Programs (Computers)

20040082467 Bethel Coll., Saint Paul, MN, USA
Analysis of the Advantages and Limitations of Stationary Imaging Fourier Transform Spectrometer
Beecken, Brian P.; Kleinman, Randall R.; July 14, 2004; 15 pp.; In English
Contract(s)/Grant(s): NAG1-02012; No Copyright; Avail: CASI; A03, Hardcopy

New developments in infrared sensor technology have potentially made possible a new space-based system which can measure far-infrared radiation at lower costs (mass, power and expense). The Stationary Imaging Fourier Transform Spectrometer (SIFTS) proposed by NASA Langley Research Center, makes use of new detector array technology. A mathematical model which simulates resolution and spectral range relationships has been developed for analyzing the utility of such a radically new approach to spectroscopy. Calculations with this forward model emulate the effects of a detector array on the ability to retrieve accurate spectral features. Initial computations indicate significant attenuation at high wavenumbers. Author
Imaging Spectrometers; Fourier Transformation; Infrared Detectors; Spectroscopy

20040083018 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Accurate Modeling of Cache Replacement Policies in a Data Grid
Otoo, E.; Shoshani, A.; 2003; In English
Report No.(s): DE2003-815511; No Copyright; Avail: National Technical Information Service (NTIS)

Caching techniques have been used to improve the performance gap of storage hierarchies in computing systems. In data intensive applications that access large data files over wide area network environment, such as a data grid, caching mechanism can significantly improve the data access performance under appropriate workloads. In a data grid, it is envisioned that local disk storage resources retain or cache the data files being used by local application. Under a workload of shared access and high locality of reference, the performance of the caching techniques depends heavily on the replacement policies being used. A replacement policy effectively determines which set of objects must be evicted when space is needed. Unlike cache replacement policies in virtual memory paging or database buffering, developing an optimal replacement policy for data grids is complicated by the fact that the file objects being cached have varying sizes and varying transfer and processing costs that vary with time. We present an accurate model for evaluating various replacement policies and propose a new replacement algorithm referred to as 'Least Cost Beneficial based on K backward references (LCB-K).' Using this modeling technique, we compare LCB-K with various replacement policies such as Least Frequently Used (LFU), Least Recently Used (LRU), Greedy Dual Size (GDS), etc., using synthetic and actual workload of accesses to and from tertiary storage systems. The results obtained show that (LCB-K) and (GDS) are the most cost effective cache replacement policies for storage resource management in data grids.
NTIS
Data Bases; Virtual Memory Systems; Algorithms

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*.

20040081371 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Low-Cost Clustered Archive Approach for Storing Remote Sensing Data
Tilmes, Curt; [2004]; 1 pp.; In English; 3rd USENIX Conference on File and Storage Technologies, 2004, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

As part of NASA's Earth Observing System (EOS) Data and Information System (EOSDIS), the Moderate Resolution Imaging Spectrometer (MODIS) Data Processing System (MODAPS) is now processing data from two instruments on the EOS flag ship spacecraft Terra and Aqua. Between the two, MODAPS is generating over 1 Terrabyte of data per day and has surpassed 3 Petabytes of total data. The bulk of the data is stored near-line in StorageTek Powerhorn tape jukeboxes. Accessing data that has been moved to tape involves submitting an order, scheduling the tape, and waiting for the data to become available. I am developing a low cost clustered archive that could enable storing a very large amount of data such as the MODIS data described above in an organized fashion on a cluster of commodity hardware using low cost SATA hard drives such that the files are directly available online. The system takes full advantage of Open Source software, using the GNULinux operating system, PostgreSQL relational database and the Apache HTTP Server. This poster session will depict my approach, the interface to the archive, a brief discussion of the internals of the system and some performance numbers from my prototyping. I will also describe various costs and benefits of this approach versus the traditional large tape jukebox approach currently in use in the EOSDIS.
Author
Data Storage; Earth Observing System (Eos); Low Cost; Remote Sensing; MODIS (Radiometry)

20040081509 Naval Air Systems Command, Orlando, FL, USA
Usability Analysis of a Personal Digital Assistant Based Data Collection Tool for the Shipboard Training Environment
Allen, Robert C.; Hession, Paul J.; Kring, Eleni D.; Advanced Technologies for Military Training; April 2004; 49 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Researchers for the U.S. Navy have developed multiple instructor aides for performance measurement hosted on hand-held computers such as pen tablet computers. This technology provides a potential solution to the challenge of supporting training in complex, data intensive shipboard environments. However, Hand-held computers are relatively expensive and can be cumbersome in the confined spaces found in such environments. Therefore, the U. S. Navy is investigating the use of more portable, lightweight data collection tools such as Personal Digital Assistants (PDAs). Hardware and software limitations associated with these devices exist, including limited screen real estate and memory. The challenge for the Naval training and human factors communities is to develop training applications for PDAs that are relevant to shipboard users and that also apply sound human factors and usability principles. The primary purpose of this paper is to describe a usability analysis of a training application loaded onto a Pocket PC. The analysis included heuristic evaluations, user testing sessions, and redesign recommendations. The target audience of the application is U.S. Navy shipboard instructors, who would use the application to prebrief a training audience, to collect data during an exercise, and to debrief the training audience.
Author
Minicomputers; Portable Equipment; Training Evaluation; Ships

20040082290 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Pore Formation and Mobility Investigation: The Apparatus, Operations, Science Obtained, and Potential for Continued Usage
Gurgel, R. N.; Luz, P.; Smith, G. A.; Spivey, R.; Sen, S.; Anilkumar, A.; [2004]; 1 pp.; In English; Institute of Electrical and Electronics Engineering-Lasers and Electro-Optics (IEEE-LEOS) Society Meeting, 28-30 Jun. 2004, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The objective of the presentation is to provide an overview of the Pore Formation and Mobility Investigation (PFMI) hardware that is currently aboard the International Space Station and to identify European experiments could utilize it. The hardware, integration in the Glovebox, operations,-science results, and instrument performance assessment will be presented.

The possibilities of adapting the optical observation system will also be reviewed.
Author
Mobility; Hardware; Formation

20040082313 Murray State Univ., KY, USA
Design Space Issues for Intrinsic Evolvable Hardware
Hereford, James; Gwaltney, David; [2004]; 2 pp.; In English; 2004 NASA/DoD Conference on Evolvable Hardware, 24-26 Jun. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper discusses the problem of increased programming time for intrinsic evolvable hardware (EM) as the complexity of the circuit grows. As the circuit becomes more complex, then more components will be required and a longer programming string, L, is required. We develop equations for the size of the population, n, and the number of generations required for the population to converge, based on L. Our analytical results show that even though the design search space grows as 2L (assuming a binary programming string), the number of circuit evaluations, n*ngen, only grows as O(Lg3), or slightly less than O(L). This makes evolvable techniques a good tool for exploring large design spaces. The major hurdle for intrinsic EHW is evaluation time for each possible circuit. The evaluation time involves downloading the bit string to the device, updating the device configuration, measuring the output and then transferring the output data to the control processor. Each of these steps must be done for each member of the population. The processing time of the computer becomes negligible since the selection/crossover/mutation steps are only done once per generation. Evaluation time presently limits intrinsic evolvable hardware techniques to designing only small or medium-sized circuits. To evolve large or complicated circuits, several researchers have proposed using hierarchical design or reuse techniques where submodules are combined together to form complex circuits. However, these practical approaches limit the search space of available designs and preclude utilizing parasitic coupling or other effects within the programmable device. The practical approaches also raise the issue of why intrinsic EHW techniques do not easily apply to large design spaces, since the analytical results show only an O(L) complexity growth.
Derived from text
Circuits; Strings; Evolvable Hardware

20040082326 Murray State Univ., KY, USA
Design Space Issues for Intrinsic Evolvable Hardware
Hereford, James; Gwaltney, David; [2004]; 4 pp.; In English; 2004 NASA/DoD Conference on Evolvable Hardware, 24-26 Jun. 2004, Seattle, WA, USA; No Copyright; Avail: CASI; A01, Hardcopy

This paper discuss the problem of increased programming time for intrinsic evolvable hardware (EHW) as the complexity of the circuit grows. We develop equations for the size of the population, n, and the number of generations required for the population to converge, ngen, based on L, the length of the programming string. We show that the processing time of the computer becomes negligible for intrinsic EHW since the selection/crossover/mutation steps are only done once per generation, suggesting there is room for use of more complex evolutionary algorithms m intrinsic EHW. F i y , we review the state of the practice and discuss the notion of a system design approach for intrinsic EHW.
Derived from text
Evolvable Hardware; Systems Engineering; Genetic Algorithms; Strings

20040082636 Purdue Univ., West Lafayette, IN
Collective Value of QoS: A Performance Measure Framework for Distributed Heterogeneous Networks
Kim, Jong-Kook; Kidd, Taylor; Siegal, Howard J.; Irvine, Cynthia; Levin, Tim; Apr. 2001; 15 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0804; DABT63-99-C-0010
Report No.(s): AD-A423590; No Copyright; Avail: CASI; A03, Hardcopy

When user's tasks in a distributed heterogeneous computing environment are allocated resources, and the total demand placed on system resources by the tasks, for a given interval of time, exceeds the resources available, some tasks will receive degraded service, receive no service at all, or may be dropped from the system. One part of a measure to quantify the success of a resource management system (RMS) in such an environment is the collective value of the tasks completed during an interval of time, as perceived by the user, the application, or the policy maker. For the case where a task may be a data communication request, the collective value of data communication requests that are satisfied during an interval of time is measured. The Flexible Integrated System Capability (FISC) measure defined here is one way of obtaining a multi-dimensional measure for quantifying this collective value. While the FISC measure itself is not sufficient for scheduling

purposes, it can be a critical part of a scheduler or a scheduling heuristic. The primary contribution of this work is providing a way to measure the collective value accrued by an RMS using a broad range of attributes and to construct a flexible framework that can be extended for particular problem domains.
DTIC
Communication Networks; Computer Programs; Heterogeneity; Quality Control; Resources Management

20040082661 Naval Postgraduate School, Monterey, CA
Analysis of the Intel Pentium's Ability to Support a Secure Virtual Machine Monitor
Robin, John S.; Irvine, Cynthia E.; Aug. 2000; 17 pp.; In English
Report No.(s): AD-A423654; No Copyright; Avail: CASI; A03, Hardcopy

A virtual machine monitor (VMM) allows multiple operating systems to run concurrently on virtual machines (VMs) on a single hardware platform. Each VM can be treated as an independent operating system platform. A secure VMM would enforce an overarching security policy on its VMs. The potential benefits of a secure VMM for PCs include: a more secure environment, familiar COTS operating systems and applications, and enormous savings resulting from the elimination of the need for separate platforms when both high assurance policy enforcement, and COTS software are required. This paper addresses the problem of implementing secure VMMs on the Intel Pentium architecture. The requirements for various types of VMMs are reviewed. We report an analysis of the virtualizability of all of the approximately 250 instructions of the Intel Pentium platform and address its ability to support a VMM. Current virtualization techniques for the Intel Pentium architecture are examined and several security problems are identified. An approach to providing a virtualizable hardware base for a highly secure VMM is discussed.
DTIC
Virtual Reality

20040082679 Naval Postgraduate School, Monterey, CA
A Multi-Threading Architecture for Multilevel Secure Transaction Processing
Isa, Haruna R.; Shockley, William R.; Irvine, Cynthia E.; May 1999; 16 pp.; In English
Report No.(s): AD-A423692; No Copyright; Avail: CASI; A03, Hardcopy

A TCB and security kernel architecture for supporting multi-threaded, queue-driven transaction processing applications in a multilevel secure environment is presented. Our design exploits hardware security features of the Intel 80x86 processor family. Intel's CPU architecture provides hardware with two distinct descriptor tables. We use one of these in the usual way for process isolation. For each process, the descriptor table holds the descriptors of ″system-low″ segments, such as code segments, used by every thread in a process. We use the second table to hold descriptors for segments known to individual threads within the process. This allocation, together with an appropriately designed scheduling policy, permits us to avoid the full cost of process creation when only switching between threads of different security classes in the same process. Where large numbers of transactions are encountered on transaction queues, this approach has benefits over traditional multilevel systems.
DTIC
Security

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040081033 NASA Ames Research Center, Moffett Field, CA, USA
The Fringe-Imaging Skin Friction Technique PC Application User's Manual
Zilliac, Gregory G.; September 1999; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 519-20-22
Report No.(s): NASA/TM-1999-208794; A-99V0036; No Copyright; Avail: CASI; A03, Hardcopy

A personal computer application (CXWIN4G) has been written which greatly simplifies the task of extracting skin friction measurements from interferograms of oil flows on the surface of wind tunnel models. Images are first calibrated, using a novel approach to one-camera photogrammetry, to obtain accurate spatial information on surfaces with curvature. As part of the image calibration process, an auxiliary file containing the wind tunnel model geometry is used in conjunction with a two-dimensional direct linear transformation to relate the image plane to the physical (model) coordinates. The application

then applies a nonlinear regression model to accurately determine the fringe spacing from interferometric intensity records as required by the Fringe Imaging Skin Friction (FISF) technique. The skin friction is found through application of a simple expression that makes use of lubrication theory to relate fringe spacing to skin friction.
Author
Friction Measurement; Personal Computers; Mathematical Models; Computer Techniques; Imaging Techniques; Linear Transformations; Skin Friction

20040081409 Computational Physics, Inc., Springfield, VA, USA
Next Generation Transport Phenomenology Model
Strickland, Douglas J.; Knight, Harold; Evans, J. Scott; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NASW-01122; NAS5-01122
Report No.(s): Quarterly-Report-11; No Copyright; Avail: CASI; A01, Hardcopy

This report describes the progress made in Quarter 3 of Contract Year 3 on the development of Aeronomy Phenomenology Modeling Tool (APMT), an open-source, component-based, client-server architecture for distributed modeling, analysis, and simulation activities focused on electron and photon transport for general atmospheres. In the past quarter, column emission rate computations were implemented in Java, preexisting Fortran programs for computing synthetic spectra were embedded into APMT through Java wrappers, and work began on a web-based user interface for setting input parameters and running the photoelectron and auroral electron transport models.
Author
Aeronomy; Applications Programs (Computers); Computer Programs; Electron Transfer; Photoelectrons; Phenomenology

20040082055 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Retrofitting the AutoBayes Program Synthesis System with Concrete Syntax
Fischer, Bernd; Visser, Eelco; March 2004; ISSN 0924-3275; 17 pp.; In English
Report No.(s): UU-CS-2004-012; Copyright; Avail: CASI; A03, Hardcopy

AutoBayes is a fully automatic, schema-based program synthesis system for statistical data analysis applications. Its core component is a schema library. i.e., a collection of generic code templates with associated applicability constraints which are instantiated in a problem-specific way during synthesis. Currently, AutoBayes is implemented in Prolog; the schemas thus use abstract syntax (i.e., Prolog terms) to formulate the templates. However, the conceptual distance between this abstract representation and the concrete syntax of the generated programs makes the schemas hard to create and maintain. In this paper we describe how AutoBayes is retrofitted with concrete syntax. We show how it is integrated into Prolog and describe how the seamless interaction of concrete syntax fragments with AutoBayes's remaining legacy meta-programming kernel based on abstract syntax is achieved. We apply the approach to gradually mitigate individual schemas without forcing a disruptive migration of the entire system to a different First experiences show that a smooth migration can be achieved. Moreover, it can result in a considerable reduction of the code size and improved readability of the code. In particular, abstracting out fresh-variable generation and second-order term construction allows the formulation of larger continuous fragments.
Author
Computer Programs; Statistical Analysis; Data Processing

20040082075 Computer Sciences Corp., Lanham, MD, USA
Effect of Variations in IRU Integration Time Interval On Accuracy of Aqua Attitude Estimation
Natanson, G. A.; Tracewell, Dave; 2003; 13 pp.; In English; Flight Dynamics Symposium, 29-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

During Aqua launch support, attitude analysts noticed several anomalies in Onboard Computer (OBC) rates and in rates computed by the ground Attitude Determination System (ADS). These included: 1) periodic jumps in the OBC pitch rate every 2 minutes; 2) spikes in ADS pitch rate every 4 minutes; 3) close agreement between pitch rates computed by ADS and those derived from telemetered OBC quaternions (in contrast to the step-wise pattern observed for telemetered OBC rates); 4) spikes of +/- 10 milliseconds in telemetered IRU integration time every 4 minutes (despite the fact that telemetered time tags of any two sequential IRU measurements were always 1 second apart from each other). An analysis presented in the paper explains this anomalous behavior by a small average offset of about 0.5 +/- 0.05 microsec in the time interval between two sequential accumulated angle measurements. It is shown that errors in the estimated pitch angle due to neglecting the aforementioned variations in the integration time interval by the OBC is within +/- 2 arcseconds. Ground attitude solutions are found to be

accurate enough to see the effect of the variations on the accuracy of the estimated pitch angle.
Author
Airborne/Spaceborne Computers; Angular Distribution; Time Lag; Accuracy; Time

20040082199 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA/BAE SYSTEMS SpaceWire Effort
Rakow, Glenn Parker; Schnurr, Richard G.; Kapcio, Paul; October 2003; 1 pp.; In English; International SpaceWire Seminar 2003, 4-5 Nov. 2003, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

This paper discusses the state of the NASA and BAE SYSTEMS developments of SpaceWire. NASA has developed intellectual property that implements SpaceWire in Register Transfer Level (RTL) VHDL for a SpaceWire link and router. This design has been extensively verified using directed tests from the SpaceWire Standard and design specification, as well as being randomly tested to flush out hard to find bugs in the code. The high level features of the design will be discussed, including the support for multiple time code masters, which will be useful for the James Webb Space Telescope electrical architecture. This design is now ready to be targeted to FPGA's and ASICs. Target utilization and performance information will be presented for Spaceflight worthy FPGA's and a discussion of the ASIC implementations will be addressed. In particular, the BAE SYSTEMS ASIC will be highlighted which will be implemented on their .25micron rad-hard line. The chip will implement a 4-port router with the ability to tie chips together to make larger routers without external glue logic. This part will have integrated LVDS drivers/receivers, include a PLL and include skew control logic. It will be targeted to run at greater than 300 MHz and include the implementation for the proposed SpaceWire transport layer. The need to provide a reliable transport mechanism for SpaceWire has been identified by both NASA And ESA, who are attempting to define a transport layer standard that utilizes a low overhead, low latency connection oriented approach that works end-to-end. This layer needs to be implemented in hardware to prevent bottlenecks.
Author
Application Specific Integrated Circuits; James Webb Space Telescope; Control Systems Design; Vhsic (Circuits); Program Verification (Computers)

20040082203 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Influence of Sub-grid-Scale Isentropic Transports on McRAS Evaluations using ARM-CART SCM Datasets
Sud, Y. C.; Walker, G. K.; Tao, W. K.; 2004; 1 pp.; In English; DOE ARM Science Team Meeting, 22-26 Mar. 2004, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

In GCM-physics evaluations with the currently available ARM-CART SCM datasets, McRAS produced very similar character of near surface errors of simulated temperature and humidity containing typically warm and moist biases near the surface and cold and dry biases aloft. We argued it must have a common cause presumably rooted in the model physics. Lack of vertical adjustment of horizontal transport was thought to be a plausible source. Clearly, debarring such a freedom would force the incoming air to diffuse into the grid-cell which would naturally bias the surface air to become warm and moist while the upper air becomes cold and dry, a characteristic feature of McRAS biases. Since, the errors were significantly larger in the two winter cases that contain potentially more intense episodes of cold and warm advective transports, it further reaffirmed our argument and provided additional motivation to introduce the corrections. When the horizontal advective transports were suitably modified to allow rising and/or sinking following isentropic pathways of subgrid scale motions, the outcome was to cool and dry (or warm and moisten) the lower (or upper) levels. Ever, crude approximations invoking such a correction reduced the temperature and humidity biases considerably. The tests were performed on all the available ARM-CART SCM cases with consistent outcome. With the isentropic corrections implemented through two different numerical approximations, virtually similar benefits were derived further confirming the robustness of our inferences. These results suggest the need for insentropic advective transport adjustment in a GCM due to subgrid scale motions.
Author
Atmospheric Temperature; Surface Temperature; Approximation; Upper Atmosphere; Bias; Correction

20040082204 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SANs and Large Scale Data Migration at the NASA Center for Computational Sciences
Salmon, Ellen M.; March 2004; 1 pp.; In English; Spring 2004 Storage Networking World, 5-8 Apr. 2004, Phoenix, AZ, USA; No Copyright; Avail: Other Sources; Abstract Only

Evolution and migration are a way of life for provisioners of high-performance mass storage systems that serve high-end computers used by climate and Earth and space science researchers: the compute engines come and go, but the data remains.

At the NASA Center for Computational Sciences (NCCS), disk and tape SANs are deployed to provide high-speed I/O for the compute engines and the hierarchical storage management systems. Along with gigabit Ethernet, they also enable the NCCS's latest significant migration: the transparent transfer of 300 Til3 of legacy HSM data into the new Sun SAM-QFS cluster.
Derived from text
Migration; Computer Programs; Earth Sciences

20040082394 Massachusetts Inst. of Tech., MA, USA
MEANS User Documentation, Appendix A
Melconian, Terran; [2004]; 65 pp.; In English
Contract(s)/Grant(s): NAG2-1548; No Copyright; Avail: CASI; A04, Hardcopy

MEANS is an acronym for the MIT Extensible Air Network Simulation. MIT is the Massachusetts Institute of Technology, where MEANS was developed. MEANS models the flow of aircraft in a simulation of the US National Airspace System. It can optionally follow the flow of passengers as well. The flight model takes the form of several queues through which the aircraft pass, as well as delays at certain times; the passengers can be transported via flights. MEANS is an event-based model. This means that events are scheduled at some point in the future, and once an event has executed, the simulation t h e advances to that of the next event. This is a different approach than some simulations (particularly those of physical systems), where time is advanced in fixed increments and the state of the system is updated at each step.This documentation is a ″user guide″ for MEANS - it describes how to USE means, not write new modules. For programming instructions, see the programming documentation, available as a separate document.This document assumse no programming knowledge. It will describe how to run MEANS, understand the data formats, and use such utility programs as already exist. For more detailed information on the internal workings of MEANS, and how to programmatically add to it, refer to the programming documentation.
Derived from text
User Manuals (Computer Programs); Flight Paths; Flight Time

20040082619 Naval Postgraduate School, Monterey, CA
MYSEA Technology Demonstration
Irvine, Cynthia; Shifflett, David; Clark, Paul; Levin, TImothy; Dinolt, George; Apr. 2003; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423566; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the Monterey Security Enhanced Architecture (MYSEA, pronounced my-SEE-ah) project is to provide a trusted distributed operating environment for enforcing multi-domain security policies, which supports unmodified (COTS productivity applications. The architecture encompasses a combination of many low-assurance commercial components and relatively few specialized (e.g., high- assurance) multi-domain components. This arrangement permits the ongoing DoD and U.S. Government investment in commodity personal computer (PC) operating systems and applications to be integrated into an environment where enforcement of critical security policies is assigned to more trusted elements. Assurance is derived from the application of high assurance system design and development methods to the trusted elements as well as to the overall architecture.
DTIC
Operating Systems (Computers)

20040082621 Naval Postgraduate School, Monterey, CA
IPsec Modulation for Quality of Security Service
Spyropoulou, Evdoxia; Agar, Chris; Levin, Timothy; Irvine, Cynthia; Mar. 13, 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423568; No Copyright; Avail: CASI; A03, Hardcopy

Quality of Service (QoS) mechanisms can be beneficial to both the user and the overall distributed system. QoS users benefit by having reliable access to services. The distributed system whose resources are QoS managed benefits by having more predictable resource utilization and, where supported, more efficient resource allocation. We have previously examined how reliability, predictability and efficiency can be enhanced by including security as a real part of QoS, transforming security from an inflexible performance obstacle into a constructive management tool. We have termed the effects of this inclusion, ″Quality of Security Service″ (QoSS) 10. The motivation for the work described here is to examine specific methods for

managing variability of security services, including choices offered to users, resource cost calculation, and modulation of underlying security mechanisms.
DTIC
Computer Networks; Modulation; Security

20040082624 Naval Postgraduate School, Monterey, CA
An Overview of MSHN: The Management System for Heterogeneous Networks
Hensgen, Debra A.; Kidd, Taylor; St. John, David; Schnaidt, Matthew C.; Siegel, Howard J.; Apr. 1999; 16 pp.; In English
Report No.(s): AD-A423572; No Copyright; Avail: CASI; A03, Hardcopy

The Management System for Heterogeneous Networks (MSHN) is a resource management system for use in heterogeneous environments. This paper describes the goals of MSHN, its architecture, and both completed and ongoing research experiments. MSHN's main goal is to determine the best way to support the execution of many different applications, each with its own quality of service (QoS) requirements, in a distributed, heterogeneous environment. MSHN's architecture consists of seven distributed, potentially replicated components that communicate with one another using CORBA (Common Object Request Broker Architecture). MSHN's experimental investigations include: (1) the accurate, transparent determination of the end-to-end status of resources; (2) the identification of optimization criteria and how non-determinism and the granularity of models affect the performance of various scheduling heuristics that optimize those criteria; (3) the determination of how security should be incorporated between components as well as how to account for security as a QoS attribute; and (4) the identification of problems inherent in application and system characterization.
DTIC
Computer Networks; Heterogeneity; Management Systems; Resources Management; Security

20040082628 Louisiana Univ., Lafayette, LA
Phase 0: Feasibility Study for ARN Balanced Flow NOMEX Supply Chain
Kolluni, Ramesh; Smith, Mark; Meredith, Paul; Masuchun, Wiboon; Kanumilli, Vijay; Mar. 29, 2004; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): SPO103-02-D-0017/0003; SPO103-02-D-0019; Proj-BAA-01-0005
Report No.(s): AD-A423579; No Copyright; Avail: CASI; A04, Hardcopy

Without total asset visibility, DLA's retail focus has been on fulfilling retail requisitions rather than optimizing the overall supply chain performance. Also, the upstream tiers have been left to the management capabilities of end-item contractors, most of which are not capable of managing their upstream partners. To address these problems, the existing ARN concepts and systems needs to be extended to provide total asset visibility, decision support, and process improvements across the entire supply chains. Using NOMEX items, the project's Phase 0 effort has developed a validated framework for the implementation of the Extended ARN Operational Systems. A Data Model was developed for extending the AAVS Datamart to provide total asset visibility across the NOMEX Supply Chain. A business case analysis was conducted to investigate potential cost benefits of the Data Model and its enabling tools to DLA. The results indicated a net benefit of $17,383,445, an ROI of 8.21% and a 53% reduction in stock-outs.
DTIC
Clothing; Decision Support Systems; Fabrics; Feasibility; Manufacturing

20040082639 Naval Research Lab., Washington, DC
Simulating Sensor Networks in NS-2
Downard, Ian T.; May 31, 2004; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423595; NRL/FR/5522--04-10; 073; No Copyright; Avail: CASI; A03, Hardcopy

Optimizing sensor networks involves addressing a wide range of issues. These issues stem from limited energy reserves, computation power, communication capabilities, and self-managing sensor nodes. The NS-2 simulation environment is a flexible tool for network engineers to investigate how various protocols perform with different configurations and topologies. This report describes how we extended the NS-2 framework to include support for sensor networks.
DTIC
Computer Networks; Computer Programs; Simulation

20040082660 Eotvos Lorand Univ., Budapest
Interface for Fusing Human and Robotic Intelligence Using Scale-Free Small World Structures
Lorincz, Andras; Jun. 5, 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-03-1-3084
Report No.(s): AD-A423653; EOARD-SPC-02-4084; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Neumann Janos Szamitogep-tudomanyi Tarsasag and Eotvos Lorand University as follows: The contractor will perform exploratory research to investigate scale-free small world network (SSW) technology. The techniques developed could be extended to modular Bayesian inferencing. As described in the technical proposal, the utility (effectiveness) of the approach will be investigated using two representative problems: I) extraction and Representation of Semantic Information based on Word Associations; II) Semantic relations amongst medical documents.
DTIC
Artificial Intelligence; Intelligence; Robotics

20040082668 Defence Science and Technology Organisation, Salisbury
Investigating Web Map Service Client Technologies
Blyth, Joel; Geoghegan, Sean; O'Dea, Damiam; Jan. 2004; 44 pp.; In English
Report No.(s): AD-A423666; DSTO-TN-0536; DODA-AR-013-009; No Copyright; Avail: CASI; A03, Hardcopy

Web Map Services may provide some assistance in alleviating the high cost of providing Geospatial Information System (GIS) capabilities to Defence users. This report discusses the development of several implementations of client applications of the Web Map Service interface. Problerns encountered in the use of various Web technologies to construct the client applications are detailed. Suggestions are also made for future development efforts to improve client functionality.
DTIC
Geographic Information Systems

20040082728 California Univ., Irvine, CA
Integrated Management of Power Aware Computation and Communication (IMPACCT)
Chou, Pai; Bagherzadeh, Nader; May 2003; 242 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-1-1719; Proj-ARPI
Report No.(s): AD-A423807; AFRL-IF-WP-TR-2004-1516; No Copyright; Avail: CASI; A11, Hardcopy

The IMPACCT, or Integrated Management of Power Aware Computation and Communication, program objectives are to enhance the power/performance tradeoff range and to correctly compose different component level power management techniques at the system level. Power and timing constraints can be used as knobs to tune the system for performance or power, without hardwiring to either goal. To maximize performance and resolve power hot spots, we exploit system-level task motion under pair-wise timing and total power as constraints. A distinguishing feature of our work is our ability to handle co-activation, an essential property for the correct operation of these embedded systems. Furthermore, we propose mode selection as a generalized way for fully exploiting novel power management features provided by an increasingly intelligent class of power-aware components. They are capable of managing power and provide many more power modes. However, today s power management techniques often cannot take full advantage of these rich features, but instead they use only two or three modes (e.g., on/off). Our mode selection methodology models the dependency and produces a mode schedule that considers restricted transitions and overhead amortization.
DTIC
Computation; Systems Integration

20040082738 Northrop Grumman Corp., El Segundo, CA
Security/Trust as a Polymorphic Computing Constraint
Weissman, Clark; Hashii, Brant; Cole, Jerry; Sep. 2003; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-01-C-1891; Proj-L454
Report No.(s): AD-A423822; AFRL-IF-WP-TR-2004-1517; No Copyright; Avail: CASI; A04, Hardcopy

DoD Joint Vision 2020 (JV2020) is the integrated multi-service planning document for conduct among coalition forces of future warfare. It requires the confluence of a number of key avionics technical developments: integrating the network-centric battlefield, management of hundred thousands of distributed processors, high assurance Multi Level Security (MLS) in the battlefield, and low cost high assurance engineering. The paper describes the results of a study and modeling of a new security architecture (MLS-PCA) that yields a practical solution for JV2020 based upon DARPA Polymorphic

Computing Architecture (PCA) advances and a new distributed process-level encryption scheme. The paper defines a functional model and a verified formal specification of MLS- PCA, for high assurance, with the constraints PCA software, hardware, and morphware must support. Also, the paper shows a viable mapping of the MLS-PCA model to the PCA hardware. MLS- PCA is designed to support upwards of 400,000 CPUs predicted by Moore s law to be available circa 2020.
DTIC
Polymorphism; Security; Systems Integration

20040082787 Trinity Coll., Dublin
Secure Group Management in a Coalition Environment
O'Mahony, Donal; Jan. 27, 2003; 18 pp.; In English
Contract(s)/Grant(s): F61775-01-WE052
Report No.(s): AD-A423920; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking University of Ireland Trading as Trinity College Dublin as follows: The contractor will investigate issues related to the formation and security of ad-hoc wireless networks in situations where teams are operating separated from their base location and possibly roving. The most capable group management systems available (for example, multicast protocol like VersaKey) employ a fixed group controller responsible for matching join-requests against the allowed-members list. Failure of this group manager disrupts communications and renders ineffective the entire group. Additionally, such ad- hoc schemes rely on forward confidentiality of departing nodes and backward confidentiality of newly joined nodes. Thus appropriate measures must be established to authenticate users and control access to resources and information. This effort will address these information assurance shortcomings.
DTIC
Communication Networks

20040082793 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Intelligent Query Answering Through Rule Learning and Generalization
Carsten, James M.; Mar. 2004; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423931; AFIT/GCS/ENG/04-05; No Copyright; Avail: CASI; A07, Hardcopy

The Department of Defense (DoD) relies heavily on information systems to complete a myriad of tasks, from day-to- day personnel actions to mission critical imagery retrieval, intelligence analysis, and mission planning. The astronomical growth in size and performance of data storage systems leads to problems in processing the amount of data returned on any given query. Typical relational database systems return a set of unordered records. This approach is acceptable in small information systems, but in large systems, such as military image retrieval systems with more than 1 million records, it requires considerable time (often hours to days) to sort through thousands of records and select the relevant for analysis. This research introduces Intelligent Query Answering (IQA) as a novel approach to information retrieval. IQA implements the FOIL algorithm to learn rules based upon user feedback QUI90. The Winnow algorithm adjusts rule weights based on user classification, for improved document orderings BLU97. A semantic tree specific to the domain allows rule generalization across the domain. Testing shows a document sort accuracy rate of 63-93% against a controlled test dataset and 78-89% accuracy rate on a subset of declassified National Air Intelligence Center imagery metadata. These results demonstrate that this research provides groundwork for future efforts in rule learning and rule generalization in the information retrieval field.
DTIC
Computer Storage Devices; Data Storage; Information Retrieval; Information Systems; User Requirements

20040082815 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Software Development Outsourcing Decision Support Tool with Neural Network Learning
Newberry, James D.; Mar. 2004; 246 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423978; AFIT/GCS/ENG/04-16; No Copyright; Avail: CASI; A11, Hardcopy

The Air Force (AF) needs an evolving software tool for guiding decision makers through the complexities of software outsourcing. Previous research identified specific outsourcing strategies and linked them to goals and consequences through a variety of relationship rules. These strategies and relationship rules were inserted into a decision support tool. Since that time, more historical data and outsourcing literature has been collected thus necessitating an update to such a tool. As the number of software outsourcing projects are completed, the AF must capture the outsourcing decision experiences which guided the projects and their outcomes. In order to efficiently incorporate this new experience, the decision tool must be redesigned to allow the additional knowledge to be added in such a way that the decision rule base is automatically updated. With this new

feature, the tool would increase its precision of predicting software outsourcing success as the software outsourcing knowledge evolves. Capturing software outsourcing as knowledge instead of raw information will help guide decision makers down paths proven to succeed staying clear of risks that historically plagued software outsourcing projects of the past. Software outsourcing decision makers desire not only a characterization of past experiences and predictions of future outcomes, but also reasons to help them make informed decisions.
DTIC
Computer Programming; Decision Support Systems; Neural Nets; Software Engineering

20040082830 University of Southern California, Los Angeles, CA
Flexible and Scalable Methods for Multi-Agent Distributed Resource Allocations by Exploiting Phase Transitions
Zhang, Weixiong; May 2004; 120 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0531; Proj-ANTS
Report No.(s): AD-A423994; AFRL-IF-RS-TR-2004-127; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes the main findings and results on five independent yet closely related research topics, which were motivated by some difficult distributed constraint problems from Autonomous Negotiating Teams (ANTs) domains: (1) distributed constraint problem solving in sensor networks and low overhead distributed constraint algorithms, (2) analysis of negotiation protocols as distributed search, (3) phase transitions and backbones of the Traveling Salesman Problem, (4) configuration space analysis of Boolean satisfiability and backbone-guided local search, and (5) improved integer local search algorithms for complex scheduling problems. Our results provide deep understanding of the difficulty and complexity of distributed constraint problems in sensor networks and distributed environments, and produce effective and efficient methods, algorithms and software for these difficult problems.
DTIC
Computer Networks; Phase Transformations; Resource Allocation; Resources Management

20040082839 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Analysis of the Performance and Security of J2SDK 1.4 JSSE implementation of SSL/TLS
Bias, Danny R.; Mar. 2004; 98 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424003; AFIT/GCS/ENG/04-02; No Copyright; Avail: CASI; A05, Hardcopy

The Java SSL/TLS package distributed with the J2SE 1.4.2 runtime is a Java implementation of the SSLv3 and TLSv1 protocols. Java-based web services and other systems deployed by the DoD will depend on this implementation to provide confidentiality, integrity, and authentication. Security and performance assessment of this implementation is critical given the proliferation of web services within DoD channels. This research assessed the performance of the J2SE 1.4.2 SSL and TLS implementations, paying particular attention to identifying performance limitations given a very secure configuration. The performance metrics of this research were CPU utilization, network bandwidth, memory, and maximum number of secure socket that could be created given various factors. This research determined an integral performance relationship between the memory heap size and the encryption algorithm used. By changing the default heap size setting of the Java Virtual Machine from 64 MB to 256 MB and using the symmetric encryption algorithm of AES256, a high performance, highly secure SSL configuration is achievable. This configuration can support over 2000 simultaneous secure sockets with various encrypted data sizes. This yields a 200 percent increase in performance over the default configuration, while providing the additional security of 256-bit symmetric key encryption to the application data.
DTIC
Computer Networks; Computer Programming; Display Devices; Java (Programming Language); Programming Languages; Security

20040084125 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Stability and Control in Computational Simulations for Conceptual and Preliminary Design: the Past, Today, and Future?
Mason, William H.; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 309-340; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

This attitude is only slightly exaggerated, and both sides have good reasons for their attitudes. In essence, it appears to originate because detailed control system development, and the assessment of aircraft characteristics in terms of stability and control, requires an understanding of the aerodynamic characteristics at flight boundaries. Here, nonlinear aerodynamics

typically produced a significant flow separation and component interactions dominate the analysis.
Author
Computation; Stability; Boundary Layer Separation; Aerodynamic Characteristics; Active Control

20040084132 Lockheed Martin Aeronautical Systems, Marietta, GA, USA
Computational Methods for Stability and Control: A Perspective
Raj, Pradeep; COMSAC: Computational Methods for Stability and Control; April 2004, pp. 214-226; In English; See also 20040084120; No Copyright; Avail: CASI; A03, Hardcopy

This presentation offers a perspective on the NASA COMSAC initiative from the vantage point of aerospace industry . In this centennial year of Wright Brothers ″controlled″ powered flight, it is rather fitting that we hold a symposium devoted exclusively to the problem of more effectively predicting stability and control characteristics of flight vehicles! Although the symposium is limited in scope to only computational methods, resulting improvements in our ability to computationally predict S&C characteristics can have far-reaching implications. The presentation starts out by highlighting the rationale and urgency for advancing the state of the art in computational methods for S&C. A couple of examples are included to illustrate the capabilities and deficiencies of the current suite of methods. This is followed by a brief discussion of the challenges for the COMSAC initiative. A summary chart concludes this presentation.
Derived from text
Computation; Stability; Flight Control

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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.

20040081072 NASA Ames Research Center, Moffett Field, CA, USA
Compiling Planning into Scheduling: A Sketch
Bedrax-Weiss, Tania; Crawford, James M.; Smith, David E.; [2004]; 8 pp.; In English; Integrating Planning and and Scheduling Workshop; No Copyright; Avail: CASI; A02, Hardcopy

Although there are many approaches for compiling a planning problem into a static CSP or a scheduling problem, current approaches essentially preserve the structure of the planning problem in the encoding. In this pape: we present a fundamentally different encoding that more accurately resembles a scheduling problem. We sketch the approach and argue, based on an example, that it is possible to automate the generation of such an encoding for problems with certain properties and thus produce a compiler of planning into scheduling problems. Furthermore we argue that many NASA problems exhibit these properties and that such a compiler would provide benefits to both theory and practice.
Author
Scheduling; Planning

20040081399 Emergent Space Technologies, Inc., USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Modular, Data Driven System: Architecture for GSFC Ground Systems: GSFC's Mission Services Evolution Center (GMSEC)
Cary, Everett; Smith, Danford; March 29, 2004; 13 pp.; In English; A Modular, Data Driven System Architecture for GSFC Ground Systems, Ground Systems Architectures Workshop 2004, 29 Mar. - 1 Apr. 2004, Manhattan Beach, CA, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The GSFC Mission Services Evolution Center (GMSEC) was established in 2001 to coordinate ground and flight data systems development and services at NASA's Goddard Space Flight Center (GSFC). GMSEC system architecture represents a new way to build the next generation systems to be used for a variety of missions for years to come. The old approach was to find or build the best products available and integrate them into a reusable system to meet everyone's needs. The new approach assumes that needs, products, and technology will change.
Author (revised)
Data Systems; Architecture (Computers); Ground Support Systems

20040082620 South Carolina Univ., Columbia, SC
MAC-Layer Modeling and Analysis for Exploring Self- Regulation Enhancements in 802.11-Based Wireless Networks
Haggard, Michael L.; Apr. 15, 2004; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423567; No Copyright; Avail: CASI; A06, Hardcopy

This thesis presents a simulation model created to accurately explore the range of responses of a WLAN supporting a lighting force moving across the battlefield. The objective has been to define a simulation model, built on a accurate analysis model of the lighting force units, which takes into consideration formations and movement techniques of this force on the battlefield. By subjecting this model to different movement patterns, traffic profiles, and packet volume, assessment of QoS data patterns can be used to make dynamic changes to the management of the network to maximize QOS under such conditions. Creation of such a model is an essential first step in being able to identify possible data patterns that are recognizable, and thus codifiable″ into a set of heuristic enhancements to the 502.11 MAC protocol and architecture-with the goal being to endow the WLAN with sell- regulating capabilities. The model developed in this thesis is envisioned to significantly aid in the design of effective ubiquitous, wearable computing and wireless communications devices.
DTIC
Access Control; Augmentation; Automatic Control; Local Area Networks; Numerical Control

20040082634 Naval Postgraduate School, Monterey, CA
Security as a Dimension of Quality of Service in Active Service Environments
Irvine, Cynthia; Levin, Tim; Spyropoulou, Evie; Allen, Bruce; Apr. 6, 2001; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423588; No Copyright; Avail: CASI; A02, Hardcopy

The introduction of metacomputing and distributed resource management mechanisms to the Internet and World Wide Web will make available to users and applications a diverse set of previously unavailable network and computing resources. Middleware resource management systems (RMSs) will use geographically distributed, heterogeneous resources to support applications with a wide range of computation needs 1234. The RMS in such an environment is responsible for: efficiently scheduling multiple simultaneous tasks onto specific network resources; supporting user requirements for performance and security; and providing support for tasks to adapt to changing resource availability. This is accomplished by balancing costs for various services against their benefits, where the benefits can be to individual users or may be associated with the system as a whole, e.g. total throughput.
DTIC
Computer Networks; Security

20040082638 Naval Postgraduate School, Monterey, CA
High Assurance Multilevel Services for Off-The- Shelf Workstation Applications
Irvine, Cynthia E.; Anderson, James P.; Robb, Dion A.; Hackerson, Jason; Oct. 1998; 12 pp.; In English
Report No.(s): AD-A423592; No Copyright; Avail: CASI; A03, Hardcopy

The need for multilevel secure (MLS) systems still exists yet, the popularity of desktop systems has resulted in the imposition of new requirements. To be useful, a system must employ commercial-off-the-shelf (COTS) operating systems and office productivity software. We describe the preliminary architecture for a COTS-driven local area network that will provide MLS services to users while permitting them to employ standard office productivity tools on standard workstations. Our ongoing development centers on the provision of multilevel mail and messaging to the desktop.
DTIC
Commercial Off-the-Shelf Products; Computer Programs; Workstations

20040082645 Naval Postgraduate School, Monterey, CA
Diamond High Assurance Security Program: Trusted Computing Exemplar
Irvine, Cynthia E.; Levin, Timothy E.; Dinolt, George W.; Sep. 2002; 14 pp.; In English
Report No.(s): AD-A423605; NPS-CS-02-004; No Copyright; Avail: CASI; A03, Hardcopy

Over the past decade, the U.S. Government has not been significantly involved in high assurance Trusted Computing acquisitions and research. During this time, the Government's focus on commercial off the shelf procurements helped to fuel explosive advances in commercial technology, but it also contributed to the lack of progress in the ability of commercial systems to appropriately protect themselves and the data with which they are entrusted. While industry has been driven to supply the latest technology at the fastest pace, it has not been motivated, either internally or externally via customer demand,

to produce highly trustworthy computing systems. As a result, the National Information Infrastructure is weak; there are no high security, high assurance, off-the-shelf products available that can be used to strengthen it; and the National capability to design and construct such trusted computer systems and networks has atrophied. To address this downward spiral, the Center for INFOSEC Studies and Research (CISR) in Monterey, California, proposes a Trusted Computing Exemplar project that will provide an openly distributed worked example of how high assurance trusted computing components can be built. Completion of this project will be performed as part of CISR's Diamond High Assurance Security Program (Diamond HASP). The authors propose four related activities: (1) creation of a prototype framework for rapid high assurance system development, (2) development of a reference-implementation trusted computing component, (3) evaluation of the component for high assurance, and (4) open dissemination of deliverables related to the first three activities. The project's open development methodology will provide widespread availability of key high assurance enabling technologies and ensure transfer of knowledge and capabilities for trusted computing to the next generation of developers, evaluators, and educators. (1 figure, 9 refs.)
DTIC
Architecture (Computers); Commercial Off-the-Shelf Products; Computer Information Security; Diamonds; Local Area Networks; Security

20040082680 Naval Postgraduate School, Monterey, CA
Remote Boot of a Diskless Linux Client for Operating System Integrity
Allen, Bruce; Jul. 2002; 17 pp.; In English
Report No.(s): AD-A423694; NPS-CS-02-002; No Copyright; Avail: CASI; A03, Hardcopy

These instructions describe how to build a diskless client with dedicated user store on the server. The diskless Linux client is organized to provide read-write files over NFS at home, read-only files over NFS for accessing bulky immutable utilities, and sone volatile RAM disk files to allow the Linux Kernel to boot. This approach is exceptional because 1) the client system is diskless; system administration is managed at a single server, and 2) it is more secure; the only data that can be modified is user data under the home directory. Although these instructions describe setup between a Linux client and a Linux server, the Linux client can boot from any server with BOOTP, TFTP and NFS services installed.
DTIC
Client Server Systems; Unix (Operating System)

20040082681 Naval Postgraduate School, Monterey, CA
A QoS Performance Measure Framework for Distributed Heterogeneous Networks
Kim, Jong-Kook; Hensgen, Debra A.; Kidd, Taylor; Siegel, Howard J.; St. John, David; Jan. 2000; 11 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0804; DABT63-99-C-0010
Report No.(s): AD-A423695; No Copyright; Avail: CASI; A03, Hardcopy

In a distributed heterogeneous computing environment, users' tasks are allocated resources to simultaneously satisfy, to varying degrees, the tasks different, and possibly conflicting, quality of service (QoS) requirements. When the total demand placed on system resources by the tasks, for a given interval of time, exceeds the resources available, some tasks will receive degraded service or no service at all. One part of a measure to quantify the success of a resource management system (RMS) in such a distributed environment is the collective value of the tasks completed during an interval of time, as perceived by the user, application, or policy maker. The Flexible Integrated System Capability (FISC) ratio introduced here is a measure for quantifying this collective value. The FISC ratio is a multi- dimensional measure, and may include priorities, versions of a task or data, deadlines, situational mode, security, application- and domain-specific QoS, and dependencies. In addition to being used for evaluating and comparing RMSs, the FISC ratio can be incorporated as part of the objective function in a system's scheduling heuristics.
DTIC
Heterogeneity; Quality Control

20040082798 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Automated Agent Ontology Creation for Distributed Databases
Bartolo, Austin A.; Mar. 2004; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423942; AFIT/GCS/ENG/04-01; No Copyright; Avail: CASI; A06, Hardcopy

In distributed database environments, the combination of resources from multiple sources requiring different interfaces is a universal problem. The current solution requires an expert to generate an ontology, or mapping, which contains all

interconnections between the various fields in the databases. This research proposes the application of software agents in automating the ontology creation for distributed database environments with minimal communication. The automatic creation of a domain ontology alleviates the need for experts to manually map one database to other databases in the environment. Using several combined comparison methods, these agents communicate and negotiate similarities between information sources and retain these similarities for client agent queries without the manual mapping of different data sources achieving an average accuracy of 57% before leader negotiation and an average accuracy of 61% after leader negotiation. The best matching accuracy achieved in a single test is 79%. This is directly applicable to the Department of Defense (DOD) that possesses many systems, which share information that enables the military to achieve their objectives. The DOD created an environment called the Joint Battlespace Infosphere (JBI) to solve this integration problem. This research improves upon the JBI's use of exact matching of field names for integrating the information within the environment. It simulates this type of interaction by demonstrating agents wrapped around different databases negotiating and generating an ontology. An agent-generated ontology is compared with an expert generated ontology and testing uses a set of queries run against the ontologies show that this technique can be useful in a distributed information environment.
DTIC
Data Bases; Distributed Processing

20040082964 Army War Coll., Carlisle Barracks, PA
Business and Security in a Wired World. Center for Strategic Leadership Issue Paper, Volume 07-02
Murphy, Dennis; Jul. 2002; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423953; No Copyright; Avail: CASI; A01, Hardcopy

This seminar examined the concepts of cyber terrorism, cyber crime, and information infrastructure attacks and fostered an improved understanding of the increasing exposure of U.S. business organizations as targets of terrorism. The relationship of government and industry in identifying and mitigating critical infrastructure vulnerabilities was examined, and existing, proposed, and alternative cooperative strategies were reviewed. Panels included presentations from the U.S. Commission on National Security (also known as the Hart-Rudman Commission); the Defense Information Systems Agency, the FBI's National Infrastructure Protection Center, and several leaders in industrial security who described initiatives designed to mitigate risk, safeguard information, and protect infrastructure. A crisis exercise was conducted that was designed to draw upon the information provided by the panel experts and examine key aspects of policy implementation, legislative involvement, information sharing, stakeholder expectations, incident response and recovery, and organizational culture. The scenario posited cyber attacks accompanied by physical attacks on two major U.S. corporations that were followed by the convening of an inter-governmental, inter-agency response team in New York City. The game also posited an industry-government Joint Crisis Team (JCT), an operational response entity modeled on the Federal Emergency Management Agency's (FEMA) Federal Response Plan, that put both industry and government resources at the disposal of responders. These four teams (two industry teams and two government teams) grappled with the problems generated by the scenario and interacted with each other, formally and informally, throughout the exercise. Lessons learned include the identification of key organizational and procedural gaps and seams in dealing with cyber terror and information infrastructure attack.
DTIC
Commerce; Computer Information Security; Leadership; Organizations; Security; Terrorism; United States

20040084085 Physics and Electronics Lab. TNO, The Hague, Netherlands
Toward a Validation of the ADCF AAW Model Suite
Arciszewski, H. F. R.; Voogd, J. M.; April 2004; 40 pp.; In English
Contract(s)/Grant(s): TNO Proj. 015.30697
Report No.(s): FEL-03-A089; TD-2003-0046; Copyright; Avail: Other Sources

Validation is a process to ensure that a simulation system is suitable for the purposes it is intended for. When looking at current practice we observe that validation already takes place, albeit implicitly rather than explicitly. It also is apparent that the single most important aspect of validation, the testing of the simulation system against live data, already is the focus of current work. In the case of military systems, the physics is usually well understood, but parameters and exact behaviour are more likely than not confidential and therefore not publicly available. Hence a comparison between model predictions and measured data is the definitive test for a model. When looking at the Royal Netherlands Navy (RNLN) Air Defence and Command Frigate Anti-Air Warfare (ADCF AAW) model suite that is to be used during and after the live firings of the new frigate and to verify some of the staff requirements, the observation about the importance of testing a simulation system against live data applies directly to this suite. Therefore it is strongly recommended to test all relevant AAW models with data collected during the live firings. Although a full validation is always advisable, other steps in the validation process may or

may not be taken, subject to approval of the client and budgetary or other constraints.
Author
Air Defense; Warfare; Mathematical Models; Program Verification (Computers); Computer Systems Simulation

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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*.

20040081100 NASA Ames Research Center, Moffett Field, CA, USA
Collective Intelligence, Data Routing and Braess' Paradox
Wolpert, David H.; Tumer, Kagan; Journal of Artificial Intelligence Research; July 06, 2004; Volume 16, pp. 359-387; In English; Copyright; Avail: Other Sources

We consider the problem of designing the the utility functions of the utility-maximizing agents in a multi-agent system (MAS) so that they work synergistically to maximize a global utility. The particular problem domain we explore is the control of network routing by placing agents on all the routers in the network. Conventional approaches to this task have the agents all use the Ideal Shortest Path routing Algorithm (ISPA). We demonstrate that in many cases, due to the side-effects of one agent's actions on another agent s performance, having agents use ISPA's is suboptimal as far as global aggregate cost is concerned, even when they are only used to route infinitesimally small amounts of traffic. The utility functions of the individual agents are not aligned with the global utility, intuitively speaking. As a particular example of this we present an instance of Braess paradox in which adding new links to a network whose agents all use the ISPA results in a decrease in overall throughput. We also demonstrate that load-balancing, in which the agents decisions are collectively made to optimize the global cost incurred by all traffic currently being routed, is suboptimal as far as global cost averaged across time is concerned. This is also due to side-effects , in this case of current routing decision on future traffic. The mathematics of Collective Intelligence (COIN) is concerned precisely with the issue of avoiding such deleterious side effects in multi-agent systems, both over time and space. We present key concepts from that mathematics and use them to derive an algorithm whose ideal version should have better performance than that of having all agents use the ISPA, even in the infinitesimal limit. We present experiments verifying this, and also showing that a machine-learning-based version of this COIN algorithm in which costs are only imprecisely estimated via empirical means (a version potentially applicable in the real world) also outperforms the ISPA, despite having access to less information than does the ISPA. In particular, this COIN algorithm almost always avoids Braess' paradox.
Author
Artificial Intelligence; Algorithms; Distributed Processing; Paradoxes; Mathematical Models

20040081500 Research and Technology Organization, Neuilly-sur-Seine, France
Advanced Technologies for Military Training
April 2004; 396 pp.; In English; Advanced Technologies for Military Training, 13-15 October 2003, Genoa, Italy; See also 20040081501 - 20040081525
Report No.(s): RTO-MP-HFM-101; AC/323(HFM-101)TP/52; Copyright; Avail: CASI; C01, CD-ROM; A17, Hardcopy

Computer-Based Instruction, Training System Design, Distributed Training, and Virtual Reality are technologies that have dramatically changed. But many of the problems and issues related to training technologies, its application, acceptance, and effectiveness are still with us today. This unclassified Symposium theme was to share data and establish working relationships that can continue to deal with the problem of training and simulation from a human systems integration point of view.
Author
Computer Assisted Instruction; Virtual Reality; Training Simulators; Training Analysis; Training Evaluation; Learning

20040081503 Office of Naval Research, Arlington, VA, USA
Overview: The US Office of Naval Research Training Technology R and D
Chipman, Susan F.; Advanced Technologies for Military Training; April 2004; 19 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The U.S. Office of Naval Research (ONR) has a long, continuous, and distinguished tradition of support for research and development of advanced technologies for application to military training. This paper provides an overview of the history and structure of those research programs with emphasis on areas of major current activity: 1) Basic research on tutorial dialog

aiming for true natural language interaction capability for artificially intelligent training systems; 2) Effective instructional strategies for artificially intelligent coaching in dynamically evolving situations such as instrument flying, shipboard command information center tasks, and shipboard damage control and 3) The integration of artificially intelligent coaches into virtual reality simulators. The content of this paper is very closely related to material available on an ONR web site designed for do-it-yourself briefings: (http://www.onr.navy.mil/sci_tech/personnel/cnb_sci/342/default.htm).
Author
Research and Development; Military Technology; Artificial Intelligence; Training Simulators

20040081504 Army Research Inst., Orlando, FL, USA
Training Dismounted Combatants in Virtual Environments
Goldberg, Stephen L.; Knerr, Bruce W.; Grosse, James; Advanced Technologies for Military Training; April 2004; 18 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The U.S. Army Research Institute, U.S. Army Simulation, Training and Instrumentation Command, and the U.S. Army Research Laboratory recently completed a four-year effort to improve capabilities for dismounted soldier simulation. With increased emphasis on Military Operations in Urban Terrain (MOUT) new flexible training methods are needed that can represent a range of urban environments. Virtual environments have that capability but technological challenges must be overcome to produce an effective virtual training system for the dismounted combatant. This paper reviews improvements made during the project in the areas of representing the dismounted combatants environment, producing realistically performing Dismounted Infantry Semi-Automated Forces, and developing of an After Action Review system that captures performance in MOUT. At the end of each year of the project a Culminating Event was held during which improvements made in technologies made during the year were integrated and then evaluated by soldiers. The paper also contains a discussion of soldiers ratings of the usability and training effectiveness of these capabilities. Significant improvements have occurred as a result of this project taking virtual dismounted soldier simulation a step closer to fielding.
Author
Military Operations; Cities; Virtual Reality; Training Simulators

20040081513 Naval Research Lab., Washington, DC, USA
Virtual Technologies and Environments for Expeditionary Warfare Training
Cohn, Joseph; Templeman, James; Schmorrow, Dylan; Muller, Peter; Lyons, Denise; Advanced Technologies for Military Training; April 2004; 12 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Over the past decade, Virtual Environment (VE)-based training systems have become commonplace within the military training domain. These systems offer such benefits as small footprint, rapid reconfiguration, and enhanced training delivery. In addition, they appear to offer significant relief for a market starved for low cost training systems, and hold great potential as effective training tools. Interaction with VE involves the ability of individuals to effectively perform essential perceptual sensory-motor tasks within the virtual world. More specifically, this can involve the ability to move about the VE, manipulate virtual objects, locate virtual sounds, deal appropriately with physical constraints, or perform visual tasks (i.e., discriminate colors; judge distance; search for, recognize, and estimate the size of objects). The Office of Naval Research's Virtual Technologies and Environments (VIRTE) Program was developed to address this design challenge. VIRTE is focusing on developing two capabilities central to applying VE technology to training: (1) improving the quality of interaction provided by VE, and (2) applying advanced training aids and methodologies to real Navy and Marine Corps requirements. Our approach takes maximum advantage of the growing knowledge base in human-centric design to build systems that are well-suited for enhancing performance of real-world tasks. In addition to traditional Knowledge Acquisition and Knowledge Engineering approaches, our interdisciplinary development team is utilizing team task analyses, motion sickness evaluations, and usability analyses. The team has also developed a novel methodology for evaluating team-based performance enhancement in VE systems. This cross-disciplinary approach gives the team a unique perspective into designing effective, low cost, deployable simulations. The technology testbeds that are being developed are useful not only for stand-alone training, but also for embedded training, team training, and mission rehearsal.
Author (revised)
Virtual Reality; Training Simulators

20040081514 Virginia Modeling, Analysis and Simulation Center, Suffolk, VA, USA
Training in Peacekeeping Operations Using Virtual Environments
Loftin, R. Bowen; Scerbo, Mark W.; McKenzie, Rick; Catanzaro, Jean M.; Bailey, Nathan R.; Phillips, Mark A.; Perry, Gaye;

Advanced Technologies for Military Training; April 2004; 12 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The present paper describes two studies aimed at evaluating Virtual Environment (VE) technology for training individuals to perform military checkpoint duty. Participants stood guard at a fictitious base in which simulated drivers in vehicles approached seeking entrance. Participants inspected each vehicle, interacted with the drivers, verified their identification, and made a decision to allow the driver to enter the base, detain the vehicle, or asked the driver to turn around and leave. The first experiment was conducted in a CAVE environment with stereoscopic visual and auditory displays, participant tracking, and voice recognition. The second experiment provided the same training on a desktop system. The results of both studies showed that participants learned quite effectively with either interface, but that overall levels of performance were better with the fully immersive VE. These findings suggest that VE technology holds promise for activities that are more like experience-based training and which place a greater emphasis on social interaction skills.
Author
Training Simulators; Virtual Reality

20040081521 Air Force Research Lab., Mesa, AZ, USA
Generalized Operations Simulation Environment for Aircraft Maintenance Training
Andre, Terence S.; Bennett, Winston R., Jr.; Castillo, Anna R.; McClain, Dale P.; Purtee, Mathew D.; Wenzel, Brenda M.; Graci, Mary; Advanced Technologies for Military Training; April 2004; 8 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A training need exits for a common, cost-effective virtual reality simulation platform for aircraft maintenance training. The need is driven by a lack of concurrency between equipment and simulators, inaccessibility of equipment and simulators for training, high life-cycle and sustainment costs for training simulators, and the absence of full-scale assets or mock-up devices at training squadrons. In the absence of training assets and devices, resident training has been restricted to traditional methods such as referencing technical orders and academic courseware. An additional need for on-demand training at operational units has contributed to increased costs by allowing maintainers to use operational flight simulators that often require declassification for maintenance training purposes. This paper describes the assessment of the Virtual Environment Safe-for-maintenance Trainer and development of the Generalized Operations Simulation Environment, the next generation virtual reality aircraft maintenance training program.
Author
Training Simulators; Maintenance Training; Virtual Reality

20040082071 Nova Southeastern Univ., Fort Lauderdale, FL, USA
Application of Artificial Intelligence Techniques in Uninhabited Aerial Vehicle Flight
Dufrene, Warren R., Jr.; [2004]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the development of an application of Artificial Intelligence (AI) for Unmanned Aerial Vehicle (UAV) control. The project was done as part of the requirements for a class in AI at NOVA Southeastearn University and a beginning project at NASA Wallops Flight Facility for a resilient, robust, and intelligent UAV flight control system. A method is outlined which allows a base level application for applying an Artificial Intelligence method, Fuzzy Logic, to aspects of Control Logic for UAV flight. One element of UAV flight, automated altitude hold, has been implemented and preliminary results displayed.
Author
Artificial Intelligence; Control Systems Design; Pilotless Aircraft; Automatic Control

20040082505 Vanderbilt Univ., Nashville, TN, USA
Robot Behavior Acquisition Superposition and Composting of Behaviors Learned through Teleoperation
Peters, Richard Alan, II; July 07, 2004; 25 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-1515; No Copyright; Avail: CASI; A03, Hardcopy

Superposition of a small set of behaviors, learned via teleoperation, can lead to robust completion of a simple articulated reach-and-grasp task. Results support the hypothesis that a set of learned behaviors can be combined to generate new behaviors of a similar type. This supports the hypothesis that a robot can learn to interact purposefully with its environment through a developmental acquisition of sensory-motor coordination. Teleoperation bootstraps the process by enabling the robot to observe its own sensory responses to actions that lead to specific outcomes. A reach-and-grasp task, learned by an articulated robot through a small number of teleoperated trials, can be performed autonomously with success in the face of significant variations in the environment and perturbations of the goal. Superpositioning was performed using the Verbs and Adverbs

algorithm that was developed originally for the graphical animation of articulated characters. Work was performed on Robonaut at NASA-JSC.
Author
Teleoperators; Robots; Artificial Intelligence; Autonomy; Superposition (Mathematics)

20040082767 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Discovering the Merit of the Wavelet Transform for Object Classification
Eyster, Matthew D.; Mar. 2004; 156 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423870; AFIT/GE/ENG/04-09; No Copyright; Avail: CASI; A08, Hardcopy

Vision is the primary sense by which most biological systems collect information about their environment. Computer vision is a branch of artificial intelligence concerned with endowing machines with the ability to understand images. Object recognition is a key part of machine vision with far reaching benefits ranging from target recognition, surveillance systems, to automation systems. Extraction of salient features from an image is one of the key steps in object recognition. Typically, geometric primitives are extracted from an image using local analysis. However, the wavelet transform provides a global approach with good locality. Additionally, the directional and multiresolution properties may be exploited as a pre-processor to a neural network. This thesis examines the benefits of the wavelet transform as a preprocessor to a neural network for object recognition. Scaling of the wavelet coefficients and different neural network topologies are investigated. The system developed in this research is not intended to be critiqued on its classification performance. It only successfully classifies about 20% of the photographed models, however more important is the determination of the benefits of the wavelet transform, the effects of the various post-wavelet scaling functions, and the best neural network topology for this research. This is done by analyzing the system s performance on CAD models.
DTIC
Artificial Intelligence; Classifications; Computer Vision; Exploration; Targets; Wavelet Analysis

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040082157 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Goddard Profiling Algorithm (GPROF): Description and Current Applications
Olson, William S.; Yang, Song; Stout, John E.; Grecu, Mircea; [2004]; 14 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric scientists use different methods for interpreting satellite data. In the early days of satellite meteorology, the analysis of cloud pictures from satellites was primarily subjective. As computer technology improved, satellite pictures could be processed digitally, and mathematical algorithms were developed and applied to the digital images in different wavelength bands to extract information about the atmosphere in an objective way. The kind of mathematical algorithm one applies to satellite data may depend on the complexity of the physical processes that lead to the observed image, and how much information is contained in the satellite images both spatially and at different wavelengths. Imagery from satellite-borne passive microwave radiometers has limited horizontal resolution, and the observed microwave radiances are the result of complex physical processes that are not easily modeled. For this reason, a type of algorithm called a Bayesian estimation method is utilized to interpret passive microwave imagery in an objective, yet computationally efficient manner.
Derived from text
Algorithms; Satellite Imagery; Microwave Imagery; Computer Systems Design

20040082391 Massachusetts Inst. of Tech., Cambridge, MA, USA
An Exploratory Study of Cost Engineering in Axiomatic Design: Creation of the Cost Model Based on an FR-DP Map
Lee, Taesik; Jeziorek, Peter; [2004]; 7 pp.; In English; Third International Conferenc eon Axiomatic Design, 21-24 Jun. 2004, Seoul, Korea, Republic of; No Copyright; Avail: CASI; A02, Hardcopy

Large complex projects cost large sums of money throughout their life cycle for a variety of reasons and causes. For such large programs, the credible estimation of the project cost, a quick assessment of the cost of making changes, and the management of the project budget with effective cost reduction determine the viability of the project. Cost engineering that deals with these issues requires a rigorous method and systematic processes. This paper introduces a logical framework to a&e effective cost engineering. The framework is built upon Axiomatic Design process. The structure in the Axiomatic Design

process provides a good foundation to closely tie engineering design and cost information together. The cost framework presented in this paper is a systematic link between the functional domain (FRs), physical domain (DPs), cost domain (CUs), and a task/process-based model. The FR-DP map relates a system s functional requirements to design solutions across all levels and branches of the decomposition hierarchy. DPs are mapped into CUs, which provides a means to estimate the cost of design solutions - DPs - from the cost of the physical entities in the system - CUs. The task/process model describes the iterative process ot-developing each of the CUs, and is used to estimate the cost of CUs. By linking the four domains, this framework provides a superior traceability from requirements to cost information.
Author
Cost Analysis; Design to Cost; Domains; Functional Design Specifications; Mathematical Models

20040082776 Prometheus, Inc., Sharon, MA
MISAR: Waveform Design and Filtering in Zak Space
Tolimieri, Richard; An, Myoung; Jun. 2, 2004; 32 pp.; In English
Contract(s)/Grant(s): FA9550-04-C-0003
Report No.(s): AD-A423905; AFRL-SR-AR-TR-04-0289; No Copyright; Avail: CASI; A03, Hardcopy

In this report, the authors document their ongoing effort to develop the Finite Zak Transform (FZT) into a framework for adaptive signal and filter design. The general idea is that by representing one-dimensional signals in multi- dimensional spaces, the underlying geometry in these multi- dimensional spaces can lead to new signal decompositions and processing methods. The specific application outlined in this report is spatial localization and scattering co-efficient computation from the noisy echoes of chirp waveforms interrogating a point target environment. The methods developed will be extended in future efforts to materials identification from chirp pulse echoes, including the determination of the scattering delays due to dielectric materials. Numerical experiments are included to emphasize the feasibility of this approach. Zak space representation provides a geometric, time-frequency setting for developing tools for solving this problem. In this setting, the authors have established geometric conditions for choosing optimal or nearly optimal sampling rates for the echoes of the chirp waveforms, and methods for processing and interpreting the information contained in the resulting sampled echoes. (61 figures, 4 refs.)
DTIC
Adaptive Filters; Chirp Signals; Image Processing; Integral Transformations; Pulse Radar; Signal Processing; Signal to Noise Ratios; Waveforms

20040082788 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Performance Tradeoff Study of a GPS-Aided INS for a Rocket Trajectory
Istanbulluoglu, Muhittin; Mar. 2002; 232 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423921; AFIT/GE/ENG/02M-11; No Copyright; Avail: CASI; A11, Hardcopy

The Turkish Air Force (TuAF) has started a project to launch a satellite using only Turkish resources. Primary motivation behind this research is to assist TuAF's project by keeping up with these innovations in the navigational arena. The basic challenge in navigation system design is to decide which navigation system (or systems) and implementation techniques will be used, depending on accuracy requirements. The two primary navigation systems that will be integrated in this research are the Inertial Navigation System (INS), and the Global Positioning System (GPS). The Kalman filter algorithm is used to integrate INS and GPS. The rocket (Atlas IIAS launch vehicle) flight profile is generated by using PROFGEN and simulated ″true″ GPS ephemeris data is incorporated into system as GPS measurements. The ″modified″ alternative system performance analysis tool, MatSOFE, is utilized in this research study. Standard and differential GPS are compared, as are three different grades of INS, in a tradeoff performance analysis.
DTIC
Global Positioning System; Tradeoffs; Trajectories

20040082825 Naval Surface Warfare Center, Bethesda, MD
A Criterion for Conversion of Summations to Integrations in Structural Acoustics
Maidanik, G.; Becker, K. J.; Maga, L. J.; May 2004; 72 pp.; In English
Report No.(s): AD-A423989; NSWCCD-70-TR-2003/058; No Copyright; Avail: CASI; A04, Hardcopy

An analytical formulation of a transfer function pertaining to a simple structural model is used to examine this criterion. The model consists of a coated plate immersed in fluid media on either side. The first fluid interfaces the coating atop and is semi-infinite in extent. The second fluid interfaces the bottom of the plate and terminates at a baffle that defines a reflection coefficient. An external drive is placed on a plane that lies in the fluid between the plate and the baffle. Focus is centered on

the transfer function of a spectral component in the external drive to a spectral component on the inter-face with the top fluid. The presence of the baffle generates, in this transfer function, resonances and anti-resonances. These are discernible in those regions of the frequency domain in which the modal overlap parameters are less than unity. In those regions of the frequency domain in which the modal overlap parameters exceed unity the resonances and the anti-resonances merge onto values that are conditioned by the absence of the cavity. It transpires that converting a summation to an integration is tantamount to merging artificially the resonances and the anti-resonances also in those regions in which the modal overlap parameters are less than unity. The merging, again, are onto values that are conditioned by the absence of the cavity.
DTIC
Acoustics; Criteria; Human-Computer Interface; Transfer Functions

20040082843 Wright State Univ., Dayton, OH
Computational Mathematics for Determining Uncertain Bounds in Multi-Valued Engineering Design
Grandhi, Ramana V.; Apr. 30, 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0377
Report No.(s): AD-A424007; AFRL-SR-AR-TR-04-0307; No Copyright; Avail: CASI; A03, Hardcopy

Many scientific and engineering communities have recognized that intrinsic uncertainties in an engineering structural system have multifaceted natures (randomness, non- randomness, partial randomness, vagueness, and so forth) and traditional probability theory does not always provide an appropriate framework for handling the various types of uncertainties. The primary objectives of this research work were to explore the possible mathematical frameworks of Uncertainty Quantification (UQ) and to develop an appropriate and unified framework for multiple types of uncertainty sources. The candidate frameworks include probability theory and evidence theory (Dempster-Shafer theory). Multidisciplinary Optimization is addressed by developing sensitivity analysis of quantified uncertainty in a structural system and a cost-efficient UQ methodology.
DTIC
Structural Engineering

20040082948 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Evaluating the Navigation Potential of the National Television System Committee Broadcast Signal
Eggert, Ryan J.; Mar. 2004; 150 pp.; In English
Report No.(s): AD-A423977; AFIT/GE/ENG/04-08; No Copyright; Avail: CASI; A07, Hardcopy

The accuracy and worldwide availability of the Global Positioning System (GPS) make it the dominant system for navigation and precise positioning. Unfortunately, many situations arise in which GPS may not be adequate, e.g., urban navigation. This research evaluates the navigation potential of the National Television System Committee (NTSC) broadcast signal using a time-difference-of-arrival (TDOA) algorithm. TDOA measurements are made using NTSC broadcast signals collected from low and high multipath environments. These measurements are then used to evaluate the severity and dynamic effects of NTSC broadcast multipath signals. Three data reduction algorithms were developed--one that modifies the classical cross-correlation TDOA approach, and two that difference the signals' time-of-arrival at each receiver. Each algorithm was evaluated for consistency and accuracy in each environment. Multipath mitigation was demonstrated using a locally fabricated antenna. Collected NTSC broadcast signal samples reveal TDOA measurement errors ranging from 1 to 200 meters, with typical errors between 10 and 40 meters. Multipath was shown to be the dominant error source. However, errors due to the particular hardware configuration used in this research were also significant. Simple multipath mitigation techniques were able to reduce these errors, and analyses of the received waveforms provide the foundation for developing additional active multipath mitigation techniques. Simulations using eight television station locations near Dayton, Ohio reveal 40 meter position accuracy with the typical range errors found in this research. Extreme measurement errors from high multipath areas reduced this accuracy to 100 meters.
DTIC
Broadcasting; Global Positioning System; Navigation; Television Systems

20040083982 Texas A&M Univ., College Station, TX, USA
Numerical Modeling, Thermomechanical Testing, and NDE Procedures for Prediction of Microcracking Induced Permeability of Cryogenic Composites
Noh, Jae; Whitcomb, John; Oh, Bongtaek; Lagoudas, Dimitris; Maslov, Konstatin; Ganpatyre, Atul; Kinra, Vikram; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC8-223; No Copyright; Avail: CASI; A02, Hardcopy

Reusable Space Vehicles will include light cryogenic composite fuel tanks that must not leak excessively even after multiple launches. Damage in cryogenic composite fuel tanks induced during manufacturing and advanced by thermomechanical cycling can accelerate leakage of the propellant. Whether the leakage exceeds tolerable levels depends on many factors, including pressure gradients, microcrack density, other damage such as delamination, connectivity of the cracks, residual stresses from manufacture, service-induced stresses from thermal and mechanical loads, and composite lay-up. Although it is critical to experimentally characterize permeability during various thermal and mechanical load histories, optimal design depends on having analytical models that can predict the effect of various parameters on performance. Our broad goal is to develop such models that are experimentally validated by destructive and non-destructive evaluation means. Derived from text

Mathematical Models; Thermodynamics; Nondestructive Tests; Cracks; Cryogenics

20040084067 NASA Langley Research Center, Hampton, VA, USA

Evaluation and Analysis of F-16XL Wind Tunnel Data From Static and Dynamic Tests

Kim, Sungwan; Murphy, Patrick C.; Klein, Vladislav; June 2004; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WU 762-20-41-03

Report No.(s): NASA/TM-2004-213234; L-18380; No Copyright; Avail: CASI; A05, Hardcopy

A series of wind tunnel tests were conducted in the NASA Langley Research Center as part of an ongoing effort to develop and test mathematical models for aircraft rigid-body aerodynamics in nonlinear unsteady flight regimes. Analysis of measurement accuracy, especially for nonlinear dynamic systems that may exhibit complicated behaviors, is an essential component of this ongoing effort. In this report, tools for harmonic analysis of dynamic data and assessing measurement accuracy are presented. A linear aerodynamic model is assumed that is appropriate for conventional forced-oscillation experiments, although more general models can be used with these tools. Application of the tools to experimental data is demonstrated and results indicate the levels of uncertainty in output measurements that can arise from experimental setup, calibration procedures, mechanical limitations, and input errors.

Author

Mathematical Models; Aerodynamic Characteristics; Aircraft Structures; Airframes; F-16 Aircraft

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040082060 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Did a Gamma-Ray Burst Initiate the Late Ordovician Mass Extinction?

Melott, A. L.; Lieberman, B. S.; Laird, C. M.; Martin, L. D.; Medvedov, M. V.; Thomas, B. C.; Cannizzo, J. K.; Gehrels, N.; Jackman, C. H.; [2004]; 22 pp.; In English

Contract(s)/Grant(s): NSF AST-00-70702; No Copyright; Avail: CASI; A03, Hardcopy

Gamma-ray bursts (hereafter GRB) produce a flux of radiation detectable across the observable Universe. A GRB within our own galaxy could do considerable damage to the Earth's biosphere; rate estimates suggest that a dangerously near GRB should occur on average several times per billion years. At leastfive times in the history of lfe, the Earth experienced mass extinctions that eliminated a large percentage of the biota. Many possible causes have been documented, and GRB may also have contributed. The late Ordovician mass extinction approximately 440 million years ago may be at least partly the result of a GRB. Due to severe depletion of the ozone layer, intense solar ultraviolet radiation is expected to result from a nearby GRB, and some of the patterns of extinction and survivorship at this time may be attributable to elevated levels of UV radiation reaching the Earth. In addition a GRB could trigger the global cooling which occurs at the end of the Ordovician period that follows an interval of relatively warm climate. Intense rapid cooling and glaciation at that time, previously identijied as the probable cause of this mass extinction, may have resultedfiom a GRB.

Author

Gamma Ray Bursts; Prediction Analysis Techniques

20040082710 Syracuse Univ., NY

Radar Signal Detection Based on Bayesian Hierarchical Models and Image Analysis Techniques

Varsheny, Pramod K.; Chen, Biao; May 2004; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0525; Proj-762R

Report No.(s): AD-A423763; AFRL-SN-RS-TR-2004-123; No Copyright; Avail: CASI; A04, Hardcopy

The research undertaken under this effort has two major components. First the application of Bayesian inference theory is applied to problems ranging from Distributed Detection with multiple sensors clutter scene characterization/ identification for airborne radar systems to adaptive CFAR detection with heterogeneous clutter. Secondly, multichannel radar detection algorithms are developed that are particularly suitable for airborne radar surveillance systems operating in a complex clutter/interference/noise environments.
DTIC
Bayes Theorem; Image Analysis; Radar Detection; Signal Detection; Signal Processing

20040082739
Coupled Dynamic Systems and Le Chatelier's Principle in Noise Control
Maidanik, G.; Becker, K. J.; Jun. 2004; 28 pp.; In English
Report No.(s): AD-A423828; NSWCCD-70-TR-2004/088; No Copyright; Avail: CASI; A03, Hardcopy

Investigation of coupling an adjunct dynamic system to an externally driven dynamic system - a master dynamic system - reveals that the response of the adjunct dynamic system affects the pre-coupled response of the master dynamic system. The responses, in the two dynamic systems when coupled, are estimated by the stored energies and, respectively. Since the adjunct dynamic system, prior to coupling was with zero stored energy, the pre-coupled stored energy in the master dynamic system is expected to be reduced to when coupling is instituted; i.e., one expects. In this case a beneficial noise control of the master dynamic system would result from the coupling. It is argued that the change in the disposition of the stored energies as just described may not be the only change. The coupling may influence the external input power into the master dynamic system which may interfere with the expected noise control. Indeed, the coupling may influence the external input power such that the expected beneficial noise control may not materialize. An example of this kind of noise control reversal is cited.
DTIC
Fluid Dynamics; Noise Reduction

20040082768 Naval Undersea Warfare Center, Newport, RI
Detection Performance of a Suboptimum Processor in Non-Gaussian Noise
Nuttall, Albert H.; Apr. 19, 2004; 66 pp.; In English
Report No.(s): AD-A423872; NUWC-NPT-TR-11; 541; No Copyright; Avail: CASI; A04, Hardcopy

The performance of a suboptimum processor for three different signal types in three different noise backgrounds has been investigated numerically in terms of the receiver operating characteristics and compared with the performance of the optimum processor in the same environments. The three distributions considered are Gaussian, sech, and fourth power; the sech distribution decays exponentially for large arguments, while the fourth-power distribution decays inversely proportional to the fourth power. Noise with the fourth-power distribution is very heavy-tailed and constitutes a debilitating effect on standard linear processors in weak signal environments. The suboptimum processor consists of a hard limiter followed by an energy detector. In the presence of heavy-tailed noise Interference, this suboptimum processor approach loses on the order of 1 dB In signal detectability relative to the optimum processor. Lack of the detailed signal structure is not a detriment to this processor; furthermore, the information required to realize the absolute optimum processor will not likely be available in practice.
DTIC
Background Noise; Detection; Random Noise; Receivers

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040081522 Institute for Human Factors TNO, Soesterberg, Netherlands
Keep Systematic Training System Design Efficient!
Verstegen, Danieelle; vanRooij, John C. G. M.; Advanced Technologies for Military Training; April 2004; 11 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Systematic methods for training system design have been available for years. Using such methods for the development of user requirements and specifications for technically advanced training means (simulators, E-learning, CBT, etc.) ensures that these will fulfil the training needs. The problem is that applying systematic methods takes time and effort, and requires

expertise. Our solution is to work iteratively and in workshops under supervision of experienced facilitators. The same systematic method for training system design can be used at different moments with different levels of detail. The SLIM method has been designed for the needs statement phase. In this early stage training needs analysis and training program design are done at a rather global level. Later on, using the same or a similar step-by-step method, the results can be elaborated in more detail, in order to write specifications and -eventually- to implement training. The SLIM method emphasises aspects that are often not systematically addressed: the place of training means in overall training, the choice between high and lower fidelity options, facilities for instruction, feedback and assessment, and the role of the instructors. Inviting all stakeholders ensures that the chosen solution is widely supported. In this paper we briefly describe the SLIM method, and the experiences during its application in a number of different cases. We conclude that needs statements can be developed quickly and systematically using the SLIM method in workshop setting.
Author
Training Analysis; Systems Engineering

20040082288 NASA Marshall Space Flight Center, Huntsville, AL, USA
Multivariable Parametric Cost Model for Ground Optical: Telescope Assembly
Stahl, H. Philip; Rowell, Ginger Holmes; Reese, Gayle; Byberg, Alicia; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

A parametric cost model for ground-based telescopes is developed using multi-variable statistical analysis of both engineering and performance parameters. While diameter continues to be the dominant cost driver, diffraction limited wavelength is found to be a secondary driver. Other parameters such as radius of curvature were examined. The model includes an explicit factor for primary mirror segmentation and/or duplication (i.e. multi-telescope phased-array systems). Additionally, single variable models based on aperture diameter were derived.
Author
Cost Analysis; Phased Arrays; Telescopes; Statistical Analysis; Cost Effectiveness

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040081397 Helsinki Univ., Helsinki, Finland
The Eigenvalue Problem of the p-Laplacian in Metric Spaces
Pere, Mikko; 2004; ISSN 1239-6303; 30 pp.; In English
Report No.(s): Rept-136; Copyright; Avail: Other Sources

The eigenvalue problem of the p-Laplacian consists of finding functions u in the Sobolev space W(sup 1,p)(sub 0)(Omega) with zero boundary values that satisfy the equation in a weak sense for some lambda not equal to 0, 1 \h p \h infinity. For the least positive eigenvalue lambda(sub p) = lambda(sub p)(Omega) this is equivalent to minimizing the Rayleigh quotient. In this article we examine this variational problem in the so called Newton space N(sup 1,p)(sub 0)(Omega), which is a generalization of the Sobolev space W(sup 1,p)(sub 0)(Omega) in a metric measure space with some extra conditions. We first recall the definition of the Newton spaces and then prove the existence of solutions for this generalized eigenvalue problem. In the main theorem we prove that the solutions are Holder continuous using the De Giorgi method.
Author
Eigenvalues; Laplace Transformation; Sobolev Space

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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*.

20040079788 State Univ. of New York, Stony Brook, NY, USA, Brookhaven National Lab., Upton, NY, USA
Neutrinos and Implications for Physics Beyond the Standard Model
Goldhaber, M.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006598; BNL-71614-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Neutrinos; Physics; Mathematical Models

20040079789 Brookhaven National Lab., Upton, NY, State Univ. of New York, Stony Brook, NY, USA
Fast Neutron Source Detection at Long Distances using Double-Scatter Spectrometry
Forman, L.; Vanier, P. E.; Welsh, K.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006596; BNL-71469-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

Fast neutrons can be detected with relatively high efficiency, \g15%, using two planes of hydrogenous scintillator detectors where a scatter in the first plane creates a start pulse and scatter in the second plane is separated by time-of- flight. Indeed, the neutron spectrum of the source can be determined as the sum of energy deposited by pulse height in the first added to the energy of the second found by time-of-flight to the second detector. Gamma rays can also create a double scatter by Compton interaction in the first with detection in the second, but these events occur in a single time window because the scattered photons all travel at the speed of light. Thus, gamma ray events can be separated from neutrons by the time-of-flight differences. We have studied this detection system with a Cf-252 source using Bicron 501A organic scintillators and report on the ability to efficiently detect fast neutrons with high neutrodgamma detection ratios. We have further studied cosmic-ray neutron background detection response that is the dominant background in long range detection. We have found that most of the neutrons are excluded from the time-of-flight window because they are either too high in energy, \glOMeV, or too low, \h 10 keV. Moreover, if the detection planes are position-sensitive, the angular direction of the source can be determined by the ratio of the energy of scattered protons in the first detector relative to the position and energy of the scattered neutron detected in the second. This ability to locate the source in theta is usefbl, but more importantly increases the signal to noise relative to cosmic-ray produced neutrons that are relatively isotropic. This technique may be used in large arrays to detect neutrons at ranges up to 0.5 kilometer.
NTIS
Fast Neutrons; Scattering

20040079790 Brookhaven National Lab., Upton, NY, Indiana Univ., Bloomington, IN, USA, Argonne National Lab., IL
Twenty Percent Partial Siberian Snake in the AGS
Huang, H.; Ahrens, L.; Bai, M.; Brown, K. A.; Glenn, W.; 2003; 14 pp.; In English
Report No.(s): DE2004-15006594; BNL-71492-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

An 11.4% partial Siberian snake was used to successfully accelerate polarized proton through a strong intrinsic depolarizing spin resonance in the AGS. No noticeable depolarization was observed. This opens up the possibility of using a 20% to 30% partial Siberian snake in the AGS to overcome all weak and strong depolarizing spin resonances. Some design and operation issues of the new partial Siberian snake are discussed.
NTIS
Protons; Depolarization

20040081317 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Second-Order Pseudo-Gaussian Shaper
Beche, J. F.; Nov. 2002; In English
Report No.(s): DE2003-816377; LBNL-52855; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this document is to provide a calculus spreadsheet for the design of second-order pseudo-gaussian shapers. Fred Goulding and Don Landis have studied the structure of those filters and their implementation and this document will outline the calculation leading to the relation between the coefficients of the filter. The general equation of the second order pseudo-gaussian filter is: f(t) = P(sub 0)(center-dot) e(sup -3kt)(center-dot) sin(sup 2)(kt). The parameter k is a normalization factor.
NTIS
Filters; Normal Density Functions

20040081323 Oak Ridge National Lab., TN, Basel Univ., Switzerland
Evaluation of Silicon Neutron Resonance Parameters in the Energy Range Thermal to 1800 keV
Derrien, H.; Leal, L. C.; Guber, K. H.; Valentine, T.; Larson, N. M.; Aug. 2002; In English
Report No.(s): DE2003-814166; ORNL/TM-2001/271; No Copyright; Avail: National Technical Information Service (NTIS)

The evaluation of the neutron cross sections of the three stable isotopes of silicon in the energy range thermal to 20 MeV was performed by Hetrick et al. for ENDF/B-VI (Evaluated Nuclear Data File). Resonance parameters were obtained in the energy range thermal to 1500 keV from a SAMMY analysis of the Oak Ridge National Laboratory experimental neutron transmission data. A new measurement of the capture cross section of natural silicon in the energy range 1 to 700 keV has

recently been performed at the Oak Ridge Electron Linear Accelerator. Results of this measurement were used in a SAMMY reevaluation of the resonance parameters, allowing determination of the capture width of a large number of resonances. The experimental data base is described; properties of the resonance parameters are given. For the first time the direct neutron capture component has been taken into account from the calculation by Rauscher et al. in the energy range from thermal to 1 MeV. Results of benchmark calculations are also given. The new evaluation is available in the ENDF/B-VI format.
NTIS
Neutrons; Evaluation; Silicon; Resonance

20040081327
Analysis of DO -\g K Anti-K X Decays
2003; In English
Report No.(s): DE2003-814248; SLAC-PUB-9935; No Copyright; Avail: National Technical Information Service (NTIS)
Using data taken with the CLEO II detector, they have studied the decays of the D(sup 0) to K(sup+)K(sup -), K(sup 0)(bar K)(sup 0), K(sub S)(sup 0)K(sub S)(sup 0), K(sub S)(sup 0)K(sub S)(sup 0)(pi)(sup 0), K(sup+)K(sup -)(pi)(sup 0). The authors present significantly improved results for B(D(sup 0)(yields) K(sup+)K(sup -)) = (0.454(+/-) 0.028(+/-) 0.035)%, B(D(sup 0)(yields) K(sup 0)(bar K)(sup 0)) = (0.054(+/-) 0.012(+/-) 0.010)% and B(D(sup 0)(yields) K(sub S)(sup 0)K(sub S)(sup 0)K(sub S)(sup 0))= (0.074(+/-) 0.010(+/-) 0.015)% where the first errors are statistical and the second errors are the estimate of their systematic uncertainty. They also present a new upper limit B(D(sup 0)(yields) K(sub S)(sup 0)K(sub S)(sup 0)(pi)(sup 0))< 0.059% at the 90% confidence level and the first measurement of B(D(sup 0)(yields) K(sup+)K(sup -)(pi)(sup 0)) = (0. 14(+/-) 0.04)%.
NTIS
Confidence Limits; Decay Rates

20040081329 Argonne National Lab., Idaho Falls, ID, USA, Brookhaven National Lab., Upton, NY, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Energy-Deposition and Damage Calculations in Core-Vessel Inserts at the Spallation Neutron Source
2003; In English
Report No.(s): DE2003-814465; ORNL/TM-2002/125; No Copyright; Avail: National Technical Information Service (NTIS)
Heat-deposition and damage calculations are described for core-vessel inserts in the target area of the Spallation Neutron Source. Two separate designs for these inserts (or neutron beam tubes) were studied; a single-unit insert and a multi-unit insert. The single unit contains a neutron guide; the multi unit does not. Both units are constructed of stainless steel. For the single unit, separate studies were carried out with the guide composed of stainless steel, glass, and aluminum. Results are also reported for an aluminum window on the front of the insert, a layer of nickel on the guide, a cadmium shield surrounding the guide, and a stainless steel plug in the beam-tube opening. The locations of both inserts were the most forward positions to be occupied by each design respectively thus ensuring that the calculations are conservative.
NTIS
Energy Transfer; Damage; Computation; Inserts; Spallation; Neutron Sources

20040081330 Rutgers - The State Univ., Piscataway, NJ, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Probing the Deuteron at High-T
2003; In English
Report No.(s): DE2003-814899; No Copyright; Avail: National Technical Information Service (NTIS)
The deuteron is probed at both higher s and higher momentum transfer to the nucleon with photodisintegration than with elastic scattering. Kinematics makes the construction of a meson-baryon theory more difficult, and the potential success of a quark-based theory more likely.
NTIS
Deuterons; Elastic Scattering

20040081333 Fermi National Accelerator Lab., Batavia, IL, USA
Heavy Flavour Lifetimes and Lifetime Differences
Rademacker, J.; Sep. 2003; In English
Report No.(s): DE2003-815058; FERMILAB-CONF-03/260; No Copyright; Avail: National Technical Information Service (NTIS)

The authors give an overview of heavy flavour lifetime measurements, focusing on recent results from the Tevatron and the B factories. In the first part of this article we summarize the status and latest measurements of B-hadron lifetimes and lifetime ratios, including some recent result from the Tevatron and the B factories, and compare those results with the predictions from Heavy Quark Expansion (HQE). Future prospects for lifetime measurements at the B factories and the Tevatron are discussed. In the second part, we review the status and prospects of measuring the difference between the lifetimes of the two CP eigenstates in the B(sub s)(sup 0)-(bar B)(sub s)(sup 0) system.
NTIS
Particle Accelerators; Hadrons; Measure and Integration

20040081335 Fermi National Accelerator Lab., Batavia, IL, USA, Indiana Univ., Bloomington, IN, USA
Lattice QCD Production on Commodity Clusters at Fermilab
Holmgren, D.; Singh, A.; Mackenzie, P.; Simone, J.; Gottlieb, S.; 2003; In English
Report No.(s): DE2003-815581; FERMILAB-CONF-03/255; No Copyright; Avail: National Technical Information Service (NTIS)
The report describes the construction and results to date of Fermilab's three Myrinet-networked lattice QCD production clusters (an 80-node dual Pentium III cluster, a 48-node dual Xenon cluster, and a 128-node dual Xenon cluster). It examines a number of aspects of performance of the MILC lattice QCD code running on these clusters.
NTIS
Quantum Chromodynamics; Xenon Isotopes

20040081337 Stanford Linear Accelerator Center, Stanford, CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Build up of Electron Cloud in the PEP-II Particle Accelerator in the Presence of a Solenoid Field and with Different Bunch Pattern
Cai, Y.; Pivi, M.; Furman, M. A.; Sep. 2003; In English
Report No.(s): DE2003-815615; SLAC-PUB-10164; No Copyright; Avail: National Technical Information Service (NTIS)
We have augmented the code POSINST to include solenoid fields, and used it to simulate the build up of electron cloud due in the PEP-II positron ring. We find that the distribution of electrons is strongly affected by the resonances associated with the cyclotron period and bunch spacing. In addition,we discover a threshold beyond which the electron density grows exponentially until it reaches the space charge limit. The threshold does not depend on the bunch spacing but does depend on the positron bunch population.
NTIS
Electron Clouds; Solenoids; Electron Density (Concentration)

20040081338 Stanford Linear Accelerator Center, Stanford, CA, USA
Performance and Calibration of the Crystal Calorimeter of the BaBar Detector
Kocian, M.; 2003; In English
Report No.(s): DE2003-815619; SLAC-PUB-10170; No Copyright; Avail: National Technical Information Service (NTIS)
The BABAR detector at the B-factory at SLAC is equipped with a calorimeter consisting of 6580 CsI(Tl) crystals. This allows for the measurement of the energies of photons and neutral pions and the identification of electrons with high precision, needed in the reconstruction of B-meson decays. The detailed performance of the calorimeter will be presented. As the B-factory operates at high luminosity the calorimeter is exposed to substantial background and radiation damage. The calorimeter is calibrated regularly at different energies in order to meet the precision goals. The calibration methods include the use of a radioactive source, Bhabha events, radiative Bhabha events, (pi)(sup 0)-Mesons, and a light pulser system.
NTIS
Calorimeters; Crystals; Calibrating; Detectors

20040081341 Technical Research Centre of Finland, Espoo, Finland
Introduction to the Concept of Exergy-for a Better Understanding of Low-Temperature-Heating and High-Temperature-Cooling Systems
Shukuya, M.; Hammache, A.; 2002; 66 pp.; In English
Report No.(s): PB2004-106088; VTT/RN-2158; No Copyright; Avail: CASI; A04, Hardcopy
Chapter 1 describes the characteristics of a thermodynamic concept, exergy, in association with building heating and

cooling systems. Exergy is the concept that explicitly indicates 'what is consumed.' Chapter 2 introduces the various forms of exergy and the mathematical formulations used to evaluate them. Chapter 3 introduces an example of exergy calculation for space heating systems.
NTIS
Thermodynamics; Cooling Systems; Energy

20040081342 Stanford Linear Accelerator Center, Stanford, CA, USA
BaBar Electromagnetic Calorimeter in its Third Year of Operation
Eschrich, I. G.; 2002; In English
Report No.(s): DE2003-815621; SLAC-PUB-10172; No Copyright; Avail: National Technical Information Service (NTIS)
The BABAR experiment at the SLAC B-Factory has recorded more than 80/fb of integrated luminosity since 1999. Its electromagnetic calorimeter which consists of 6580 CsI(Tl) crystals has to detect both photons below 20 MeV as well as electrons in the 0.5-9 GeV range with a few percent resolution. Status and performance of the readout electronics including reliability issues and operational experience after the first three years of operation are presented.
NTIS
Calorimeters; Electrons; Crystals

20040081343 Oak Ridge National Lab., TN
Hadronic beta Decays with BaBar
2003; In English
Report No.(s): DE2003-815624; No Copyright; Avail: National Technical Information Service (NTIS)
The authors report about the studies of the decay channels B(sup -)(yields) D(sup 0)K(sup -), B(sup 0)(yields) D*(sup -) a(sub 1)(sup+) and B(sup 0)(yields) D(sub s)(sup (*)-)(pi)(sup+) with a sample of 62 x 10(sup 6)(Upsilon)(4S) decays into B meson pairs collected with the BABAR detector at the PEP II asymmetric e(sup+)e(sup -) collider.
NTIS
Hadrons; Particle Decay

20040081345 Fermi National Accelerator Lab., Batavia, IL, USA
Design Modifications, Fabrication and Test of HFDB-03 Racetrack Magnet Wound with Pre-Reacted Nb(2)Sn Rutherford Cable
Ambrosio, G.; Andreev, N.; Barzi, E.; Bhashyam, S.; Carcagno, R.; 2003; In English
Report No.(s): DE2003-816044; FERMILAB-CONF-03/291; No Copyright; Avail: National Technical Information Service (NTIS)
A 10 T racetrack magnet (HFDB-03) wound with pre-reacted Nb(sub 3)Sn Rutherford cable has been fabricated and tested at Fermilab. This magnet is the third one in a proof-of-principle series for the use of the React-and-Wind technology in common-coil dipole magnets for future accelerators. It consists of two flat racetrack coils (28 turns each) separated by 5 mm. The maximum field on the coil, at the short sample limit of 16530 A, is 10 tesla. The cable has 41 strands with 0.7 mm diameter and the minimum bend radius in the magnet ends is 90 mm. The predecessor of this magnet (HFDB-02) reached 78% of the short sample limit at 7.7 T. The mechanical design was improved and the fabrication procedure was slightly modified in order to address possible causes of limitation. In this paper we present the mechanical design and analysis of HFDB-03, the modifications to the fabrication procedure and the test results.
NTIS
Design Analysis; Fabrication; Performance Tests; Magnets

20040081346 Oregon State Univ., Corvallis, OR, USA
Improvements in Neutronics/Thermal-Hydraulics Coupling in Two-Phase Flow Systems Using Stochastic-Mixture Transport Models. Final Report
Palmer, T. S.; Wu, Q.; 2003; In English
Report No.(s): DE2003-815998; No Copyright; Avail: National Technical Information Service (NTIS)
In this NEER project, researchers from Oregon State University have investigated the limitations of the treatment of two-phase coolants as a homogeneous mixture in neutron transport calculations. Improved methods of calculating the neutron distribution in binary stochastic mixtures have been developed over the past 10-15 years and are readily available in the transport literature. These methods are computationally more expensive than the homogeneous models, but can give much

more accurate estimates of ensemble average fluxes and reaction rates provided statistical descriptions of the distributions of the two materials are known. A thorough review of the two-phase flow literature has been completed and the relevant mixture distributions have been identified. Using these distributions, we have performed Monte Carlo criticality calculations of fuel assemblies to assess the accuracy of the atomic mix approximation when compared to a resolved treatment of the two-phase coolant.
NTIS
Neutron Distribution; Binary Mixtures; Reaction Kinetics

20040081358 Universita degli Studi G. D'Annunzio, Rome, Italy, California Univ., San Diego, La Jolla, CA, USA
Recent Results on /V(sub ub)/,/V(sub cb)/ and Mixing from BaBar
Jun. 2003; In English
Report No.(s): DE2003-813208; SLAC-PUB-9922; No Copyright; Avail: National Technical Information Service (NTIS)

We present the measurements of the CKM matrix parameters V(sub ub), V(sub cb) and of the B mixing oscillation frequency with the BaBar experiment at the asymmetric B-factory PEPII. Data were collected in the years 2000-2002 and the total available statistics corresponds to 91 fb(sup -1). The V(sub ub), V(sub cb) measurements utilize both inclusive and exclusive semileptonic decays of the B meson. The(Delta)m(sub d) parameter is measured by using the time evolution of the B, determined from the flight length difference between the two B mesons.
NTIS
Particle Decay; Mesons

20040081363 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Wavelet Crosstalk Matrix and Its Application to Assessment of Shift-Variant Imaging Systems
Qi, J.; Huesman, R. H.; 2003; In English
Report No.(s): DE2003-816215; No Copyright; Avail: National Technical Information Service (NTIS)

The objective assessment of image quality is essential for design of imaging systems. Barrett and Gifford introduced the Fourier cross talk matrix. Because it is diagonal for continuous linear shift-invariant imaging systems, the Fourier cross talk matrix is a powerful technique for discrete imaging systems that are close to shift invariant. However, for a system that is intrinsically shift variant, Fourier techniques are not particularly effective. Because Fourier bases have no localization property, the shift-variance of the imaging system cannot be shown by the response of individual Fourier bases; rather, it is shown in the correlation between the Fourier coefficients. This makes the analysis and optimization quite difficult. In this paper, we introduce a wavelet cross talk matrix based on wavelet series expansions. The wavelet cross talk matrix allows simultaneous study of the imaging system in both the frequency and spatial domains. Hence it is well suited for shift variant systems. We compared the wavelet cross talk matrix with the Fourier cross talk matrix for several simulated imaging systems, namely the interior and exterior tomography problems, limited angle tomography, and a rectangular geometry positron emission tomograph. The results demonstrate the advantages of the wavelet cross talk matrix in analyzing shift-variant imaging systems.
NTIS
Tomography; Imaging Techniques; Wavelet Analysis

20040081370 Tokyo Metropolitan Univ., Tokyo, Japan, Universidade Estadual de Paulista, Sao Paulo, Brazil, Fermi National Accelerator Lab., Batavia, IL, USA
Long Baseline Neutrino Oscillations: Parameter Degeneracies and JHF/NUMI Complementarity
Minakata, H.; Nunokawa, H.; Parke, S.; Oct. 2003; In English
Report No.(s): DE2003-816151; FERMILAB-CONF-03/308-T; No Copyright; Avail: National Technical Information Service (NTIS)

A summary of the parameter degeneracy issue for long baseline neutrino oscillations is presented and how a sequence of measurements can be used to resolve all degeneracies. Next, a comparison of the JHF and NuMI Off-Axis proposals is made with emphasis on how both experiments running neutrinos can distinguish between the normal and inverted hierarchies provided the E/L of NuMI is less than or equal to the E/L of JHF. Due to the space limitations of this proceedings only an executive style summary can be presented here, but the references and transparencies of the talk contain the detailed arguments.
NTIS
Neutrinos; Oscillations

20040082293 NASA Marshall Space Flight Center, Huntsville, AL, USA

Induced Transparency and Absorption in Coupled Microresonators

Smith, David D.; Chang, Hongrok; [2004]; 2 pp.; In English; Institute of Electrical and Electronics Engineers-Laser and Electro-Optics (IEEE-LEOS) Society Meeting, 28-30 Jun. 2004, San Diego, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy

We review the conditions for the occurrence of coherence phenomena in passive coupled optical microresonators. We derive the effective steady-state response and determine conditions for induced transparency and absorption in these systems. Author

Absorption; Resonators; Transparence; Electromagnetism; Coupled Modes; Coherence

20040082406 Fermi National Accelerator Lab., Batavia, IL, USA, Rochester Univ., NY, USA

Cooling of Electronics in Collider Experiments

Stanek, R.; Cooper, W.; Demarteau, M.; Derylo, G.; Fast, J.; 2003; In English

Report No.(s): DE2003-817288; FERMILAB-CONF-03/352-E; No Copyright; Avail: National Technical Information Service (NTIS)

Proper cooling of detector electronics is critical to the successful operation of high-energy physics experiments. Collider experiments offer unique challenges based on their physical layouts and hermetic design. Cooling systems can be categorized by the type of detector with which they are associated, their primary mode of heat transfer, the choice of active cooling fluid, their heat removal capacity and the minimum temperature required. One of the more critical detector subsystems to require cooling is the silicon vertex detector, either pixel or strip sensors. A general design philosophy is presented along with a review of the important steps to include in the design process. Factors affecting the detector and cooling system design are categorized. A brief review of some existing and proposed cooling systems for silicon detectors is presented to help set the scale for the range of system designs. Fermilab operates two collider experiments, CDF& D0, both of which have silicon systems embedded in their detectors. A review of the existing silicon cooling system designs and operating experience is presented along with a list of lessons learned.

NTIS

Cooling Systems; Specific Heat; Systems Engineering

20040082411 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Regina Univ., Saskatchewan, Canada

Mesonic Form Factors

Bonnet, F. D. R.; Edwards, R. G.; Fleming, G. T.; Lewis, R.; Richards, D. G.; 2002; In English

Report No.(s): DE2004-819893; No Copyright; Avail: National Technical Information Service (NTIS)

We have started a program to compute the electromagnetic form factors of mesons. We discuss the techniques used to compute the pion form factor and present preliminary results computed with domain wall valence fermions on MILC asqtad lattices, as well as Wilson fermions on quenched lattices.

NTIS

Mesons; Form Factors

20040082413 Lockheed Martin Corp., Syracuse, NY, USA

Lattice-Matched GaInAsSb/A1GaAsSb/GaSb Materials for Thermophotovoltaic Devices

Wang, C. A.; Vineis, C. J.; Choi, H. K.; Connors, M. K.; Huang, R. H.; Sep. 2002; 18 pp.; In English

Report No.(s): DE2004-821862; LM-02K092; No Copyright; Avail: Department of Energy Information Bridge

High-performance GaInAsSb/AlGaAsSb/GaSb thermophotovoltaic (TPV) devices with quantum efficiency and fill factor near theoretical limits and open-circuit voltage within about 15% of the limit can be routinely fabricated. To achieve further improvements in TPV device performance, detailed materials studies of GaInAsSb epitaxial growth, the microstructure, and minority carrier lifetime, along with device structure considerations are reported. This paper discusses the materials and device issues, and their implications on TPV device performance. In addition, improvements in TPV performance with integrated distributed Bragg reflectors and back-surface reflectors are discussed.

NTIS

Carrier Lifetime; Gallium Antimonides; Bragg Reflectors

20040082414 Fermi National Accelerator Lab., Batavia, IL, USA
Applying Synchrotron Phase Measurement to the Estimation of Maximum Beam Intensity in the Fermilab Booster
Yang, X.; MacLachlan, J.; Mar. 2004; 12 pp.; In English
Report No.(s): DE2004-822053; FERMILAB-TM-2231; No Copyright; Avail: Department of Energy Information Bridge

It is important to have experimental methods to estimate the maximum beam intensity for the Fermilab Booster as objective input into long term program commitments. An important existing limit is set by the available rf power. This limit is difficult to set a priori, because the real longitudinal impedance is not well known. The synchrotron phase at transition crossing was measured using both the mountain range plot and the direct phase measurement of the RF accelerating voltage relative to the beam, and results were consistent. They were applied to predict 6 x 10(sup 12) maximum Booster beam intensity with present running conditions.
NTIS
Impedance; Synchrotrons

20040082612 California Univ., Santa Barbara, CA
Quantum Coherent Electron-Phonon Nanolaboratories
Cleland, A. N.; Aug. 30, 2003; 84 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0228
Report No.(s): AD-A422311; ARO-3998.1-PH; No Copyright; Avail: CASI; A05, Hardcopy

This project was aimed at creating mechanically suspended nanostructures that include active electronic devices, with the goal of achieving coherence between electrons and vibrational phonons. We pursued separately the use of metal tunnel junctions (515 tunnel junctions and single- electron transistors, SETs), and electrostatically defined double quantum dots, as the electronic system. We performed cryogenic measurements with varying degrees of success. Due to unanticipated difficulties, the focus shifted direction several times. Our most successful implementation was the use of an SET coupled to the vibrational motion of a doubly- clamped 100 MHz flexural resonator, with which we achieved a displacement sensitivity roughly 100 times the quantum limit of motion. A ten times higher frequency resonator, at I GHz, could be detected at 10 times the quantum limit. We believe further improvement in the sensitivity and noise of the displacement sensor is possible. Other areas of research, such as using double-quantum dots, did not prove as illuminating or useful; direct, resonant coupling as observed by dc current- voltage measurements did not reveal the hoped-for signatures of resonant coupling. There are a number of reasons as to why this may be, and further work might further elucidate the physics.
DTIC
Electric Current; Phonons; Quantum Electronics; Quantum Theory

20040082622 Naval Facilities Engineering Service Center, Port Hueneme, CA
Naval Total Asset Visibility (NTAV) Precision Asset Location (PAL) - System Tests on the SS Curtiss
Gunderson, Steven J.; Canfield, Mary F.; Dann, Geoffery; McCambridge, Daniel J.; Jan. 2004; 250 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423570; NFESC-TR-2201-AMP; No Copyright; Avail: CASI; A11, Hardcopy

Two precision asset location (PAL) systems were tested on the SS Curtiss in Port Hueneme, California. The two systems were a commercial-off-the-shelf direct sequence spread spectrum (DSSS) system from WhereNet, Inc., and a prototype ultra-wideband (UWB) system from Multi-Spectral Solutions, Inc. (MSSI). The objective was to evaluate the two technologies for operation in high multipath shipboard environments. Testing was performed in open cargo spaces (worst-case multipath) and partially loaded cargo spaces (blockage). A reference laser surveying system was installed for comparison and accuracy tests were conducted over a cargo space. Both systems operated in the open-space shipboard environment and to each vendor's specified accuracy. Each system's accuracy decreased during blockage experiments. The University of Southern California's UltRa Lab characterized the SS Curtiss shipboard environment and found it had delay spreads on the order of 3 microsec, far exceeding the 10 to 300 ns delay spreads of office and industrial environments. Multipath nulls were also measured, with some as deep as 30 to 40 dB.
DTIC
Position (Location); Spread Spectrum Transmission; Visibility

20040082697 Arctic and Antarctic Scientific Research Inst., Saint Petersburg
Numerical Simulation of Weak Turbulent Kolmogorov Spectrum in Water Surface Waves
Lavrenov, Igor; Resio, Don; Zakharov, Vladimir; Jan. 2001; 13 pp.; In English
Contract(s)/Grant(s): DACA-42-00-C0044; ONR-N00014-98-1-0070
Report No.(s): AD-A423736; No Copyright; Avail: CASI; A03, Hardcopy

Gravity waves in water surface are characterized by a small steepness value. It makes possible to apply the weak turbulence approach in order to find out the problem solution with the help of kinetic equation for energy spectrum. This equation was formulated by K.Hasselmann 1962,1963) and V Zakharov (1968).
DTIC
Gravity Waves; Kinetic Theory; Kolmogorov Theory; Spectra; Surface Waves; Turbulence; Water Waves

20040082760 Florida State Univ., Tallahassee, FL
Risk Mitigaion for HTS Motors: Intermediate Temperature (27 K) Strain Effects in Reinforced Bi-Sr-Ca-Cu-O Superconductors
Schwartz, Justin; Jun. 7, 2004; 13 pp.; In English
Report No.(s): AD-A423863; No Copyright; Avail: CASI; A03, Hardcopy

High temperature superconductors , known for their high critical temperatures, also have very high upper critical fields and thus have received significant attention for superconducting magnets (SCMs). To operate in a SCM, however, the superconductor must have high J(sub c) in the presence of high magnetic field and under the action of mechanical strain (Epsilon) that results from the manufacturing processes, differential thermal contraction, and Lorentz forces. For some FITS applications, the effects of mechanical strain on J(sub c) limit the system performance and lifetime, thus posing the most serious risk to successful lifetime operation. Past results at FSU indicated that the effects of longitudinal compression (in the current carrying ″ah?' direction) on J(sub c) are critical. These experiments, which studied the effects of longitudinal compression applied at room temperature and at 77 K, clearly showed that the effects of strain became more serious as the temperature decreased. Since many applications are expected to operate around 30 K, minimizing risk necessitates understanding the effects of abr compressive strains at lower temperature. The NHMFL has recently developed a large bore dewar specifically designed to house a neon liquifier that feeds liquid directly to a large bath-cooled sample space. The sample space is sufficient in size and flexibility to accommodate tensile and compressive experiments on short sample conductors and to perform Lorentz-force tests on coils. Here we report on the progress towards measuring the effects of stress and strain on the transport J(sub c) of BSCCO and YBCO. We report progress on measurements at room temperature and on the development of a fatigue-stress-strain- I(sub c) probe that will operate in conjunction with the liquid neon condenser to facilitate the 27 K measurements.
DTIC
Bscco Superconductors; High Temperature Superconductors; Magnetic Fields; Risk; Stress-Strain Relationships; Temperature Effects

20040082765 QinetiQ Ltd., Hants
A Critical Review of Fast Transient Breakdown in Solid Insulators
Wraight, A.; Hoad, Richard; Thomas, C.; Mar. 2003; 63 pp.; In English
Contract(s)/Grant(s): F61775-02-12055; F61775-02-WE055
Report No.(s): AD-A423868; No Copyright; Avail: CASI; A04, Hardcopy

This report critically reviews currently available information on the subject of fast transient breakdown in solid dielectric insulators. Information is readily available on breakdown in solids under DC or low frequency conditions, as research into these areas has been driven by the power generating industries over many years. However, pulsed systems are generally constructed using safety factors or DC breakdown values for incorporated insulators. More recently fast transient (sub-nanosecond) breakdown in gases has been researched due to the use of gases in spark gaps. The mechanisms involved in breakdown in solids under DC and low frequency AC conditions have been discussed and the relevance of these to breakdown under fast transient conditions has been explored. Also, theories that are pertinent to breakdown in solids under fast transient conditions have been reviewed. Measurement techniques for the collection of breakdown data have been examined and a test cell for the investigation of breakdown under fast transient conditions has been proposed. Statistical models that are used to describe breakdown in solids have also been discussed.
DTIC
Dielectric Properties; Electrical Faults; Insulators

20040082782 Academy of Sciences (Russia), Tomsk
On Sensitivity of Developing Organism of Drosophila to Repetitively Pulsed Microwave and X-Ray Radiation
Korovin, Sergei; Aug. 11, 2003; 15 pp.; In English
Contract(s)/Grant(s): ISTC-2356
Report No.(s): AD-A423913; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Institute of High Current Electronics, RAS, Siberian Division as follows: While there have been many studies on the biological effects of continuous-wave microwave energy, there is much less information on effects of pulsed energy, especially at high powers. Such information is needed, for example, to set appropriate safety standards for radar and communications systems. A key feature of pulses from such modern systems is their high electric-field strength, with the possibility of non-thermal mechanisms of biological interaction. Preliminary experiments in this lab with several simple organisms were suggestive of non-thermal mechanisms, but there were several methodological issues that could give other explanations. Current research will follow-up on these issues and separate possible non-thermal versus conventional mechanisms. Also regarding safety, there have been almost no related studies on the development of individual organisms. This project will study of the biological effects of gigawatt, periodically-pulsed, nanosecond microwave radiation on individual development in the fruit fly, Drosophila melanogaster. Researchers will conduct dose-response, controlled studies at different stages of development and will determine the regularity and possible mechanism of any observed effects. The results of studies can be used as a basis for estimating hygienic and ecological dangers when operating such radiation sources.
DTIC
Drosophila; Electric Fields; Microorganisms; Microwave Frequencies; Microwaves; Organisms; Pulsed Radiation; Radiation Effects; Sensitivity; X Rays

20040082795 Voss Scientific, Albuquerque, NM
Azimuthally Propagating Modes in an Axially- Truncated, Circular, Coaxial Waveguide
Courtney, Clifton C.; Sep. 2003; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-03-M-0101; Proj-3005
Report No.(s): AD-A423939; AFRL-DE-TR-2003-1135; No Copyright; Avail: CASI; A03, Hardcopy

In this note we derive and examine the modal properties of the Azimuthally Propagating, Truncated, Cylindrical, Coaxial Waveguide. This guide is defined by an inner and outer radii, and a width. We derive the governing equations for the electromagnetic fields of the TEz and TMz azimuthally propagating modes. First, the characteristic equations that define the propagation constants of each mode are derived; then, the electric and magnetic fields are explicitly expressed. With these results the mode impedances are formulated, and the impedance of the propagating mode in the transition section can be calculated. This value of the transition section s impedance can then be used to impedance match the transition section to the transmission line. Finally, as an example, a transmission line transition geometry is defined for which the electric and magnetic fields of the lowest order TE and TM modes are computed and graphed. An Appendix to this note briefly discusses the selection of the form of the vector potentials used to formulate the TE and TM modes.
DTIC
Electromagnetic Fields; Waveguides

20040082800 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Characterization of Ultra Wideband Multiple Access Performance Using Time Hopped-Biorthogonal Pulse Position Modulation
Clabaugh, Donald J.; Mar. 2004; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423944; AFIT/GE/ENG/04-03; No Copyright; Avail: CASI; A05, Hardcopy

The FCC's release of its UWB First Report and Order in April 2002 spawned renewed interest in impulse signaling research. This work combines Time Hopped (TH) multiple access coding with 4-ary UWB Biorthogonal Pulse Position Modulation (TH-BPPM). Multiple access performance is evaluated in a multipath environment for both synchronous and asynchronous networks. Fast time hopping is implemented by replicating and hopping each TH-BPPM symbol NH times. Bit error expressions are derived for biorthogonal TH-BPPM signaling and results compared with previous orthogonal TH-PPM work. Without fast time hopping (NH = 1), the biorthogonal TH- BPPM technique provided gains equivalent to Gray-coded QPSK; improved BER at a given Eb/No and an effective doubling of the data rate. A synchronized network containing up to NT = 15 transmitters yields an average BER improvement (relative to an asynchronous network) of approximately -6.30 dB with orthogonal TH-PPM and approximately 5.9 dB with biorthogonal TH-BPPM. Simulation results indicate that doubling the number of multipath replications (NMP) reduces BER by approximately 3. 6 dB. Network performance degrades as NT and NMP increase and synchronized network advantages apparent in the NMP = 0 case diminish with multipath interference present. With fast time hopping (NH \g 1) improves BER performance whenever NMP \h NH while reducing effective data rate by 1/NH. Compared to the NH = 1 synchronized network, TH-BPPM modulation using NH = 10 provides approximately 5.9 dB improvement at NMP = 0 and approximately 3.6 dB improvement at NMP = 5. At NMP = 10, the BER for the hopped and NH = 1 cases are not statistically different; with NH = 10 hops, BER improvement varies from approximately 0.57 to 0.14

dB (minimal variation between synchronous and asynchronous network performance).
DTIC
Bandwidth; Broadband; Multiple Access; Pulse Position Modulation

20040082982 Princeton Univ., NJ
Wave Driven Fast Ion Loss in the National Spherical Torus Experiment
Fredrickson, E. D.; Cheng, C. Z.; Darrow, D.; Fu, G.; Gorelenkov, N. N.; Aug. 2003; In English
Report No.(s): DE2003-814739; PPPL-3851; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Tokamak Devices; Toruses

20040082984 Princeton Univ., NJ
Edge Recycling and Heat Fluxes in L- and H-Mode NSTX Plasmas
Soukhanovskii, V. A.; Maingi, R.; Raman, R.; Kugel, H.; LeBlanc, B.; Aug. 2003; In English
Report No.(s): DE2003-814740; PPPL-3852; No Copyright; Avail: National Technical Information Service (NTIS)
Edge characterization experiments have been conducted in NSTX to provide an initial survey of the edge particle and heat uxes and their scaling with input power and electron density. The experiments also provided a database of conditions for the analyses of the NSTX global particle sources, core fueling, and divertor operating regimes.
NTIS
Heat Flux; Plasmas (Physics)

20040083021 Fermi National Accelerator Lab., Batavia, IL, USA
Future Experiments with Neutrino Superbeams, Beta-Beams, and Neutrino Factories
Harris, D. A.; Oct. 2003; In English
Report No.(s): DE2003-816523; FERMILAB-CONF-03/328-E; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes the goals of the next generations of accelerator-based neutrino experiments, and the various strategies that are being considered to achieve those goals. Because these next steps in the field are significantly different from the current or previous steps, novel techniques must be considered for both the detectors and the neutrino beams themselves. We consider not only conventional neutrino beams created by decays of pions, but also those which could be made by decays of beams of relativistic isotopes (so-called 'beta-beams') and also by decays of beams of muons (neutrino factories).
NTIS
Muons; Neutrino Beams

20040083025 Rutgers - The State Univ., Piscataway, NJ, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Deuteron Elastic Scattering, Photo- and Electro- Disintegration
Gilman, R.; 2003; In English
Report No.(s): DE2003-816494; No Copyright; Avail: National Technical Information Service (NTIS)
The author presents a very brief review of his understanding of the structure of the deuteron in three exclusive photo-reactions: elastic scattering and photo- and electro-disintegration. He points out several nice, recent results, along with outstanding issues.
NTIS
Deuterons; Disintegration

20040083074 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Fabrication of Large Diameter Alumino-Silicate K+ Sources
Baca, D.; Chacon-Golcher, E.; Kwan, J. W.; Wu, J. K.; 2003; In English
Report No.(s): DE2003-816775; LBNL-51801; No Copyright; Avail: National Technical Information Service (NTIS)
Alumino-silicate K(sup+) sources have been used in HIF experiments for many years. For example the Neutralized Transport Expt. (NTX) and the High Current Transport Expt. (HCX) are now using this type of ion source with diameters of 2.54 cm and 10 cm respectively. These sources have demonstrated ion currents of 80 mA and 700 mA, for typical HIF pulse lengths of 5-10(micro)s. The corresponding current density is(approx) 10-15 mA/cm(sup 2), but much higher current density

has been observed using smaller size sources. Recently we have improved our fabrication techniques and, therefore, are able to reliably produce large diameter ion sources with high quality emitter surface without defects. This note provides a detailed description of the procedures employed in the fabrication process. The variables in the processing steps affecting surface quality, such as substrate porosity, powder size distribution, coating technique on large area concave surfaces, drying, and heat firing temperature have been investigated.
NTIS
Aluminum Silicates; Ion Sources; Accelerators

20040083077 Fermi National Accelerator Lab., Batavia, IL, USA
Hard QCD at the Tevatron
Mestropian, C.; 2003; In English
Report No.(s): DE2003-816702; FERMILAB-CONF-03/345-E; No Copyright; Avail: National Technical Information Service (NTIS)

Results from QCD studies at the Tevatron from new Run 2 data are presented. The inclusive jet cross section and dijet mass spectrum are measured at(radical)s = 1960 GeV by the CDF and D0 collaborations. CDF also reports results of searches for new particles decaying into dijets, and a study of jet shapes.
NTIS
Quantum Chromodynamics; Particle Accelerators

20040084083 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Feasibility Modelling EM-Fields
Dill, R. B.; Evenblij, B. H.; October 2003; 35 pp.; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A02/KM/499; TNO Proj. 014.13701
Report No.(s): PML-2003-A59; TD-2002-0233; Copyright; Avail: Other Sources

In order to roughly predict the magnetic signature around a ship in an early design phase a simple modelling method is proposed. It is shown that there is a relation between the undisturbed magnetic field from the currents flowing in the ship and the magnetic field that is disturbed by ships iron. This is done on the basis of a simple geometry. It is commonly known that the undisturbed magnetic field can be calculated if all currents in the ship are known (Law of Biot-Savart). If the disturbance of the field can be defined as a linear attenuation (depending on direction and place) it can be used to calculate the magnetic field outside the ship. In practice not every current in the ship will significantly contribute to the magnetic field outside the ship. It depends on: amount of current, the way the current flows and the attenuation factor of the spot in the ship. From this it can easily be understood that only small amount of the currents in the ship are responsible for 90% of the magnetic signature outside the ship. After the study we feel confident that it possible to develop a method that enables us to calculate a rough estimation of the signature outside the ship.
Author
Feasibility Analysis; Models; Magnetic Signatures

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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*.

20040082013 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Comparison of Model Prediction with Measurements of Galactic Background Noise at L-Band
LeVine, David M.; Abraham, Saji; Kerr, Yann H.; Wilson, Willam J.; Skou, Niels; Sobjaerg, S.; 2004; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The spectral window at L-band (1.413 GHz) is important for passive remote sensing of surface parameters such as soil moisture and sea surface salinity that are needed to understand the hydrological cycle and ocean circulation. Radiation from celestial (mostly galactic) sources is strong in this window and an accurate accounting for this background radiation is often needed for calibration. Modem radio astronomy measurements in this spectral window have been converted into a brightness temperature map of the celestial sky at L-band suitable for use in correcting passive measurements. This paper presents a comparison of the background radiation predicted by this map with measurements made with several modem L-band remote

sensing radiometers. The agreement validates the map and the procedure for locating the source of down-welling radiation. Author

Galaxies; Background Noise; Bands; Energy Bands; Spectra

20040082732 Army Engineer Research and Development Center, Vicksburg, MS

Using Diquat in Combination with Endothall Under Turbid Water Conditions to Control Hydrilla

Poovey, Angela G.; Skogerboe, John G.; May 2004; 8 pp.; In English

Report No.(s): AD-A423811; ERDC/TN APCRP-CC-02; No Copyright; Avail: CASI; A02, Hardcopy

This small-scale study examined three turbidity levels in the water column to investi- gate the efficacy of diquat (6,7-dihydrodipyridoL,2-ALPHA:2',1'-cpyrazinediium ion) in combination with the dipotassium salt of endothall (7-oxabicyclo2.2.L heptane-2,3- dicarboxylic acid) to control hydrilla (Hydrilla verticillata (L.f.) Royle).

DTIC

Absorbers (Materials); Aquatic Plants; Biochemistry; Carboxylic Acids; Herbicides; Plants (Botany); Water

20040082742 North Carolina State Univ., Raleigh, NC

Buried Target Detection Using Time-Reversed Acoustics

Pierson, David; Clark, T. F.; Feb. 6, 2004; 3 pp.; In English

Contract(s)/Grant(s): N00014-00-1-0459

Report No.(s): AD-A423832; No Copyright; Avail: CASI; A01, Hardcopy

In the spring of 2000, a proposal was submitted to Mr. Ken Dial at the Office of Naval Research (ONR) to study a novel approach of time-reversed acoustics to detect targets buried in a littoral environment. The proposal was written by Dr. Thomas Drake, currently at ONR, and David Pierson, currently at John Hopkins University Applied Physics Laboratory (APL), under the advice of Dr. Tony Clark, currently at North Carolina State University (NCSU), and completed under the guidance of Dr. David Aspnes, also currently at NCSU. The research demonstrated through theoretical calculations and computer simulations that time- reversed acoustics can be used to detect and classify a target buried in a inhomogeneous environment using an acoustic transceiver of simple geometry.

DTIC

Acoustics; Detection; Regions; Sound Detecting and Ranging; Target Acquisition; Underwater Acoustics

20040082757 Defence Science and Technology Organisation, Salisbury

Setup and Troubleshooting Procedures for the Klein 5500 Sidescan Sonar

Andrew, Colin; Young, Amy; Nov. 2003; 164 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423856; DSTO-GD-0372; DODA-AR-012-851; No Copyright; Avail: CASI; A08, Hardcopy

This document outlines in detail all facets associated with the set up and usage of the Klein 5500 sidescan sonar. In particular this document outlines: (1) the different types of hardware that are required, how they need to be set up and networked, (2) how to set up and use the acquisition software packages Isis and SonarPro, and (3) how to detect, analyse and troubleshoot incorrect set up and malfunctions in the hardware and software.

DTIC

Maintenance; Sonar; Underwater Acoustics

20040082770 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Geolocation of an Audio Source in a Multipath Environment Using Time-of-Arrival

Boggs, Jeffrey A.; Mar. 2004; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423878; AFIT/GCS/ENG/04-03; No Copyright; Avail: CASI; A06, Hardcopy

The Air Force and the Department of Defense (DoD) are continually searching for ways to protect U.S. forces, both stateside and abroad. One continuing threat, especially in the current world environment, is gunfire from an unseen sniper. Designated areas, such as a forward deployed base or motorcade route, need to be continuously monitored for sniper fire. Once detected, these gunmen need to be located in real time. One possible method for accomplishing this task is to geolocate the audio signals generated using time-of-arrival (TOA) algorithms. These algorithms rely on direct-path measurements for accuracy. Multipath environments therefore pose a problem when measuring signals from the audio spectrum. The errors induced by a multipath environment can be reduced by introducing additional audio receivers to the detection system. By sampling all possible combinations of a minimum set of receivers (four), a more accurate location can be calculated. An accuracy of six meters can be achieved roughly 69 percent of the time, though most of the error occurs in the vertical

component. An accuracy of six meters in the X/Y plane can be achieved approximately 97 percent of the time.
DTIC
Algorithms; Gunfire; Multipath Transmission; Position (Location); Signal Transmission; Sound Detecting and Ranging; Sound Waves

20040082806 State Research Center of Russia, Moscow
Biological Effects of Low Frequency Acoustic Oscillations and Their Hygienic Regulation
Stepanov, Vladimir; Jan. 2001; 374 pp.; In English
Report No.(s): AD-A423963; ISTC-01-7004; No Copyright; Avail: CASI; A16, Hardcopy

This report results from a contract tasking State Research Center of Russia as follows: A monograph entitled Technological Environmental Oscillations of Low Frequency (below 20 Hz) as a Risk Factor for Human Health: Hygienic. Medical, Biological, and Pathogenic Mechanisms)' will be prepared. This monograph will summarize and review in English the extensive research on this topic from the period of the Former Soviet Union to the present. The detailed monograph will be in a format suitable for publication as an Air Force Research Laboratory Technical Report. Also, a summary of the monograph will be prepared in a format suitable for publication in an English language Western scientific journal.
DTIC
Acoustics; Biological Effects; Hygiene; Low Frequencies; Oscillations; Sound Waves

20040084082 Physics and Electronics Lab. TNO, The Hague, Netherlands
Technical Report on Inversion of the Second RUMBLE Sea Trial Data
Ainslie, M. A.; Boek, W.; vanWalree, P.; January 2004; 149 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 015.30553
Report No.(s): FEL-03-A269; TD-2003-0220; Copyright; Avail: Other Sources

Geo-acoustic inversion is applied to CW reverberation measurements from an LFAS sea trial carried out in September-October 2002. The measurements were made in the Norwegian Trench, close to Stavanger (Norway) with an average water depth of approximately 250 m using CW pulses of duration 100 ms and centre frequency 1500 Hz. Inversions are carried out on both synthetic and measured reverberation data. The inversion method involves a search for combinations of sea bed parameters (such as sound speed and scattering strength) that result in a good match to the measured reverberation. The search is made by means of a genetic algorithm using the TAMAR reverberation model for forward predictions. It is found that reliable measurements can be made of the changes in scattering strength in the trial area, but not of sound speed or reflection loss. Also collected during the trial were echo-sounder data at 38 kHz. These are found to be consistent with analysis of physical grab samples of the top few cm of sediment, but are only weakly correlated with the measurements of LFAS scattering strength. We conclude that near surface properties are of little use as an indicator of the effect of the seabed on LFAS.
Author
Acoustic Velocity; Frequencies; Inversions; Reverberation

20040084223 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Progress on Acoustic Measurements of the Bulk Viscosity of Near-critical Xenon (BVX)
Gillis, Keith A.; Shinder, Iosif I.; Moldover, Michael R.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 77-78; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

We plan to determine the bulk viscosity of xenon 10 times closer to its liquid-vapor critical point than ever before. To do so, we must measure the dispersion and attenuation of sound at frequencies 1/100 of those used previously. In general, sound attenuation has contributions from the bulk viscosity acting throughout the volume of the xenon as well as contributions from the thermal conductivity and the shear viscosity acting within thin thermoacoustic boundary layers at the interface between the xenon and the solid walls of the resonator. Thus, we can determine the bulk viscosity only when the boundary layer attenuation is small and well understood. We present a comparison of calculations and measurements of sound attenuation in the acoustic boundary layer of xenon near its liquid-vapor critical point. We used a novel, compact, acoustic resonator designed specifically for these measurements. We measured the frequency response of this resonator filled with xenon at its critical density rho(sub c) in the reduced temperature range 10(exp -3) \h tau \h 10(exp -1). From the frequency response data, we obtained the resonance frequency and the attenuation for six resonant modes in the range 0.10 kHz \h f \h 7.5 kHz. Using the known thermophysical properties of xenon, we predict that the attenuation at the boundary first increases and then saturates when the effusivity of the xenon exceeds that of the solid. The model correctly predicts (+/- 1.0 %) the

quality factors Q of resonances measured in a steel resonator (epsilon(sub ss) = 6400 kg x K(exp -1) x s(exp -5/2)); it also predicts the observed increase of the Q, by up to a factor of 8, when the resonator is coated with a polymer (epsilon(sub pr) = 370 kg x K(exp -1) x s(exp -5/2)). The measured acoustic dissipation in near-critical xenon shows a prominent plateau for the Helmholtz mode and, to a lesser extent, for the longitudinal modes. These results are the first direct evidence of thermal boundary dissipation being limited by the thermophysical properties of the solid wall.
Author (revised)
Acoustic Measurement; Viscosity; Xenon; Acoustic Resonance; Sound Generators

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20040082626 Naval Research Lab., Bay Saint Louis, MS
Illumination and Turbidity Effects on Observing Faceted Bottom Elements With Uniform Lambertian Albedos
Carder, Kendall L.; Liu, Cheng-Chein; Lee, Zhongping; English, David C.; Patten, James; Jan. 2003; 10 pp.; In English
Report No.(s): AD-A423576; NRL/JA/7330/03/0021; No Copyright; Avail: CASI; A02, Hardcopy

Aircraft images were collected near Lee Stocking Island (LSI), Bahamas, with wavelike features for bright sand bottoms during times when solar zenith angles were large. The image contrast between leading and trailing wave facets approached a 10-15% difference because of algae accumulations in wave troughs or topographic variations of the bottom. Reflectance contrast for blue light was greater than for red and green wavelengths when algae or detritus was present in the troughs. However; the contrast at green and red wavelengths was greater than at blue wavelengths when caused by the interplay between bottom topography and oblique illumination. A three-dimensional backwards Monte Carlo (BMC) model was developed to evaluate the effect of oblique illumination on wavelike topographic features for various values of water clarity and bottom albedo. An inverse optical modeling approach, previously developed for flat, horizontally homogeneous bottoms, was applied to the BMC results. Bathymetric estimates for bright facets tilted 100 toward the sun were slightly smaller than actual depths, whereas shaded facet depth estimates were too high by about 5%. Larger errors were associated with albedo retrievals, where shaded facets produced albedo estimates up to 15% lower than actual values. Errors increased with tilt angles up to 200 but decreased with sea and sky turbidity. Averaging sunlit and shaded pixels before running the inverse model reduced the uncertainty of bathymetric and albedo estimates to about 2 and 5%, respectively, comparable to previous field evaluations of the inversion model.
DTIC
Albedo; Imagery; Ocean Bottom; Turbidity

20040082804
Report on the Workshop on Atomistic to Continuum Models for Long Molecules and Thin Films
Jul. 24, 2002; 6 pp.; In English
Contract(s)/Grant(s): F61775-01-WF071
Report No.(s): AD-A423961; CSP-01-5071; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this one-week long workshop was to bring experts from around the world together for intensive discussions addressing mathematical and computational issues arising in bridging the gaps in length and time scales between atomistic descriptions and reduced-order continuum mechanics models of scientifically and technologically important molecular systems. The conference focused on systems that have both a small and a long length scale. Examples are long stiff polymers such as DNA, and thin films of only a few atoms thickness, but with a large extent.
DTIC
Continuum Mechanics; Continuum Modeling; Molecules; Thin Films

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*.

20040081347 Technical Research Centre of Finland, Espoo, Finland
GENFLO-A General Thermal Hydraulic Solution for Accident Simulation
Miettinen, J.; Hamalainen, A.; 2002; 86 pp.; In English
Report No.(s): PB2004-106091; VTT/RN-2163; No Copyright; Avail: CASI; A05, Hardcopy

Thermal hydraulic simulation capability for accident conditions is needed as a part of several programs. Specific thermal hydraulic models are too heavy for simulation, because also the simulation of the rest of the system requires computer resources. The coupling between different physical models may be so complex that the fixed scope system codes are impossible to install for serving the special physical applications. Hence, the GENFLO (=GENeral FLOw) thermal hydraulic model has been developed at VTT for special applications. This report describes the generalised thermal hydraulic model, GENFLO, which at present has been used in three different applications. In RECRIT, the model is coupled the 2-D transient neutronics model TWODIN for calculating the recriticality accidents in the BWR plant. In FRAPTRAN application the model has been coupled with the transient fuel behavior code FRAPTRAN for making the study of complex fuel transient possible by simulating the sub-channel thermal hydraulics as realistic as possible. In APROS-SA application the model calculates the core thermal hydraulics during the severe accident until the fuel material relocation and pool generation to the bottom of the reactor vessel is simulated.
NTIS
Thermal Analysis; Hydraulics

20040081359 New Mexico Univ., Albuquerque, NM, USA, Oak Ridge National Lab., TN
KENO V.a Primer: A Primer for Criticality Calculations with SCALE/KENO V.a Using CSPAN for Input
Busch, R. D.; Bowman, S. M.; Jan. 2003; In English
Report No.(s): DE2003-814140; ORNL/TM-2002/155; No Copyright; Avail: National Technical Information Service (NTIS)

The SCALE (Standardized Computer Analyses for Licensing Evaluation) computer software system developed at Oak Ridge National Laboratory (ORNL) is widely used and accepted around the world for criticality safety analyses. The well-known KENO V.a three-dimensional Monte Carlo criticality computer code is the primary criticality safety analysis tool in SCALE. The KENO V.a primer is designed to help a new user understand and use the SCALE/KENO V.a Monte Carlo code for nuclear criticality safety analyses.
NTIS
Computer Programs; Standardization; Safety

20040082287 NASA Marshall Space Flight Center, Huntsville, AL, USA
Application of a Virtual Reactivity Feedback Control Loop in Non-Nuclear Testing of a Fast Spectrum Reactor
Bragg-Sitton, Shannon M.; Forsbacka, Matthew; [2004]; 10 pp.; In English; 2004 International Congress on Advances in Nuclear Power Plants (ICAPP 2004), 13-17 Jun. 2004, Pittsburgh, PA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

For a compact, fast-spectrum reactor, reactivity feedback is dominated by core deformation at elevated temperature. Given the use of accurate deformation measurement techniques, it is possible to simulate nuclear feedback in non-nuclear electrically heated reactor tests. Implementation of simulated reactivity feedback in response to measured deflection is being tested at the NASA Marshall Space Flight Center Early Flight Fission Test Facility (EFF-TF). During tests of the SAFE-100 reactor prototype, core deflection was monitored using a high resolution camera. ″virtual″ reactivity feedback was accomplished by applying the results of Monte Carlo calculations (MCNPX) to core deflection measurements; the computational analysis was used to establish the reactivity worth of van'ous core deformations. The power delivered to the SAFE-100 prototype was then dusted accordingly via kinetics calculations, The work presented in this paper will demonstrate virtual reactivity feedback as core power was increased from 1 kilowatt(sub t), to 10 kilowatts(sub t), held approximately constant at 10 kilowatts (sub t), and then allowed to decrease based on the negative thermal reactivity coefficient.
Author
Fast Nuclear Reactors; Feedback Control; Reactivity; Test Facilities

20040082784 Rome Univ., Rome

Chemical MicroRocket: Scaling and Performance Enhancement

Bruno, Claudio; Giacomazzi, Eugenio; Ingenito, Antonella; Jul. 25, 2003; 60 pp.; In English

Contract(s)/Grant(s): FA8655-02-M4034

Report No.(s): AD-A423916; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking University of Rome as follows: The ultimate objective of this work is to find criteria for designing high thrust (chemical) microrocket for mini- and microsatellites.

DTIC

Augmentation; Propulsion System Configurations; Propulsion System Performance

20040082840 Academy of Sciences of the Ukraine, Kiev

Optimization of 178m2Hf Isomer Production in Spallation Reactions

Kyryschchuk, Volodymyr I.; May 15, 2003; 23 pp.; In English

Contract(s)/Grant(s): STCU RN P-071

Report No.(s): AD-A424004; STCU 00-8004; No Copyright; Avail: CASI; A03, Hardcopy

After successful observation of gamma-emission from the 31-yr isomer of 176Hf induced by x-ray irradiation. the scientific interest for the triggering of long-lived nuclear spin isomers has greatly increased. We observed great efficiency of the triggering with low-energy (\h20 keV) x-rays inducing the decay of 178m2Hf isomers that stresses all models. which might have been able to predict such an effect. Thus, there is a necessity to produce research lab-sized quantities of 178m2Hf isomers and in such a manner that the isomer samples could be used in research experiment as soon as possible. Since the production of 176m2Hf isomers will obviously be very expensive, careful and detailed analysis for the optimization of such production must be performed. The objective of this proposal is to find the most effective way of 178m2Hf isomer production for research uses and define the main parameters of nuclear facilities needed for that. Such research must minimize the risk of non-optimal production of 178m2Hf and can lead to significant cost savings. As a result of such research, two or three spallation reactions, which would happen to be the most promising for effective production of small quantities of the 178m2Hf isomers, shall be chosen. For each of them all advantages and disadvantages will be listed. So one would be able to select, taking into account the available nuclear facilities and the accepted costs, the most suitable nuclear reaction needed to produce these small quantities of the 178m2Hf isomer. All the results of our research will be presented and discussed at scientific conferences and workshops and published in 0pen scientific periodicals.

DTIC

Isomers; Nuclear Reactions; Spallation

20040084017 Louisiana Univ., Lafayette, LA, USA

Introduction to Proton Microscopy

Hollerman, William A.; Stanaland, T. L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973

Contract(s)/Grant(s): DE-FC02-91ER-75669; DOE/LEQSF(1993-95)-03; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Department of Physics at the University of Louisiana at Lafayette brings unique materials modification and analysis capabilities to Louisiana. The heart of this capability is the Louisiana Accelerator Center (LAC), which houses a 1.7-MV, model 5SDH-2 tandem Pelletron accelerator from National Electrostatics Corporation. With dual plasma and sputter sources, this accelerator is capable of providing beams for ion beam analysis, ion implantation, and nuclear microprobe analysis and imaging. The high-energy scanning nuclear microprobe system became operational in June 2000 and is the only one of its kind in Louisiana. This instrument delivers ion beams as small as 1 x 1 m (horizontal x vertical) to a stationary target with sufficient current to provide two-dimensional elemental maps and depth profiles in microscale areas. Three-dimensional microscale etching using maskless MeV ion beam irradiation has also been demonstrated. The U.S. Department of Energy (DOE) and the Louisiana Education Quality Support Fund (LEQSF) under contract numbers DOE/LEQSF (1993-95)-03 and DE-FC02-91ER75669 supported this research.

Author

Proton Beams; Microscopy

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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*.

20040079787 Brookhaven National Lab., Upton, NY
Equal Optical Path Beam Splitters by Use of Amplitude-Splitting and Wavefront-Splitting Methods for Pencil Beam Interferometer
Qian, S.; Takacs, P.; 2003; 16 pp.; In English
Report No.(s): DE2004-15006605; BNL-71599-2003-CP; No Copyright; Avail: Department of Energy Information Bridge

A beam splitter to create two separated parallel beams is a critical unit of a pencil beam interferometer, for example the long trace profiler (LTP). The operating principle of the beam splitter can be based upon either amplitude-splitting (AS) or wavefront-splitting (WS). For precision measurements with the LTP, an equal optical path system with two parallel beams is desired. Frequency drift of the light source in a non-equal optical path system will cause the interferenceliinges to drift. An equal optical path prism beam splitter with an amplitude-splitting (AS-EBS) beam splitter and a phase shift beam splitter with a wavefiont-splitting (WS-PSBS) are introduced. These beam splitters are well suited to the stability requirement for a pencil beam interferometer due to the characteristics of monolithic structure and equal optical path. Several techniques to produce WS-PSBS by hand are presented. In addition, the WS-PSBS using double thin plates, made from microscope cover plates, has great advantages of economy, convenience, availabilityy and ease of adjustment over other beam splitting methods. Comparison of stability measurements made with the AS-EBS, WS-PSBS, and other beam splitters is presented.
NTIS
Pencil Beams; Interferometry; Beam Splitters; Amplitudes

20040081334 Westinghouse Savannah River Co., Aiken, SC, USA
Surface Plasmon Resonance Spectroscopy-Based Process Sensors
McWhorter, S.; Anderson, B. B.; Zeigler, K.; Jul. 30, 2003; In English
Report No.(s): DE2003-815565; WSRC-TR-2003-00290; No Copyright; Avail: National Technical Information Service (NTIS)

The Analytical Development Section (ADS) of the Savannah River Technology Center (SRTC) developed a novel, monolithic surface plasmon resonance (SPR) probe for process monitoring as part of the Defense Programs Plant Directed Research and Development Program. The sensor incorporates multi-layer thin films on a fused-silica hemispherical lens. The simple optical design of the device increases robustness and fabrication precision and allows for sensitive SPR measurements to be made without complex polarizing and collimating optics. The utility of the probe is demonstrated for sensing moisture and hydrogen in process environments. Theoretical optical modeling of the SPR system and room temperature performance characteristics of the sensor are reported.
NTIS
Mathematical Models; Spectroscopy; Resonance Probes; Sensors; Surface Plasmon Resonance

20040082113 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Navigation Concepts for the James Webb Space Telescope
Long, Anne; Leung, Dominic; Kelbel, David; Beckman, Mark; Grambling, Cheryl; [2003]; 14 pp.; In English; Flight Mechanics Symposium, 29-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper evaluates the performance that can be achieved using candidate ground and onboard navigation approaches for operation of the James Webb Space Telescope, which will be in an orbit about the Sun-Earth L2 libration point. The ground navigation approach processes standard range and Doppler measurements from the Deep Space Network The onboard navigation approach processes celestial object measurements and/or ground-to- spacecraft Doppler measurements to autonomously estimate the spacecraft s position and velocity and Doppler reference frequency. Particular attention is given to assessing the absolute position and velocity accuracy that can be achieved in the presence of the frequent spacecraft reorientations and momentum unloads planned for this mission. The ground navigation approach provides stable navigation solutions using a tracking schedule of one 30-minute contact per day. The onboard navigation approach that uses only optical quality celestial object measurements provides stable autonomous navigation solutions. This study indicates that unmodeled changes in the solar radiation pressure cross-sectional area and modeled momentum unload velocity changes are the major

error sources. These errors can be mitigated by modeling these changes, by estimating corrections to compensate for the changes, or by including acceleration measurements.
Author
James Webb Space Telescope; Autonomous Navigation; Onboard Equipment; Optical Measurement; Space Navigation; Solar Radiation

20040082145 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fabrication of MEMS-Based Microshutter Arrays for Optical Transmission Selection
Lynch, Bernard A.; Franz, David E.; Hu, R. G.; Jhabvala, M. D.; Kotecki, C. A.; Li, M. J.; Oh, H.; Zheng, Y.; [2004]; 2 pp.; In English; 2004 MEMS Alliance Symposium on MEMS in Homeland Security Defense and Aerospace Applications, 29-30 Mar. 2004; No Copyright; Avail: CASI; A01, Hardcopy

A MEMS-based programmable aperture mask is under development at the NASA Goddard Space Flight Center. Termed the Microshutter (u-shutter) Array, the device will be used to control the transmission of light, with both high efficiency and contrast, to a multi-object spectrometer on the James Webb Space Telescope. Fabrication of the p-shutter array employs several novel designs and processing techniques. The current generation of micro-shutters consists of 128x64 pixel arrays with unit cell dimensions of 100x200 microns. Shutters are patterned in silicon nitride and sit on a 100 micron silicon frame that is DRIE etched below each shutter. The front and back sides of the device are shown. A magnetic cobalt-iron alloy patterned on top of the shutter allows it to be actuated 90 degrees out-of-plane, into the frame, by an external magnetic field. An electrode on the shutter and a vertical electrode on the sidewall of the frame, approximately 90pm deep, allow them to be electrostatically latched in their rotated position. The vertical electrode is deposited and patterned on the backside of the frame in a single step using a directionally controlled evaporation. Individual addressing of shutters for electrostatic latching is accomplished via a crosspoint addressing scheme, with no on-chip active components. A portion of an array with shutters in the open, latched, and closed positions is shown. Light loss at shutter edges is minimized by an overhanging aluminum light-shield that is anchored to the frame. A photoresist sacrificial layer is used to raise the light-shield up and over the 2 micron gap that surrounds each pixel. After completion, arrays are subjected to life cycle, environmental and optical testing. Fabricated devices have survived 10(exp 6) actuation cycles at both room and cryogenic temperatures and a 14g rms launch-simulation test. Optical testing has shown contrast measurements between open and closed shutters up to 10000:1.
Author
Fabrication; Light Transmission; Microelectromechanical Systems; Arrays

20040082155 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA Micro-Pulse Lidar Network (MPLNET): Co-location of Lidars with AERONET
Welton, Ellsworth J.; Campbell, James R.; Berkoff, Timothy A.; Spinhirne, James D.; Holben, Brent; Tsay, Si-Chee; 2004; 1 pp.; In English; Aeronet/Photon Workshop, 10-14 May 2004, Huelva, Spain; No Copyright; Avail: Other Sources; Abstract Only

We present the formation of a global-ground based eye-safe lidar network, the NASA Micro-Pulse Lidar Network (MPLNET). The aim of MPLNET is to acquire long-term observations of aerosol and cloud vertical profiles at unique geographic sites within the NASA Aerosol Robotic Network (AERONET). Network growth follows a federated approach, pioneered by AERONET, wherein independent research groups may join MPLNET with their own instrument and site. MPLNET utilizes standard instrumentation and data processing algorithms for efficient network operations and direct comparison of data between each site. The micro-pulse lidar is eye-safe, compact, and commercially available, and most easily allows growth of the network without sacrificing standardized instrumentation gods. Red-time data products (next-day) are available, and include Level 1 daily lidar signal images from the surface to -2Okm, and Level 1.5 aerosol extinction provides at times co-incident with AERONET observations. Testing of our quality assured aerosol extinction products, Level 2, is near completion and data will soon be available. Level 3 products, continuous daylight aerosol extinction profiles, are under development and testing has begun. An overview of h4PL″ will be presented. Successful methods of merging standardized lidar operations with AERONET will also be discussed, with the first 4 years of MPLNET results serving as an example.
Derived from text
Optical Radar; Aerosols; Data Processing; Robotics

20040082182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Potential Predictability of U.S. Summer Climate with ″Perfect″ Soil Moisture
Yang, Fanglin; Kumar, Arun; Lau, K.-M.; 2004; 31 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The potential predictability of surface-air temperature and precipitation over the USA continent was assessed for a GCM forced by observed sea surface temperatures and an estimate of observed ground soil moisture contents. The latter was obtained by substituting the GCM simulated precipitation, which is used to drive the GCM's land-surface component, with observed pentad-mean precipitation at each time step of the model's integration. With this substitution, the simulated soil moisture correlates well with an independent estimate of observed soil moisture in all seasons over the entire US continent. Significant enhancements on the predictability of surface-air temperature and precipitation were found in boreal late spring and summer over the US continent. Anomalous pattern correlations of precipitation and surface-air temperature over the US continent in the June-July-August season averaged for the 1979-2000 period increased from 0.01 and 0.06 for the GCM simulations without precipitation substitution to 0.23 and 0.3 1, respectively, for the simulations with precipitation substitution. Results provide an estimate for the limits of potential predictability if soil moisture variability is to be perfectly predicted. However, this estimate may be model dependent, and needs to be substantiated by other modeling groups.
Author
Atmospheric Temperature; Precipitation (Meteorology); Surface Temperature

20040082304 NASA Marshall Space Flight Center, Huntsville, AL, USA
James Webb Space Telescope (JWST) Primary Mirror Material Selection
Stahl, H. Philip; Feinberg, Lee D.; Russell, Kevin; Texter, Scott; [2004]; 1 pp.; In English; Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

The James Webb Space Telescope (JWST) conducted a phase down select process via the Advanced Mirror System Demonstrator (AMSD) project to assess the Technology Readiness Level of various candidate mirror materials. This process culminated in the selection of Beryllium as the JWST primary mirror material. This paper outlines the mirror evaluation process, defines the selection criteria and summarizes the candidate mirror's performances.
Derived from text
Mirrors; Optical Materials; James Webb Space Telescope; Evaluation; Optical Data Storage Materials

20040082314 NASA Marshall Space Flight Center, Huntsville, AL, USA
Mirror Requirements for SAFIR
Stahl, H. Philip; Leisawitz, David T.; Benford, Dominic J.; [2004]; 1 pp.; In English; Astronomical Telescopes and Instrumentation 2004 Scottish Exhibition and Convention Center, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

Large-aperture lightweight low-cost cryogenic mirrors are an enabling technology for planned NASA far-infrared and sub-millimeter missions such as CMB-Pol, SAFIR and SPECS. This paper examines d e mirror requirements necessary to design, build and characterize mirror segments for large space telescopes operating at temperatures of less than 1OK. Such mirrors should be diffraction limited in the far-IR with an areal density of less than 10 kg/sq m, aperture of 1 to 2 meters and cost of less than $500,000 per square meter.
Author
Cryogenics; Mirrors; Far Infrared Radiation; Diffraction; Low Cost

20040082331 NASA Marshall Space Flight Center, Huntsville, AL, USA
AS04-AS02-133 Electroformed-Nickel Hard-X-Ray Optic Development at NASA/MSFC
Ramsey, Brian; Eisner, Ron; Engelhaupt, Darell; Gubarev, Mikhail; Kolodziejczak, Jeffrey; ODell, Stephen; Speegle, Chet; Weisskopf, Martin; [2004]; 1 pp.; In English; Space Telescope Systems (UV-Gamma) Symposium: AS04 Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; Copyright; Avail: Other Sources; Abstract Only

We are developing the nickel electroforming process to fabricate high-quality mirrors for the region. Two applications for these optics are a balloon-borne payload, termed HERO, and a hard-X-ray telescope module for consideration for the Constellation-X mission. In the formation on shells, of 15 arcsec angular resolution, will provide over 200 sq cm of effective collecting area unprecedented sensitivity in the 20-75 keV region. A first flight of a partial payload, feature approximately 1/4 of the total collecting area, is scheduled for the Spring of 2004. In the Co-application, two mirror shells, of diameters 150 and 230 mm, are being fabricated. This is particularly challenging as high angular resolution must be maintained with shells of only 1 mm thickness (driven by the tight weight budget for the mission). Further, the shells must be low (less than 5 A on sub-micron spatial scales) to permit efficient use of planned multilayer coatings which must release cleanly from their forming mandrels without any surface degradation.
Author
X Ray Optics; Nickel; Electroforming; Fabrication

20040082340 NASA Glenn Research Center, Cleveland, OH, USA

Quantitative Rainbow Schlieren Deflectometry as a Temperature Diagnostic for Spherical Flames

Feikema, Douglas A.; June 2004; 17 pp.; In English; 42nd Aerodpace Sciences Meeting and Exchbit, 5-8 Jan. 2004, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-101-42-02

Report No.(s): NASA/TM-2004-212955; AIAA Paper 2004-0958; E-14351-1; No Copyright; Avail: CASI; A03, Hardcopy

Numerical analysis and experimental results are presented to define a method for quantitatively measuring the temperature distribution of a spherical diffusion flame using Rainbow Schlieren Deflectometry in microgravity. First, a numerical analysis is completed to show the method can suitably determine temperature in the presence of spatially varying species composition. Also, a numerical forward-backward inversion calculation is presented to illustrate the types of calculations and deflections to be encountered. Lastly, a normal gravity demonstration of temperature measurement in an axisymmetric laminar, diffusion flame using Rainbow Schlieren deflectometry is presented. The method employed in this paper illustrates the necessary steps for the preliminary design of a Schlieren system. The largest deflections for the normal gravity flame considered in this paper are 7.4 x 10(-4) radians which can be accurately measured with 2 meter focal length collimating and decollimating optics. The experimental uncertainty of deflection is less than 5 x 10(-5) radians.

Derived from text

Microgravity; Numerical Analysis; Deflection; Temperature Distribution; Diffusion Flames

20040082346 NASA Marshall Space Flight Center, Huntsville, AL, USA

X-Ray Vision

Ramsey, B. D.; Elsner, R. F.; Engelhaupt, D.; Kolodziejczak, J. J.; ODell, S. L.; Speegle, C. O.; Weisskopf, M. C.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We are fabricating optics for the hard-x-ray region using electroless nickel replication. The attraction of this process, which has been widely used elsewhere, is that the resulting full shell optics are inherently stable and thus can have very good angular resolution. The challenge with this process is to develop lightweight optics (nickel has a relatively high density of 8.9 g/cu cm), and to keep down the costs of mandrel fabrication. We accomplished the former through the development of high-strength nickel alloys that permit very thin shells without fabrication- and handling-induced deformations. For the latter, we have utilized inexpensive grinding and diamond turning to figure the mandrels and then purpose-built polishing machines to finish the surface. In-house plating tanks and a simple water-bath separation system complete the process. To date we have built shells ranging in size from 5 cm diameter to 50 cm, and with thickness down to 100 micron. For our HERO balloon program, we are fabricating over 200 iridium-coated shells, 250 microns thick, for hard-x-ray imaging up to 75 keV. Early test results on these have indicated half-power-diameters of 15 arcsec. The status of these and other hard-x-ray optics will be reviewed.

Author

X Ray Optics; High Strength Alloys; Nickel Alloys; Electroless Deposition; Imaging Techniques

20040082389 NASA Marshall Space Flight Center, Huntsville, AL, USA

First Results of Digital Topography Applied to Macromolecular Crystals

Lovelace, J.; Soares, A. S.; Bellamy, H.; Sweet, R. M.; Snell, E. H.; Borgstahl, G.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

An inexpensive digital CCD camera was used to record X-ray topographs directly from large imperfect crystals of cubic insulin. The topographs recorded were not as detailed as those which can be measured with film or emulsion plates but do show great promise. Six reflections were recorded using a set of finely spaced stills encompassing the rocking curve of each reflection. A complete topographic reflection profile could be digitally imaged in minutes. Interesting and complex internal structure was observed by this technique.The CCD chip used in the camera has anti-blooming circuitry and produced good data quality even when pixels became overloaded.

Author

CCD Cameras; Digital Cameras; Topography; X Rays; Crystals; Insulin

20040082615 Air Force Research Lab., Edwards AFB, CA

A Novel Wave Front Method Used for Tracking Terrestrial Concentrator Focal Spot Location

Beasley, Joseph N.; Apr. 22, 2004; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A423560; No Copyright; Avail: CASI; A03, Hardcopy

A major requirement for using a solar propulsion system is the proper placement of the focal spot on the thruster absorber plane. Without proper placement of the focal spot, solar energy is not transferred to the propellant gas or at worst case, a significantly smaller proportion of the incident energy is transferred to the gas.
DTIC
Concentrators; Optical Equipment; Position (Location); Propulsion System Configurations; Propulsion System Performance; Solar Energy; Wave Fronts

20040082654 Naval Observatory, Washington, DC
Analytical Study of Optical Wavefront Aberrations Using Maple
Murison, Marc A.; May 1996; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423634; No Copyright; Avail: CASI; A03, Hardcopy
This paper describes a package for analytical ray tracing of relatively simple optical systems. AESOP (An Extensible Symbolic Optics Package) enables analysis of the effects of small optical element misalignments or other perturbations. (It is possible to include two or more simultaneous independent perturbations.) Wavefront aberrations and optical path variations can be studied as functions of the perturbation parameters. The power of this approach lies in the fact that the results can be manipulated algebraically, allowing determination of misalignment tolerances as well as developing physical intuition, especially in the picometer regime of optical path length variations.
DTIC
Aberration; Optical Properties; Wave Fronts

20040082665 Defence Science and Technology Organisation, Salisbury
Enhancing Imagery to Improve the Visibility of Detail
Whatmough, Robert; Feb. 2004; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423663; DSTO-TR-1557; DODA-AR-013-039; No Copyright; Avail: CASI; A03, Hardcopy
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.
DTIC
Image Processing; Imagery; Visibility

20040084015 Surface Optics Corp., San Diego, CA, USA
Analysis of Non-Volatile Residues with a Standard FTIR Accessory, The VSphere (Trademark)
Szczesniak, M. Martin; Beecroft, Michael; Shelley, Paul; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
The VSphere was developed for analysis of non-volatile residues (NVRs) in solvents in the process of cleanliness evaluation. The solvent to be analyzed is placed in a small gold-plated cup and evaporated. A thin film of NVR is formed on the cup s wall. The cup is attached to the illumination/detection optics. An infrared spectrum is recorded and analyzed. The VSphere provides a superior way of NVR analysis over traditional horizontal ATR accessories or KBR pellets. The original VSphere accessory was built for the SOC 400 Hand Held FTIR. It was immediately implemented at Boeing Rockedyne for evaluation of cleanliness of rocket engines. A number of practical applications were developed at Boeing Commercial Airplane. Recently, the availability of the VSphere accessory has been broadened to Nicolet FTIR spectrometers. This version allows for parallel infrared and gravimetric analysis of the same specimen. The presentation will provide a detailed technical description of the accessory and its applications.
Author
Infrared Spectroscopy; Fast Fourier Transformations; Residues; Chemical Analysis

20040084052 NASA Glenn Research Center, Cleveland, OH, USA
Optical Properties of Thin Film Molecular Mixtures
Jaworske, Donald A.; Shumway, Dean A.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 6 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Thin films composed of molecular mixtures of metal and dielectric are being considered for use as solar selective coatings for a variety of space power applications. By controlling the degree of molecular mixing, the solar selective coatings can be tailored to have the combined properties of high solar absorptance, , and low infrared emittance, . On orbit, these combined properties would simultaneously maximize the amount of solar energy captured by the coating and minimize the amount of thermal energy radiated. Mini-satellites equipped with solar collectors coated with these cermet coatings may utilize the captured heat energy to power a heat engine to generate electricity, or to power a thermal bus that directs heat to remote regions of the spacecraft. Early work in this area identified the theoretical boundary conditions needed to operate a Carnot cycle in space, including the need for a solar concentrator, a solar selective coating at the heat inlet of the engine, and a radiator.1 A solar concentrator that can concentrate sunlight by a factor of 100 is ideal. At lower values, the temperature of the solar absorbing surface becomes too low for efficient heat engine operation, and at higher values, cavity type heat receivers become attractive. In designing the solar selective coating, the wavelength region yielding high solar absorptance must be separated from the wavelength region yielding low infrared emittance by establishing a sharp transition in optical properties. In particular, a sharp transition in reflectance is desired in the infrared to achieve the desired optical performance. For a heat engine operating at 450 C, a sharp transition at 1.8 micrometers is desired.2 The radiator completes the heat flow through the Carnot cycle.
Author
Thin Films; Optical Properties; Dielectrics; Coatings; Metal Coatings

20040084073 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sunglint Research in the Lab, and Spatial Micro-Complexity
Wiscombe, Warren; Stamnes, Knut; Su, Wenying; [2004]; 1 pp.; In English; AGU Spring Annual Meeting, 17-21 May 2004, Montreal, Canada; Copyright; Avail: Other Sources; Abstract Only

We are beginning a new investigation into polarized sunglint in a laboratory setting, using a wave tank. The wave tank has the capability of generating almost any combination of gravity and capillary waves under computer control, from simple sine waves to essentially random seas. Our aim is to perfect sunglint models, which have advanced little since the work of Cox and Munk in the 1950s using digitized photographs taken from an airplane. Sungllnt patterns, even when viewed from elevated platforms, but more and more so when viewed from low Earth orbit and beyond, have a kind of coherence and stability which transcends a pixel-by-pixel interpretation. The light forming the pattern is a sum of contributions from several or even many waves which are far from adjacent. Thus glint is a phenomenon that can only be understood in the large and never on a pixel-by-pixel basis.
Author
Glint; Sine Waves; Polarized Light; Laboratories; Spatial Dependencies; Sun

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040079791 Brookhaven National Lab., Upton, NY, USA
HYSPEC: A Crystal Time-of-Flight Hybrid Spectrometer for the Spallation Neutron Source
Shapiro, S. M.; Zaliznyak, I.; Passell, L.; Ghosh, V.; 2003; In English
Report No.(s): DE2004-15006578; BNL-71390-2003-CP; No Copyright; Avail: National Technical Information Service (NTIS)

HYSPEC combines time-of-flight spectroscopy with focusing Bragg optics to enhance the flux on small single crystal samples. It will look at a coupled H(sub 2) moderator and will use a 20-25 meter supermirror guide to transport the neutron beam. A counter-rotating chopper pair will monochromate the beam and determine the neutron burst width. A short distance from the chopper pair a vertical focusing crystal is placed in a drum shield that will focus the beam to a 2 cm height, thus maximizing the flux at the sample position. Collimators and beam definers will be placed before and after the sample, which will allow standard sample environment equipment to be used covering a wide range of temperatures and magnetic fields.
NTIS
Neutron Sources; Spallation

20040082390 NASA Marshall Space Flight Center, Huntsville, AL, USA

Vacuum Plasma Spray Forming of Tungsten Lorentz Force Accelerator Components

Zimmerman, Frank R.; [2004]; 1 pp.; In English; National Space and Missile Materials Symposium, 20-25 Jun. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Vacuum Plasma Spray (VPS) Laboratory at NASA's Marshall Space Flight Center, working with the Jet Propulsion Laboratory, has developed and demonstrated a fabrication technique using the VPS process to form anode and cathode sections for a Lorentz force accelerator made from tungsten. Lorentz force accelerators are an attractive form of electric propulsion that provides continuous, high-efficiency propulsion at useful power levels for such applications as orbit transfers or deep space missions. The VPS process is used to deposit refractory metals such as tungsten onto a graphite mandrel of the desired shape. Because tungsten is reactive at high temperatures, it is thermally sprayed in an inert environment where the plasma gun melts and deposits the molten metal powder onto a mandrel. A three-axis robot inside the chamber controls the motion of the plasma spray torch. A graphite mandrel acts as a male mold, forming the required contour and dimensions for the inside surface of the anode or cathode of the accelerator. This paper describes the processing techniques, design considerations, and process development associated with the VPS forming of Lorentz force accelerator components.

Author

Lorentz Force; Tungsten; Fabrication; Plasma Spraying; Vacuum Systems

20040082985 Princeton Univ., NJ

Plasma Physics Regimes in Tokamaks with Li Walls

Zakharov, L. E.; Gorelenkov, N. N.; White, R. B.; Krasheninnikov, S. I.; Pereverzev, G. V.; Aug. 2003; In English

Report No.(s): DE2003-814746; PPPL-3856; No Copyright; Avail: National Technical Information Service (NTIS)

Low recycling regimes with a plasma limited by a lithium wall surface suggest enhanced stability and energy confinement, both necessary for tokamak reactors. These regimes could make ignition feasible in compact tokamaks. Ignited Spherical Tokamaks (IST), self-sufficient in the bootstrap current, are introduced as a necessary step for development of the physics and technology of power reactors.

NTIS

Plasmas (Physics); Lithium; Walls; Nuclear Reactors

20040083013 Princeton Univ., NJ

Modeling of ICRH H-Minority Driven N = 1 Resonant Modes in Jet

Gorelenkov, N. N.; Mantsinen, M. J.; Sharapov, S. E.; Cheng, C. Z.; Aug. 2003; In English

Report No.(s): DE2003-814750; PPPL-3858; No Copyright; Avail: National Technical Information Service (NTIS)

A nonperturbative code NOVA-KN (Kinetic Nonperturbative) has been developed to account for finite orbit width (FOW) effects in nonperturbative resonant modes such as the low-frequency MHD modes observed in the Joint European Torus (JET). The NOVA-KN code was used to show that the resonant modes with frequencies in the observed frequency range are ones having the characteristic toroidal precession frequency of H-minority ions. Results are similar to previous theoretical studies of fishbone instabilities, which were found to exist at characteristic precession frequencies of hot ions.

NTIS

Frequency Ranges; Magnetohydrodynamics

20040084063 NASA Marshall Space Flight Center, Huntsville, AL, USA

Particle Acceleration in Relativistic Jets Due to Weibel Instability

Nishikawa, K.-I.; Hardee, P.; Richardson, G.; Preece, R.; Sol, H.; Fishman, G. J.; Astrophysical Journal; [2004]; Volume 595, pp. 555-563; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF ATM-97-30230; NSF ATM-98-70072; NSF ATM-01-00997; NSF INT-99-81508; Copyright; Avail: Other Sources

Shock acceleration is a ubiquitous phenomenon in astrophysical plasmas. Plasma waves and their associated instabilities (e.g., the Buneman instability, two-streaming instability, and the Weibel instability) created in the shocks are responsible for particle (electron, positron, and ion) acceleration. Using a three-dimensional relativistic electromagnetic particle code, we have investigated particle acceleration associated with a relativistic jet front propagating through an ambient plasma with and without initial magnetic fields. We find only small differences in the results between no ambient and weak ambient magnetic fields. Simulations show that the Weibel instability created in the collisionless shock front accelerates particles perpendicular and parallel to the jet propagation direction. While some Fermi acceleration may occur at the jet front, the majority of electron

acceleration takes place behind the jet front and cannot be characterized as Fermi acceleration. The simulation results show that this instability is responsible for generating and amplifying highly nonuniform, small-scale magnetic fields, which contribute to the electron s transverse deflection behind the jet head. The ″jitter″ radiation from deflected electrons has different properties than synchrotron radiation which is calculated in a uniform magnetic field. This jitter radiation may be important to understanding the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets, and supernova remnants.
Author
Particle Acceleration; Relativistic Particles; Shock Waves; Space Plasmas; Weibel Instability

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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*.

20040081325 Oak Ridge National Lab., TN, USA
Simulation of Transport Phenomena in Aluminum Nitride Single-Crystal Growth
de Almeida, V. F.; Rojo, J. C.; Mar. 02, 2002; In English
Report No.(s): DE2003-814238; ORNL/TM-2002/64; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this project is to apply advanced computer-aided modeling techniques for simulating coupled radiation transfer present in the bulk growth of aluminum nitride (AlN) single-crystals. Producing and marketing high-quality single-crystals of AlN is currently the focus of Crystal IS, Inc., which is engaged in building a new generation of substrates for electronic and optical-electronic devices. Modeling and simulation of this company proprietary innovative processing of AlN can substantially improve the understanding of physical phenomena, assist design, and reduce the cost and time of research activities. This collaborative work supported the goals of Crystal IS, Inc. in process scale-up and fundamental analysis with promising computational tools.
NTIS
Single Crystals; Crystal Growth; Transport Properties

20040081364 Oak Ridge National Lab., TN, Department of Energy, Washington, DC, USA
ORNL Superconducting Technology Program for Electric Power Systems
Hawsey, R. A.; Murphy, A. W.; Feb. 2002; In English
Report No.(s): DE2003-814143; ORNL/HTSPC-13; No Copyright; Avail: National Technical Information Service (NTIS)

The Oak Ridge National Laboratory (ORNL) Superconducting Technology Program is conducted as part of a national effort by the US Department of Energy's Office of Energy Efficiency and Renewable Energy to develop the science and technology base needed by US industry for development of electric power applications of high-temperature superconductivity. The two major elements of this program are wire development and applications development. A new part of the wire research effort was the Accelerated Coated Conductor Initiative. This document describes the major research and development activities for this program together with related accomplishments.
NTIS
Electric Power Transmission; Superconductivity

20040081402 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RHrFPGA Radiation-Hardened Re-programmable Field-Programmable Gate Array
Sanders, A. B.; LaBel, K. A.; McCabe, J. F.; Gardner, G. A.; Lintz, J.; Ross, C.; Golke, K.; Burns, B.; Carts, M. A.; Kim, H. S.; [2004]; 11 pp.; In English; Single Event Effects Symposium, 27-29 Apr. 2004, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Viewgraphs on the development of the Radiation-Hardened Re-programmable Field-Programmable Gate Array (RHrFPGA) are presented. The topics include: 1) Radiation Test Suite; 2) Testing Interface; 3) Test Configuration; 4) Facilities; 5) Test Programs; 6) Test Procedure; and 7) Test Results. A summary of heavy ion and proton testing is also included.
CASI
Field-Programmable Gate Arrays; Radiation Hardening; Fabrication; Heavy Ions

20040082307 NASA Marshall Space Flight Center, Huntsville, AL, USA
Kinetic Roughening Transition and Energetics of Tetragonal Lysozyme Crystal Growth
Gorti, Sridhar; Forsythe, Elizabeth L.; Pusey, Marc L.; [2004]; 2 pp.; In English; 10th International Conference on the Crystallization of Biological Macromolecules, 5-8 Jun. 2004, Beijing, China; No Copyright; Avail: Other Sources; Abstract Only

Interpretation of lysozyme crystal growth rates using well-established physical theories enabled the discovery of a phenomenon possibly indicative of kinetic roughening. For example, lysozyme crystals grown above a critical supersaturation sigma, (where supersaturation sigma = ln c/c(sub eq), c = the protein concentration and c(sub eq) = the solubility concentration) exhibit microscopically rough surfaces due to the continuous addition of growth units anywhere on the surface of a crystal. The rate of crystal growth, V(sub c), for the continuous growth process is determined by the continuous flux of macromolecules onto a unit area of the crystal surface, a, from a distance, xi, per unit time due to diffusion, and a probability of attachment onto the crystal surface, expressed. Based upon models applied, the energetics of lysozyme crystal growth was determined. The magnitudes of the energy barriers of crystal growth for both the (110) and (101) faces of tetragonal lysozyme crystals are compared. Finally, evidence supportive of the kinetic roughening hypothesis is presented.
Derived from text
Crystal Surfaces; Supersaturation; Protein Crystal Growth

20040082343 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA
Steps in Solution Growth: Dynamics of Kinks, Bunching and Turbulence
Chernov, A. A.; Rashkovich, L.; Vekilov, P. G.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Summary of recent results on fundamental issues in crystal growth from non-stoichiometric solutions, development of steps with low kink density and influence of turbulence on step bunching.
Author
Crystal Growth; Turbulence; Electron Bunching; Solutions

20040082374 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA
Turbulence within Boundary Layer Controls Step Pattern Evolution in Crystal Growth
Booth, N. A.; Chernov, A. A.; Vekilov, P. G.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Results on step bunching on KDP (101) face growing from turbulent solution flowing at the rate of approx. 1 m/s over the face. Limited step bunch height was found for the first time.
Author
Boundary Layers; Crystal Growth

20040082380 NASA Marshall Space Flight Center, Huntsville, AL, USA
Raman Microscopic Characterization of Proton-Irradiated Polycrystalline Diamond Films
Newton, R. L.; Davidson, J. L.; Lance, M. J.; April 22, 2004; 9 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DE-AC05-000R-22725; No Copyright; Avail: CASI; A02, Hardcopy

The microstructural effects of irradiating polycrystalline diamond films with proton dosages ranging from 10(exp 15) to 10(exp 17) H(+) per square centimeter was examined. Scanning Electron Microscopy and Raman microscopy were used to examine the changes in the diamond crystalline lattice as a function of depth. Results indicate that the diamond lattice is retained, even at maximum irradiation levels.
Author
Diamond Films; Irradiation; Polycrystals; Protons; Raman Spectra; Microstructure; Microscopy

20040082790 Erlangen-Nuernberg Univ., Erlangen
Experiments on Coupled Josephson Junction Devices
Abdumalikov, A. A.; Ustinov, A. V.; Jul. 15, 2003; 30 pp.; In English
Contract(s)/Grant(s): F61775-01-WE045
Report No.(s): AD-A423923; SPC-01-4045; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking University of Erlangen-Nuremberg as follows: The contractor will investigate coupled Josephson devices of two different kinds. First, the contractor will test a new concept of active antennas to couple

radiation out from Josephson arrays. Using a mixed series-parallel array-biasing scheme, the contractor will design and perform waveguide-coupled emission experiments with single- and double-row arrays at 80-120 GHz. If successful, this scheme will be further implemented and tested using dipole antennas for the 400-500 GHz range. The contractor will also investigate the loop antenna array scheme as detailed in the technical proposal. The experiments will be done with Nb/Al-AOx/Nb Josephson junction arrays. The second Josephson device to be investigated (including design, fabrication, and testing) are novel q-bit devices. These q- bits are hoped to be more flexible and therefore more suitable hardware for quantum computing than single- loop SQUIDs currently pursued by other researcher groups. Full details are provided in the accompaning technical proposal.
DTIC
Josephson Junctions

20040082986 Princeton Univ., NJ
Subcyclotron Instability of Alfven Eigenmodes due to Energetic Ions in Low Aspect Ratio Plasmas
Goerelenkov, N. N.; Fredrickson, E.; Belova, E.; Cheng, C. Z.; Gates, D.; Aug. 2003; In English
Report No.(s): DE2003-814748; PPPL-3857; No Copyright; Avail: National Technical Information Service (NTIS)
High-frequency modes with frequencies below the fundamental cyclotron frequency of thermal ions were observed in the National Spherical Torus Experiment (NSTX). Based on the measured spectrum of high-frequency modes they are identified as Compressional Alfven Eigenmodes (CAEs) and Global Alfven Eigenmodes (GAEs). CAEs have similar time evolution as plasma parameters change, while GAEs may intersect due to q-profile relaxation. A theory has been developed to study the properties of these modes. Both types of instabilities are driven by the tangential neutral-beam injection in NSTX. Beam ions excite CAEs/GAEs through the Doppler-shifted cyclotron resonance. The main source for the drive is the velocity space anisotropy of the beam ion distribution function. Simulations of the effect CAEs/GAEs may have on plasma ions indicate that these modes may provide a channel for efficient energy transfer from fast ions directly to thermal ions.
NTIS
Energy Transfer; Magnetohydrodynamic Waves; Ion Beams

20040083014 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Preliminary Comparative Study of the Electron-Cloud Effect for the PSR, ISIS, and the ESS
Furman, M. A.; Pivi, M. T. F.; 2003; In English
Report No.(s): DE2003-815509; LBNL-52872; No Copyright; Avail: National Technical Information Service (NTIS)
We present preliminary electron-cloud simulation results for the Proton Storage Ring (PSR) at LANL, ISIS at RAL, and the European Spallation Source (ESS). For each storage ring, we simulate the build-up and dissipation of the electron cloud (EC) in a representative field-free section of the vacuum chamber. For all three cases, we choose the same residual gas temperature, secondary emission yield (SEY), and secondary emission spectrum. Other variables such as proton loss rate, bunch profile, intensity and energy, residual gas pressure and chamber geometry, are set at the corresponding values for each machine. Under these assumptions, we conclude that, of the three machines, the PSR is the most severely affected by the electron cloud effect (ECE), followed by the ESS, with ISIS a distant third. We illustrate a strong sensitivity of the ECE to the longitudinal bunch profile by choosing two different shapes for the case of the PSR, and a weak sensitivity to residual gas pressure. This preliminary study does not address the ECE in other regions of the machine, nor the beam instability that might arise from the EC.
NTIS
Clouds (Meteorology); Electrons

20040084046 Alabama Univ., Birmingham, AL, USA
Deposition of Nanostructured Thin Film from Size-Classified Nanoparticles
Camata, Renato P.; Cunningham, Nicholas C.; Seol, Kwang Soo; Okada, Yoshiki; Takeuchi, Kazuo; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains color and black and white illustrations
Contract(s)/Grant(s): NSF DMR-01-16098; NSF DMR-02-43640; No Copyright; Avail: CASI; A02, Hardcopy
Materials comprising nanometer-sized grains (approximately 1_50 nm) exhibit properties dramatically different from those of their homogeneous and uniform counterparts. These properties vary with size, shape, and composition of nanoscale grains. Thus, nanoparticles may be used as building blocks to engineer tailor-made artificial materials with desired properties,

such as non-linear optical absorption, tunable light emission, charge-storage behavior, selective catalytic activity, and countless other characteristics. This bottom-up engineering approach requires exquisite control over nanoparticle size, shape, and composition. We describe the design and characterization of an aerosol system conceived for the deposition of size classified nanoparticles whose performance is consistent with these strict demands. A nanoparticle aerosol is generated by laser ablation and sorted according to size using a differential mobility analyzer. Nanoparticles within a chosen window of sizes (e.g., (8.0 plus or minus 0.6) nm) are deposited electrostatically on a surface forming a film of the desired material. The system allows the assembly and engineering of thin films using size-classified nanoparticles as building blocks.
Author
Deposition; Nanoparticles; Thin Films; Nanofabrication; Grain Size

20040084058 Alabama Agricultural and Mechanical Univ., Normal, AL, USA
Development of High Performance Nanocomposite Pyroelectric Detectors: A Possible Approach
Batra, A. K.; Aggarwal, M. D.; Lal, R. B.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recently, there has been immense interest in the use of ferroelectric thin films in pyroelectric IR sensors and thermal imaging arrays and their integration with silicon IC technology. The materials used for fabricating pyroelectric IR devices are polyvinylidene fluoride, triglycine sulfate, lead titanate, lithium tantalate, lead zirconate titanate, and others. Our approach is to fabricate pyro-ceramic/copolymers 0-3 nanocomposite thin films such as those consisting of nanosized pyro-ceramic particles embedded in poly vinylidene fluoride. The advantages of this approach are that dielectric and pyroelectric properties of diphasic composite materials can be tailored by varying the ceramic volume fraction and, hence, sensor performance can be optimized and that pyroelectric response can get reinforced while piezoelectric effect cancels, thereby minimizing microphony effect. In this presentation, methodology and technology used for the preparation of nanoparticles such as lead titanate and others, along with fabrication of nanocomposite film/detectors, will be described and discussed.
Derived from text
Pyroelectricity; Copolymers; Nanocomposites; Thermal Mapping; Ferroelectricity

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20040082663 Defence Science and Technology Organisation, Salisbury
A Review of Selected Nanotechnology Topics and Their Potential Military Applications
Wang, Jun; Dortmans, Peter J.; Jan. 2004; 48 pp.; In English
Report No.(s): AD-A423657; DSTO-TN-0537; DODA-AR-013-012; No Copyright; Avail: CASI; A03, Hardcopy

This report presents the review of progress in selected nanotechology topics and some possible applications. We survey four major branches within the field: nanotubes, quantum dots, nanomaterials and nanodevices. For each of these, we review the underlying scientific concepts, potential enabling technologies and current limitations to the realisation of nanotechnology applications. Possible implications for the future Land Force are discussed by examining potential nanotechnology impacts across seven core military skills within the Army-as-a-System construct.
DTIC
Military Technology; Nanotechnology

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*.

20040081389 Instituto Tecnologico de Aeronautica, Sao Paulo, Brazil
A Brazilian Case Study for the Air Traffic Flow Management Problem.
Rizzi, Janaina Amaral; Mueller, Carlos; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 13 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The congestion of airports and air space sectors is increasingly becoming critical in all the world. Many airports and air space sectors in Europe, USA of America, Japan and Brazil, work above their maximum capacity during almost the whole period of operation. Congestion tends to get worst in a near future, Brazil has experienced in recent years an increase in air traffic flow near 7% a year implying a growth perspective of 50% in the next five years (18). Motivated by this problem, based in previous papers and observing that ground delays are preferable than airborne delays, an integer programming model has been formulated to assign ground holding delays to flights for the Brazilian case. The objective of the model is to minimize aircrafts delay, under some constraints. It is important to say that this paper concerns the strategic planning of the air traffic, it means that it deals with existent conflicts while planning flights timetable. Eventually, the model can be used as an operational tool depending on the computation time although this is not the actual goal. The study deals with existent conflicts in the most congested Brazilian air space area known as FIR SBBS (Brasilia), with 24 airports, 14 air space sectors and 6 terminal areas. The data consisted of 355 flights, tested over 11 hours with 1 minute interval time frame. The model guarantees that the capacity constraints of air space sectors and airports are respected and guarantees that exactly one arrived time is assigned to each flight. Moreover, we are going to extend our model, in the future, to handle connections between flights. There are integer results for two different situations, the first one considers the capacity constraints of airports and air sectors, and the second one considers only the air space sectors capacity constraint. The second situation was built to allow a comparison with a known result produced by a heuristic algorithm, the result obtained is almost four times better in terms of total time delay.
Author
Air Traffic Control; Brazil; Management Planning

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040081387 British Columbia Univ., Vancouver, British Columbia, Canada
Air Travel Security and Facility Fees and Their Impact on Air Travel and Transportation Safety (the Case of Canada)
Waters, W. G.; Yu, Chun-Yan; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003, pp. 1-13; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

Competition and the rise of low-cost carriers have resulted in persistent worldwide downward pressure on air fares. At the meantime, air careers and travelers are facing the upward trend of various airport, air navigation and security fees. These are fees for facilities and services provided by government or quasi-public authorities, and appear to be not subject to the same level of competition or cost control as the air carriers themselves. An example of this trend is the rise of facility charges in Canadian aviation markets, especially the air traveller security charge (ATSC) introduced to pay for air security measures undertaken after the terrible events of September 11, 2001. The Canadian ATSC was CDN$12 (US$7.70) each way for domestic and cross-border air travel, recently reduced to CDN$14 (US$9) round trip for domestic air travel. This is a flat fee regardless of air ticket price or distance traveled. This implies a disproportionately higher percentage increase in the total price of short haul air travel compared to long distance flights. Much short haul air travel has a potential substitute via surface trips, most likely by automobile but possibly by intercity bus or raiL Therefore, it is likely that the airport security fees on short haul air travel will cause some diversion of trips to the automobile. Because the crash and fatality records of road transport are higher than for commercial air travel, the current Canadian aviation security fees v,411 lead to an increase in transport injuries and deaths. This paper provides some initial estimates of the magnitude of these road safety impacts resulting from aviation security fees. The calculations are rough, but about 250,000 air travelers per year divert to car trips due to the air security fee. This will be associated with about one to two car crash fatalities, and about 75 to 140 injuries and many more minor incidents. This does not include travelers diverted due to ″hassle″ or fears about security.
Author
Airport Security; Air Transportation; Financial Management; Low Cost; Market Research

20040081388 Wright State Univ., Dayton, OH, USA
The Impact of the Air Carrier's Top Management Functions on Flight Safety in a Globalised Environment
Lainos, John S.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 32 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The intensity of international airlines' competition due to globalization, forces their top management to make strong efforts for cost minimization, which affects the basic elements of the internal corporate environment (labor's terms and

conditions etc). On the other hand, as technology is becoming increasingly reliable, causal factors of accident/incident are more likely to be attributed to the human factor and the determinants of its activity in the company. Recent studies have proved that the activity-behaviour of the staff at working place, during working time, is strongly, directly and indirectly affected by factors from the wider internal corporate environment. The introduction and preservation of these factors is ultimately determined, by the top management decisions (C.E.O., B.O.D.). This consideration is based on the fact that the top management has the authority to program, organize, administrate, staff and control the corporate operation and to apply its decisions-through the authorized members of the hierarchy. Even in case that some of the factors of the internal corporate environment that affect negatively the staff's activity are not a result of application of the top management decisions, but a result of mismanagement by the members of the hierarchy at the various organizational levels, the ultimate responsibility still lies with the top management.
Derived from text
Air Transportation; Airline Operations; Costs; Flight Safety

20040081391 New South Wales Univ., Sydney, Australia
The Influence of Operational Uncertainties on Airline Schedule Planning and Punctuality Control Issues
Wu, Cheng-Lung; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 28 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

This paper is aimed at investigating the influence of operational uncertainties on airline schedule design and punctuality control issues. The operation of aircraft turnaround services has become the focal point when airlines try to control delays and expect the design of extra schedule buffer time for aircraft turnaround to absorb delays in aircraft rotation. The growing complex nature of airline schedule design and the growing pressure on aircraft utilisation also make the task of schedule punctuality control more difficult than ever. Hence, this paper firstly investigates operational uncertainties in aircraft turnaround operations and the effects of these uncertainties on schedule punctuality control issues. Two empirical analyses are carried out and we find that airlines face different uncertainty issues at different airports. Some uncertainties come from schedule planning strategies, e.g. short aircraft turnaround time, and some are due to operational delays at airports such as passenger processing problems. From punctuality curve analyses, we find that flight punctuality is variant depending on the time of a day, operational efficiency of ground crews and more significantly depending on the design nature of flight schedules. Simulation models are applied to carry out scenario analyses for schedule planning purposes. Results show that by increasing 4% schedule time on an example route, flight punctuality could be improved by 14%. This example further reveals some thoughts about how flight punctuality and the overall schedule reliability could be managed by considering stochastic factors in schedule design.
Author
Airline Operations; Ground Crews; Operational Problems; Schedules

20040081392 International Univ. of Japan, Niigata, Japan
Japanese Airport Benchmarking with the Endogenous-Weight TPF Model
Yoshida, Yuichiro; Fujimoto, Hiroyoshi; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 24 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

As aviation demand increased constantly along with the rapid economic growth in and the surrounding region of Japan, Japanese government promoted airport construction since 1950's. However, the change in the economic background has made rise to the criticism toward the inefficient public investment, especially transportation infrastructure. In this trend, it has been argued that some of the small regional airports are indeed over investment. Thus this paper attempts to verify the validity of such criticism by statistically measuring the efficiency of Japanese airports and conducting comparative analysis. The results show that the efficiency of regional airports in mainland Japan are less efficient than others, and that those airports constructed in the 1990's are relatively inefficient.
Author
Japan; Airports; Construction

20040081395 Boeing Phantom Works, Seattle, WA, USA
A Simultaneous Equation Model for Air Traffic in the New York Area
Lu, I.-Li; Peixoto, Julio; Taam, Winson; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 40 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

Air traffic management is a complex and multifaceted problem. In recent years, the growing concerns of delay and

congestion are echoed among passengers, airlines and federal agencies. Many studies and efforts have been devoted to the understanding of causal relationship between air traffic performance and contributing factors. In this paper, we postulate a model based on the supply and demand concepts in economic theory. We formulate and entertain a structural equation model to explain the dynamic relations of delay, traffic count, and weather variables among three major airports in the New York region. We illustrate the model with hourly aggregate data on traffic from Federal Aviation Administration, surface observations, and radar scan of precipitation from National Oceanographic Atmospheric Administration. The model describes air traffic performance and predicts hold-out samples quite well. The model also demonstrates the contribution of current and past weather information in the prediction. Moreover, the model enables one to study the propagation effect of the traffic performance measures across different airports.
Author
Airline Operations; Information Management; Mathematical Models

20040081507 Air Force Research Lab., Mesa, AZ, USA
Initial Evaluation of USAF Security Forces Distributed Mission Training (SecForDMT)
Weeks, Joseph Lloyd; Advanced Technologies for Military Training; April 2004; 15 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

USA Air Force security forces have a central role in force protection. Their missions include military police services, installation security, air base defense, military working dog functions, and combat arms training and maintenance. Surveys indicate that among the hundreds of tasks in the career field, 'Directing security forces' is rated highest on training emphasis. As a result of established needs and technology opportunities, the Air Force Research Laboratory is conducting research and development of a computer-based simulation capability called Security Forces Distributed Mission Training. The capability is designed to support training in decision making, leadership, and team coordination. It allows an instructor to start a simulation exercise on trainee computer workstations connected via a local area network. Simulation software supports the interaction of trainees with each other and with computer-generated forces (CGFs) that imitate behavior of enemy, neutral, and friendly troops and civilians. Radio functions allow multi-channel communication among instructors, trainees, and CGFs. A major design objective is to develop a simulation control interface that instructors and trainees can directly use so the costs of an on-site computer technician can be avoided. The purpose of this paper is to describe outcomes from an evaluation of the usability of the simulation control interface and the validity of computer models.
Author
Training Evaluation; Computerized Simulation; Military Operations; Training Devices

20040081510 Institute for Human Factors TNO, Soesterberg, Netherlands
Supporting Observers D1uring Distributed Team Training: The Development of a Mobile Evaluation System
VanBerlo, Marcel P. W.; Hiemstra, Annemarie M. F.; Hoekstra, Wytze; Advanced Technologies for Military Training; April 2004; 10 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Distributed team training, often in joint settings, is becoming more and more important in the military training today. As the teams and training staff are not physically on the same location, special attention should be paid to performance measurement and feedback. The question is what should be measured in distributed training and how the training staff should be supported in doing this. This paper describes a mobile performance measurement and evaluation tool, specifically developed for distributed team training (MOPED). The MOPED tool helps the evaluator in observing team performance and in quickly generating, sending and receiving data to support his evaluation.
Author
Distributed Interactive Simulation; Teams; Human Performance

20040081517 Army Research Inst., Fort Knox, KY, USA
Adaptive Thinking Training for Tactical Leaders
Lussier, James W.; Shadrick, Scott B.; Advanced Technologies for Military Training; April 2004; 12 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper reports a series of research efforts embodied in the U.S. Army s Think Like a Commander training program. The work is interesting because it seeks to train a cognitive behavior - thinking - using methods that have traditionally been applied to training more observable and measurable behaviors, e.g., marksmanship and gunnery, sports performance. In short,

it does not greatly respect a traditional distinction between such things as physical movements, perceptions, and cognitions when it comes to training, rather treats these all as behaviors that are amenable to the same training methods and principles. Deliberate practice techniques were applied to develop exercises to train the task of adaptive thinking in tactical situations. The exercises were used in command preparation courses for U.S. Army officers at the brigade, battalion, and company levels. The approach shows promise and initial data indicate significant performance gains in a key component of battlefield adaptive thinking: the rapid analysis of battlefield situations to identify of key considerations for decision-making.
Author
Education; Training Analysis; Research

20040081525 National Aerospace Lab., Amsterdam, Netherlands
Evaluation of Collective Training in a Distributed Simulation Exercise
Lemmers, Arjan J. J.; Hartikainen, Timo; Rollesbroich, Bernd; Carvajal, Francisco J. Rodriguez; Advanced Technologies for Military Training; April 2004; 14 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The military interest in Synthetic Environments (SEs) is beginning to change from thinking about the relevance of capability demonstrators to SEs being used to support distributed simulation exercises. Several European nations are actively promoting the use of SEs for Collective Training purposes to increase the military co-operation in Europe. In order to overcome the obstacles for use of distributed simulation exercises across Europe, it is important that a common European process, tools and standards are defined. This paper is focussing on the evaluation issues in distributed simulation exercises. It will outline the process of defining the evaluation needs, the identification of the functional and technical evaluation requirements and the definition of the Common Evaluation Framework (CEF). The CEF comprises processes, models, methods and presentation means for results presentation and distribution. Three supporting prototype tools for the CEF have been developed under the Euclid RTP11.13 programme: the Evaluation Definition Tool (EDT), the Evaluation Definition Selection Tool (EDST) and the Execution Evaluation Tool (EET). The EDT is used by the military user to define evaluation objectives and criteria. The EDST gives possibilities for searching and selecting evaluation objectives from a pool of ready-made objectives. The EET supports the user in post-processing the outputs acquired during the exercise and in the analysis and evaluation of the results and trainees.
Author
Military Operations; Training Evaluation; Distributed Interactive Simulation

20040082140 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Integrated Risk Management Within NASA Programs/Projects
Connley, Warren; Rad, Adrian; Botzum, Stephen; [2004]; 10 pp.; In English; Space Systems Engineering and Risk Management, Manhattan Beach, CA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

As NASA Project Risk Management activities continue to evolve, the need to successfully integrate risk management processes across the life cycle, between functional disciplines, stakeholders, various management policies, and within cost, schedule and performance requirements/constraints become more evident and important. Today's programs and projects are complex undertakings that include a myriad of processes, tools, techniques, management arrangements and other variables all of which must function together in order to achieve mission success. The perception and impact of risk may vary significantly among stakeholders and may influence decisions that may have unintended consequences on the project during a future phase of the life cycle. In these cases, risks may be unintentionally and/or arbitrarily transferred to others without the benefit of a comprehensive systemic risk assessment. Integrating risk across people, processes, and project requirements/constraints serves to enhance decisions, strengthen communication pathways, and reinforce the ability of the project team to identify and manage risks across the broad spectrum of project management responsibilities. The ability to identify risks in all areas of project management increases the likelihood a project will identify significant issues before they become problems and allows projects to make effective and efficient use of shrinking resources. By getting a total team integrated risk effort, applying a disciplined and rigorous process, along with understanding project requirements/constraints provides the opportunity for more effective risk management. Applying an integrated approach to risk management makes it possible to do a better job at balancing safety, cost, schedule, operational performance and other elements of risk. This paper will examine how people, processes, and project requirements/constraints can be integrated across the project lifecycle for better risk management and ultimately improve the chances for mission success.
Author
Project Management; Risk; Life (Durability); Costs

20040082143 South Carolina Univ., Columbia, SC, USA

NASA Experimental Program to Stimulate Competitive Research: South Carolina

Sutton, Michael A.; June 30, 2004; 143 pp.; In English

Contract(s)/Grant(s): NCC5-643; No Copyright; Avail: CASI; A07, Hardcopy

The use of an appropriate relationship model is critical for reliable prediction of future urban growth. Identification of proper variables and mathematic functions and determination of the weights or coefficients are the key tasks for building such a model. Although the conventional logistic regression model is appropriate for handing land use problems, it appears insufficient to address the issue of interdependency of the predictor variables. This study used an alternative approach to simulation and modeling urban growth using artificial neural networks. It developed an operational neural network model trained using a robust backpropagation method. The model was applied in the Myrtle Beach region of South Carolina, and tested with both global datasets and areal datasets to examine the strength of both regional models and areal models. The results indicate that the neural network model not only has many theoretic advantages over other conventional mathematic models in representing the complex urban systems, but also is practically superior to the logistic model in its capability to predict urban growth with better - accuracy and less variation. The neural network model is particularly effective in terms of successfully identifying urban patterns in the rural areas where the logistic model often falls short. It was also found from the area-based tests that there are significant intra-regional differentiations in urban growth with different rules and rates. This suggests that the global modeling approach, or one model for the entire region, may not be adequate for simulation of a urban growth at the regional scale. Future research should develop methods for identification and subdivision of these areas and use a set of area-based models to address the issues of multi-centered, intra- regionally differentiated urban growth.

Derived from text

Mathematical Models; Backpropagation (Artificial Intelligence); Complex Systems; Rural Areas

20040082295 NASA Marshall Space Flight Center, Huntsville, AL, USA

Maximally Expressive Modeling

Jaap, John; Davis, Elizabeth; Richardson, Lea; [2004]; 10 pp.; In English; 4th International Workshop on Planning and Scheduling for Space, 23-25 Jun. 2004, Darmstadt, Germany; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Planning and scheduling systems organize tasks into a timeline or schedule. Tasks are logically grouped into containers called models. Models are a collection of related tasks, along with their dependencies and requirements, that when met will produce the desired result. One challenging domain for a planning and scheduling system is the operation of on-board experiments for the International Space Station. In these experiments, the equipment used is among the most complex hardware ever developed; the information sought is at the cutting edge of scientific endeavor; and the procedures are intricate and exacting. Scheduling is made more difficult by a scarcity of station resources. The models to be fed into the scheduler must describe both the complexity of the experiments and procedures (to ensure a valid schedule) and the flexibilities of the procedures and the equipment (to effectively utilize available resources). Clearly, scheduling International Space Station experiment operations calls for a maximally expressive modeling schema.

Author

Scheduling; Planning; Manned Space Flight; Models

20040083980 United Space Alliance, USA

Affirmative Procurement

Mann, Rhonda; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 18 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: What is Affirmative. Procurement .Definitions. Regulatory Drivers. Comprehensive Procurement Guidelines. Benefits. Misconceptions.

Derived from text

Procurement; Control

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*.

20040081344 Technical Research Centre of Finland, Espoo, Finland
Mobile Data Sharing and High Availability
Hongisto, M.; 2002; 110 pp.; In English
Report No.(s): PB2004-106090; VTT/RN-2162; No Copyright; Avail: CASI; A06, Hardcopy

This work introduces a model for decentralised and platform-independent data sharing for highly dynamic networks. The goal is not to deliver a solution that can be considered similar to database systems. Communication and replication challenges are presented and examined from the perspective of nomadic computing. The aim has been to provide highly available data sharing over features over mobile distributed systems. The primary functionality of the data-sharing model introduced here has been validated with simulations. A fully functional data-sharing model has been implemented and tested in a simulated environment. A simulated environment was chosen over real network conditions in order to offer data distribution pattern tracking in several different network topologies and environments. This study provides understanding of the data sharing factors that are important in decentralised distribution models.
NTIS
Data Management; Mobile Communication Systems; Networks

20040081355 Federal Bureau of Investigation, Washington, DC, USA
Federal Bureau of Investigation's Efforts to Improve the Sharing of Intelligence and Other Information
2004; 114 pp.; In English
Report No.(s): PB2004-106285; No Copyright; Avail: CASI; A06, Hardcopy

The Federal Bureau of Investigation (FBI) has established as its highest priority the prevention of terrorist attacks on the USA. The accomplishment of this critical national security mission requires the FBI to collect, analyze, and appropriately disseminate intelligence and other information needed to disrupt or defeat terrorist activities. However, in the past, Congressional inquiries concerning the September 11, 2001, terrorist attacks on the USA, reports of commissions examining terrorism before and since September 11, and Office of the Inspector General (OIG) reports have suggested various weaknesses in the FBI's ability to effectively carry out the vital intelligence component of its counterterrorism program. As a result, the OIG initiated this audit to review the FBI's progress in addressing deficiencies in the FBI's intelligence-sharing capabilities that the FBI, Congress, the OIG, and others identified subsequent to the September 11 terrorist attacks. Our audit focused specifically on the FBI's: Identification of impediments to the sharing of counterterrorism-related intelligence and other information; improvement of its ability to share intelligence and other information both within the FBI and to the intelligence community and state and local law enforcement agencies; and dissemination of useful threat and intelligence information to other intelligence and law enforcement agencies.
NTIS
Intelligence; Terrorism

20040081440 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Enhancing the IGS Data and Products Infrastructure: A Data Center Perspective
Scharber, Michael; Noll, Carey; 2004; 1 pp.; In English; IGS Workshop 2004, 29 Feb. - 5 Mar. 2004, Berne, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

The Data Transfer and Data Centers session will present papers on current data center activities as well as various topics geared towards enhancing the availability and acquisition of International Global Positions System Service (IGS) data and products. These topics include: strategies for reducing data file latency at IGS Data Centers, standardization of data file replacement notification methods, improving the efficiency of data file transfer among IGS Data Centers, and defining a network topology for GPS data files for use in applications.
Derived from text
Global Positioning System; Data Management; Data Transfer (Computers); Data Acquisition

20040081511 Department of Defense, Washington, DC, USA

Modeling the User for Education, Training and Performance Aiding

Foster, Robert E.; Fletcher, J. D.; Advanced Technologies for Military Training; April 2004; 22 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

If we are to present instruction that is available anytime and anywhere, takes advantage of the substantial tutorial efficiencies of one teacher for every student, and is affordable, we must have recourse to technology, specifically computer technology. Such technology can be used in instructional applications that range from drill and practice and tutorial dialogues, to multiplayer simulations and games. It can be used in stand-alone modes or it can be used to supplement classroom instruction. It can be used by individuals or by groups. In all cases, however, it must take account of the current state of the learner, the eventual state of the learner that the instruction is intended to produce, and the instructional techniques that reliably effect transitions from one state to the other. Models of the learner that represent these current and objective states must to an appreciable extent be models of the learner s cognition, which produces the skills, performance, and competence needed for success in all military operations. These models may be implicit as found in intrinsically programmed instruction, or they may be explicit. Both types may be seen in technology-based instruction from its beginning. Early explicit models were largely quantitative, involving fairly simple instructional paradigms, but fairly elaborate mathematics, including instructional applications of optimal control theory. Current efforts are more concerned with qualitative models, 19 of which are briefly described and discussed. These models all contribute to some degree to the efficiency and effectiveness of technology-based instruction. However, new challenges have arisen from today s uncertain, asymmetric operational environment, which may require responses that cannot be foreseen nor well prepared for in advance. Instead we must prepare our military forces and personnel to expect the unexpected and be prepared for it with individual and collective agility, creativity, and adaptability. These qualities are fundamentally cognitive in nature and require more powerful and comprehensive cognitive models if they are to successfully serve our programs of education, training, and performance aiding.

Author

Optimal Control; Programmed Instruction; Education

20040081515 Army Research Inst., Alexandria, VA, USA

Augmenting Electronic Environments for Leadership

Psotka, Joseph; Robinson, Ken; Streeter, Lynn; Landauer, Thomas; Lochbaum, Karen; Advanced Technologies for Military Training; April 2004; 16 pp.; In English; See also 20040081500; Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Adapting instructional content to match the background knowledge of the student has been a long-standing goal of student modeling and tutoring. To this end, cognitive scientists have developed student models that rely on manual knowledge bases relevant to the particular instructional task at hand. Normally, these include domain content, instructional content, models of student misconceptions, and more. While tailoring instruction to the learner has been shown to be effective, current approaches are difficult to implement because of the enormous amount of skilled professional effort required. Ideally, the system should automatically select the most appropriate content for the student based on a minimal amount of student data. This educational desideratum has been coined the ″Goldilocks Principle″--- providing lessons, texts, probes, etc. that are neither too advanced nor too elementary, but just right - in the ″zone of proximal development (ZPD)″, known to be important for promoting efficient learning. In an early study, Wolfe et al. (1998) used Latent Semantic Analysis (LSA) to automatically select the next text passage for students to read and achieved one-sigma learning augmentation effects. In the study reported here, we examined the Goldilocks Principle in the context of an LSA - enhanced online discussion environment, where contributions were automatically selected to be most similar in meaning to learners notes or contributions. We found that these contributions were almost always of somewhat higher judged quality. We suggest that this implementation of the Goldilocks Principle is a consequence of how LSA represents consensual knowledge, and provides an automatic way for selecting the next best piece of material for a student to learn, making this an important contribution to tutoring.

Author

Students; Education

20040082046 NASA Goddard Space Flight Center, Greenbelt, MD, USA

An Approach to Tailoring Major Technical Reviews Based on Project Characteristics and Stakeholder Interests

Richstein, Alan B.; Nolte, Jerome T.; Pfarr, Barbara B.; 2004; 13 pp.; In English; 14th Annual International Symposium of the International Council of Systems Engineering, 20-24 Jun. 2004, Toulouse, France; Copyright; Avail: CASI; A03, Hardcopy

There are numerous technical reviews that occur throughout the systems engineering process life cycle. Many are well

known by project managers and stakeholders such as developers and end users, an example of much is the critical design review (CDR). This major milestone for a large, complex new project may last two or more days, include an extensive agenda of topics, and entail hundreds of hours of developer time to prepare presentation materials and associated documents. Additionally, the weeks of schedule spent on review preparation is at least partly at the expense of other work. This paper suggests an approach for tailoring technical reviews, based on the project characteristics and the project manager s identification of the key stakeholders and understanding of their most important issues and considerations. With this insight the project manager can communicate to, manage expectations oc and establish formal agreement with the stakeholders as to which reviews, and at what depth, are most appropriate to achieve project success. The authors, coming from diverse organizations and backgrounds, have drawn on their personal experiences and summarized the best practices of their own organizations to create a common framework to provide guidance on the adaptation of design reviews to other system engineers.
Derived from text
Systems Engineering; Design Analysis; Earth Sciences; Information Management

20040082291 NASA Marshall Space Flight Center, Huntsville, AL, USA
The NASA Materials Science Research Program: It's New Strategic Goals and Opportunities
Schlagheck, Ronald A.; Stagg, Elizabeth; [2004]; 1 pp.; In English; 2nd International Symposium on Physical Sciences in Space, 23-27 May 2004, Toronto, Canada; No Copyright; Avail: Other Sources; Abstract Only

In the past year, the NASA s Office of Biological and Physical Research (OBPR) has formulated a long term plan to perform strategical and fundamental research bringing together physics, chemistry, biology, and engineering to solve problems needed for current and future agency mission goals. Materials Science is one of basic disciplines within the Enterprise s Division of Physical Sciences Research. The Materials Science Program participates to utilize effective use of International Space Station (ISS) and various world class ground laboratory facilities to solve new scientific and technology questions and transfer these results for public and agency benefits. The program has recently targeted new investigative research in strategic areas necessary to expand NASA knowledge base for exploration of the universe and some of these experiments will need access to the microgravity of space. The program is implementing a wide variety of traditional ground and flight based research related types of fundamental science related to materials crystallization, fundamental processing, and properties characterization in order to obtain basic understanding of various phenomena effects and relationships to the structures, processing, and properties of materials. , In addition new initiatives in radiation protection, materials for propulsion and In-space fabrication and repair focus on research helping the agency solve problems needed for future transportation into the solar system. A summary of the types and sources for this research is presented including those experiments planned for a low gravity environment. Areas to help expand the science basis for NASA future missions are described. An overview of the program is given including the scope of the current and future NASA Research Announcements with emphasis on new materials science initiatives. A description of the planned flight experiments to be conducted on the International Space Station program along with the planned facility class Materials Science Research Rack (MSRR) and Microgravity Glovebox (MSG) type investigations. Some initial results from the first three materials experiments are given.
Author
Technology Transfer; Radiation Protection; Microgravity; Maintenance; Crystallization

20040082373 NASA Marshall Space Flight Center, Huntsville, AL, USA
S&MA Requirements Tool (SMART)
Kulpa, Vyga; June 06, 2004; 15 pp.; In English; Seventh Annual Assurance Technology Symposium, 8-11 Jun. 2004, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

In FY03 QS10 began building an S&MA web based data management tool,″Safety & Mission Assurance Requirements Tool″ (SMART) that identifies S&MA requirements, tailors requirements to IAW project/program categories, tracks implementation, and provides a template for developing requirements and tracking waivers. This report provides a SMART process flow, typical application, typical data requirement deliverables, progress in 03, and FY04 activities.
Derived from text
Data Management; Data Bases; On-Line Systems; Information Management

20040082408 Department of Energy, Washington, DC
DOE's Public Database for Green Building Case Studies
Torcellini, P. A.; Crawley, D. B.; Nov. 2003; 18 pp.; In English
Report No.(s): DE2004-15006752; No Copyright; Avail: Department of Energy Information Bridge

To help capture valuable information on ‘green building’ case studies, the U.S. Department of Energy has created an online database for collecting, standardizing, and disseminating information about high-performance, green projects. Type of information collected includes green features, design processes, energy performance, and comparison to other high-performance, green buildings.
NTIS
Energy Conservation; Buildings; Data Bases

20040082428 General Accounting Office, Washington, DC
Homeland Security: Performance of Information System to Monitor Foreign Students and Exchange Visitors Has Improved, but Issues Remain
Jun. 2004; 104 pp.; In English
Report No.(s): PB2004-106134; GAO-04-690; No Copyright; Avail: CASI; A06, Hardcopy
The Department of Homeland Security (DHS) has implemented the Student and Exchange Visitor Information System (SEVIS) to collect and record key data on foreign students, exchange visitors, and their dependents-prior to their entering the USA, upon their entry, and during their stay. In accordance with Conference Report 108-280, GAO reviewed SEVIS. Among the areas it examined were (1) system performance, (2) actions to improve performance, and (3) plans for collecting the fee to be paid by foreign students and exchange visitors to cover SEVIS costs.
NTIS
Information Systems; Collection

20040082443 Technical Research Centre of Finland, Espoo, Finland
FINNUS: The Finnish Research Programme on Nuclear Power Plant Safety 1999-2002
Kyrki-Rajamaki, R.; Puska, E. K.; 2002; In English
Report No.(s): PB2004-106092; VTT/RN-2165; No Copyright; Avail: National Technical Information Service (NTIS)
FINNUS(1999-2002) is the Finnish public research program on nuclear power plant safety, launched and administrated by the Ministry of Trade and Industry (KTM). The program has concentrated on aging, accidents and risks. This final report summarises the goals and results of the program.
NTIS
Nuclear Power Plants; Safety

20040082623 Naval Postgraduate School, Monterey, CA
Calculating Costs for Quality of Security Service
Spyropoulou, Evdoxia; Levin, Timothy; Irvine, Cynthia; Dec. 2000; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423571; No Copyright; Avail: CASI; A03, Hardcopy
This paper presents a Quality of Security Service (QoSS) costing framework and demonstration. A method for quantifying costs related to the security service and for storing and retrieving security information is illustrated. We describe a security model for tasks,which incorporates the ideas of variant security services invoked by the task, dynamic network modes, abstract security level choices and resource utilization costs. The estimated costs can be fed into a resource management system to facilitate the process of estimating efficient task schedules. Integration and scalability issues have been taken into account during the design of the QoSS costing demonstration, which we believe is suitable for incorporation into a resource management system research prototype;
DTIC
Computer Networks; Costs; Quality Control; Resources Management; Security

20040082655 Defence Science and Technology Organisation, Salisbury
The Prototype Automated Research Management System (ARMS)
Prekop, Paul; Burnett, Mark; Chapman, Chris; Feb. 2004; 35 pp.; In English
Report No.(s): AD-A423637; DSTO-TN-0540; DODA-AR-013-011; No Copyright; Avail: CASI; A03, Hardcopy
Automated Research Management System (ARMS) is a knowledge management application designed to address many of the knowledge management problems identified by SmartWays and FASSP’s Knowledge Management Review. ARMS supports knowledge management by recording and exposing the knowledge and expertise of DSTO Staff, providing organisation-wide methods for S&T Staff to find and interact with other staff with similar or complementary skills, experiences or interests, and by providing a coherent and organisation-wide R&D corporate memory of current and past DSTO work. This

report presents a set of detailed use-cases for the ARMS prototype, and the piloting process that will be used to test and evaluate it.
DTIC
Automatic Control; Information Systems; Knowledge Based Systems; Management Systems; Prototypes; Research Management

20040082706 Army War Coll., Carlisle Barracks, PA
Joint Interagency Coordination Groups (JIACGs), A Temporary Solution to a Long Term Requirement
Sopher, Terry R., Jr; Mar. 19, 2004; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423755; No Copyright; Avail: CASI; A03, Hardcopy

The value of JIACGs at the Combatant Commands has been proven to the Department of Defense the Department of Justice Federal Bureau of Investigation Central Intelligence Agency U.S. Customs Service and Department of State. The authority and understandings that established JIACGs are sufficient. What remains problematic and has been the single largest contributor to periods of less than optimal interagency coordination are the missing means - people. The type of personnel required in the JIACGs cannot be grown overnight; however they can be groomed and trained. They must be assigned for a period of not less than two years and they require some education in the interagency process. To task the agencies and departments to provide this out of hide assures non-compliance. To provide the departments and agencies with a specific means/incentive to man/ participate in the JIACGs would go a long way in ensuring interagency coordination at the Combatant Commands in support of national security interests.
DTIC
Coordination; Organizations; Security

20040082707 Army War Coll., Carlisle Barracks, PA
Leveraging the Media: The Embedded Media Program in Operation Iraqi Freedom
Starnes, Glenn T.; Mar. 8, 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423756; No Copyright; Avail: CASI; A03, Hardcopy

In the planning for the war in Iraq Secretary of Defense Donald Rumsfeld took a bold step and enacted a major change to the public affairs approach for military operations. In February 2003 he approved the concept of embedding reporters with frontline forces. The Defense Secretary along with other strategic leaders seeking to end Saddam Hussein's regime wanted the American people and the world to see, hear and feel the war up close and personal. The embedded reporters told a story that otherwise would not have been told. The Embedded Media Program was also an essential part of the Information Operations Campaign. Strategic and operational leaders leveraged (not manipulated) the media in order to enhance and in some cases achieve information operations objectives. Specifically the US-led coalition countered Iraqi propaganda while affecting tactical and operational actions on the battlefield. The ability to leverage the media coverage of the war assisted the coalition in achieving information superiority. The Embedded Media Program allowed the military to harness an important tool in waging war in the 21st century.
DTIC
Embedding; Iraq; Military Operations

20040082708 Army War Coll., Carlisle Barracks, PA
Embedding Success into the Military-Media Relationship
Rodriguez, Jose L.; Mar. 19, 2004; 31 pp.; In English
Report No.(s): AD-A423760; No Copyright; Avail: CASI; A03, Hardcopy

The intent of this research paper is to analyze the embedded media policy via the relationship of the media and military prior to during and following major hostilities in Operation Iraqi Freedom. Focus will be on the development execution and effectiveness of the embed policy vis-a-vis DoD's efforts to leverage the media in its information campaign.
DTIC
Embedding; Iraq

20040082766 Stanford Univ., Stanford, CA
The International Workshop on Structural Health Monitoring (4th) Held in Stanford, California on September 15- 17, 2003
Chang, Fu-Kuo; May 30, 2004; 34 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0419
Report No.(s): AD-A423869; AFRL-SR-AR-TR-04-0315; No Copyright; Avail: CASI; A03, Hardcopy

The Fourth International Workshop on Structural Health Monitoring was successfully organized at Stanford University on Sept. 15-17, 2003 under the sponsorship of the National Science Foundation, the US Army Research Office, and the Air Force Office of Scientific Research. The objectives of the Workshop were to: - review the progress of the current rapid development in technologies related to the field; - identify key and emerging issues in research and development, and; - promote exchange and cross-fertilization across many disciplines (sensors. sensor systems, networking, computing, data mining, diagnostics, prognostics, signal processing, multifunctional materials, etc.) and applications (ground/air/space transportation vehicles, missiles and launch systems, civil infrastructures, and marine structures.)
DTIC
Health; Management Systems; Medical Services

20040082778 Army War Coll., Carlisle Barracks, PA
Our National Information Infrastructure; An Immediate Concern in National Security Policy
Hamilton, Brian P.; Mar. 19, 2004; 25 pp.; In English
Report No.(s): AD-A423907; No Copyright; Avail: CASI; A03, Hardcopy

The USA continues to experience a phenomenal growth in the Internet combined with an increased dependence upon the automated systems within its information infrastructure. This tremendous growth is accompanied with a commensurate increase in cyber attack and crime. Both nonstate and state sponsored enemies are becoming more organized and talented and experts view the greatest dangers in cyberspace as villains lying in wait withholding full-fledged cyber attack until the opportunity for sufficient strategic advantage presents itself. The USA current security policies and strategies depend upon voluntary adherence to government recommendations with few regulations standards or financial incentives to gain private sector support. The potential losses associated with failing to secure cyberspace are too high. This paper provides an assessment of national efforts to secure cyberspace and puts forward recommendations to strengthen this critical national infrastructure. The USA must reassess its national strategies and with practical incentives enforce stronger measures to secure its information infrastructures. Otherwise the nation will face unforeseen potentially catastrophic consequences.
DTIC
Policies; Security

20040082792
WEAR (World Engineering Anthropometry Resource) Workshop 1
Sep. 22, 2003; 88 pp.; In English
Contract(s)/Grant(s): F61775-02-WF044
Report No.(s): AD-A423929; CSP-02-5044; No Copyright; Avail: CASI; A05, Hardcopy

This is an interdisciplinary workshop focused on anthropometrics and broad-based data sharing in this field. Topics include anthropometrics data itself, 3-D modeling of the human body, and database standardization to maximize utility. During this workshop the WEAR Group would jointly prepare a document with recommendations for the international information system. The objective is to come up with a draft outline and perhaps a few notes about the document at the end of this workshop in Paris. The participation at the CARS (Computer Assisted Radiology and Surgery) Conference on June 26 to 28, with a special session for the WEAR Group on June 28 Morning, will be an opportunity to get some feedback from the presentations of the members of the Group and to integrate remarks and needs from the medical imaging community concerning image information systems.
DTIC
Anthropometry; Wear

20040082809 Department of Defense, Washington, DC
A Reference Guide for Marking DoD Documents
Jul. 2004; 75 pp.; In English
Report No.(s): AD-A423966; No Copyright; Avail: CASI; A04, Hardcopy

Marking is the principal way of letting holders of information know the specific protection requirements for that information. Markings and designations serve several purposes: Alert holders to the presence of classified information, information protected under the Freedom of Information Act (FOIA), and technical information with restrictions on its dissemination. Identify, as specifically as possible, the exact information needing protection. Indicate the level of classification and any other markings for control of the information. Give information on the source(s) and reasons for classification or other restrictions. Warn holders of special access, control, or safeguarding requirements. This guide gives Department of Defense

(DoD) staff and contractors an overview of the kinds of marking required to protect classified and unclassified controlled information that cannot be disseminated to all audiences. The guide offers an integrated approach to the major requirements for marking and control of information, briefly explaining the reasons for marking and providing examples of correctly marked documents. This guide is not a substitute for training in the major systems of DoD document and data control. If your job includes original or derivative classification, decisions about FOIA exemptions, or management of scientific and technical information, you must attend specialized training.
DTIC
Classifications; Data Management; Handbooks; Information Transfer; Security

20040082813 Secretary of the Air Force, Washington, DC
Guide To Bare Base Facility Erection - Air Force Handbook 10-222, Volume 6
Apr. 1999; 92 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423974; No Copyright; Avail: CASI; A05, Hardcopy

This handbook is designed to assist you to erect and strike the most common types of Harvest Falcon bare base facilities. These include the TEMPER tent. expandable shelter container and general purpose shelter. The handbook discusses site selection and layout. Major components of each facility. erection procedures and disassembly procedures. When coupled with information contained in AFPAM t()-2t9 Vol. 5. Bare Base Conceptual Planning Guide. applicable technical orders. and instruction received at Silver Flag Training sites. personnel should be capable of effectively setting up a bare base facility complex.
DTIC
Construction; Handbooks

20040082819 Joint Warfighting Center, Fort Monroe, VA
The Joint Warfighting Center, Joint Doctrine Series, Pamphlet 4, Doctrinal Implications of Operational Net Assessment (ONA)
Feb. 24, 2004; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423983; No Copyright; Avail: CASI; A03, Hardcopy

This US Joint Forces Command (USJFCOM) Joint Warfighting Center (JWFC) pamphlet Doctrinal Implications of Operational Net Assessment is part of a ″Joint Doctrine Series″ intended to facilitate changes to joint doctrine based on the good ideas and other results that emerge from the Joint Concept Development and Experimentation Program and related joint doctrine development initiatives. The primary purpose of JWFC Doctrine Pam 4 is to raise awareness promote debate and discuss doctrinal implications associated with the initiative to develop and field an operational net assessment (0 NA) capability for the joint force. Operational net assessment is one of the important enablers for the Standing Joint Force Headquarters (SJFHQ) one of USJFCOM's top transformation priorities. ONA is a new approach that has the potential to improve dramatically what we know about all elements of the battlespace. This approach integrates people processes and tools which use multiple information sources and collaborative analysis to generate products that improve decision-making. The goal is to develop the kind of actionable knowledge that helps decision-makers focus capabilities when where and how needed to achieve desired outcomes.
DTIC
Military Operations

20040082820 Joint Warfighting Center, Fort Monroe, VA
The Joint Warfighting Center, Joint Doctrine Series, Pamphlet 5, Operational Implications of the Collaborative Information Environment (CIE)
Jun. 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423984; No Copyright; Avail: CASI; A03, Hardcopy

This US Joint Forces Command (USJFCOM) Joint Warfighting Center (JWFC) pamphlet Operational Implications of the Collaborative Information Environment (CIE) is the fifth pamphlet of a ″Joint Doctrine Series″ intended to facilitate understanding of key concepts that emerge from the Joint Concept Development and Experimentation Program and related joint doctrine development initiatives. JWFC Doctrine Pamphlet 5 is designed to give readers a basic knowledge of the value of collaboration capabilities how they might be implemented in the near future and possible operational implications. Collaboration capabilities can affect all aspects of joint operations. Although these capabilities can improve efficiency and common understanding during routine peacetime interaction among participants their potential value is most evident during

time-compressed operations associated with combat and intense non-combat operations. These capabilities are important to Department of Defense efforts to transform the way we plan and execute joint operations. To accomplish this transformational task we must improve collaboration among combatant commands Services agencies and multinational partners. An environment of collaboration can enable and integrate such a cooperative effort among these organizations and help the joint force achieve decision superiority.
DTIC
Military Operations; Planning

20040082821 Joint Warfighting Center, Fort Monroe, VA
The Joint Warfighting Center, Joint Doctrine Series, Pamphlet 3, Doctrinal Implications of the Standing Joint Force Headquarters (SJFHQ)
Feb. 24, 2004; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423985; No Copyright; Avail: CASI; A03, Hardcopy

This US Joint Forces Command (USJFCOM) Joint Warfighting Center (JWFC) pamphlet Doctrinal Implications of Operational Net Assessment is part of a ″Joint Doctrine Series″ intended to facilitate changes to joint doctrine based on the good ideas and other results that emerge from the Joint Concept Development and Experimentation Program and related joint doctrine development initiatives. The primary purpose of JWFC Doctrine Pam 3 is to raise awareness promote debate and discuss doctrinal implications associated with the initiative to develop and field an operational net assessment (0 NA) capability for the joint force. Operational net assessment is one of the important enablers for the Standing Joint Force Headquarters (SJFHQ) one of USJFCOM's top transformation priorities. ONA is a new approach that has the potential to improve dramatically what we know about all elements of the battlespace. This approach integrates people processes and tools which use multiple information sources and collaborative analysis to generate products that improve decision-making. The goal is to develop the kind of actionable knowledge that helps decision-makers focus capabilities when where and how needed to achieve desired outcomes.
DTIC
Military Operations

20040082822 Joint Warfighting Center, Fort Monroe, VA
The Joint Warfighting Center, Joint Doctrine Series, Pamphlet 2, Doctrinal Implications of Low Collateral Damage Capabilities
Feb. 24, 2004; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423986; No Copyright; Avail: CASI; A03, Hardcopy

This US Joint Forces Command (USJFCOM) Joint Warfighting Center (JWFC) pamphlet Doctrinal Implications of Operational Net Assessment is part of a ″Joint Doctrine Series″ intended to facilitate changes to joint doctrine based on the good ideas and other results that emerge from the Joint Concept Development and Experimentation Program and related joint doctrine development initiatives. The primary purpose of JWFC Doctrine Pam 2 is to raise awareness promote debate and discuss doctrinal implications associated with the initiative to develop and field an operational net assessment (0 NA) capability for the joint force. Operational net assessment is one of the important enablers for the Standing Joint Force Headquarters (SJFHQ) one of USJFCOM's top transformation priorities. ONA is a new approach that has the potential to improve dramatically what we know about all elements of the battlespace. This approach integrates people processes and tools which use multiple information sources and collaborative analysis to generate products that improve decision-making. The goal is to develop the kind of actionable knowledge that helps decision-makers focus capabilities when where and how needed to achieve desired outcomes.
DTIC
Damage; Military Operations

20040082823 Joint Warfighting Center, Fort Monroe, VA
Joint Warfighting Center Pam 1, Pamphlet for Future Joint Operations, Bridging the Gap Between Concepts and Doctrine
Feb. 24, 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423987; No Copyright; Avail: CASI; A03, Hardcopy

This Joint Warfighting Center (JWFC) Pamphlet for Future Joint Operations (PFJO) supports the transformation objectives and responsibilities described in USA Joint Forces Command (USJFCOM) publication Toward Transformation

2001. The primary purpose of the PFJO and supporting work is to facilitate changes to joint doctrine based on the good ideas and other results that emerge from the Joint Experimentation (JE) program and other transformation initiatives. An important secondary purpose is to periodically summarize concepts and experimentation objectives for participants in key events such as Exercise MILLENNIUM CHALLENGE 2002 (MC 02). This version of the PFJO provides the philosophy for accomplishing these purposes as we approach MC 02. Success in this endeavor will require a close working relationship with the JE Program and awareness of Joint Staff combatant command and Service conceptual efforts and other transformation-related initiatives. We must also determine a process and organization of supporting documents that will capture assess compare and integrate key ideas that could improve joint doctrine in the near term. We currently envision a subordinate set of JWFC pamphlets as described in Section IV that will help stimulate discussion of emerging doctrinal issues in the joint community. Although this pamphlet summarizes some of the concept elements contained in USJFCCM%s joint experimentation concepts such as Rapid Decisive Operations (RD 0) readers should refer to the approved RDO integrating concept (version 2.0) the Joint Force Headquarters (JFHQ) Concept of Employment for MC 02 and other relevant concept papers for details.
DTIC
Military Operations

20040082952 Army War Coll., Carlisle Barracks, PA
Streamlining National Security Workshop
Tussing, Bert; Menk, Peter; Oct. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423874; No Copyright; Avail: CASI; A01, Hardcopy

Current deliberations in Washington bear witness to the fact that defense of the homeland may require new policies, new infrastructure, and even new laws. But before any of these are approached, a full understanding of existing capabilities and of their integration within current interagency and intergergovernmental structures may mark the truest and most prudent course for us to follow on our journey back to homeland security. The Center for Strategic Leadership will pursue the development and examination of these issues through various venues and forums. It is hoped that the efforts of the participants at this workshop and in follow-on efforts will ultimately contribute to a significantly improved U.S. national security structure.
DTIC
Security; Streamlining

20040082956 Army War Coll., Carlisle Barracks, PA
Department of State Strategic Planning Workshop
Reynolds, Jeffrey C.; Apr. 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423882; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the conference was to expose Department of State participants to Army strategic planning and how it is incorporated into the professional development of the officer corps. Participants attended briefings on Army processes and then met in four workshop groups to examine the Department of State planning process, training and education, cooperation and planning between State and the Department of Defense (DoD), and future visioning. The breakout groups presented their conclusions in a plenary session before the conference adjourned.
DTIC
Management Planning; Military Operations; Planning

20040082957 Army War Coll., Carlisle Barracks, PA
Strategic Leaders Adapting to the Future Environment: Department of State Senior Leader Workshop. Volume 02-03
Wimbish, Bill; Feb. 2003; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423894; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the workshop was to provide participants an opportunity to first review and examine current strategic leadership theories and concepts and how the Army develops and trains its officer corps for future strategic leadership roles Second the workshop was to provide a forum to share and discuss old and new organizational and cultural challenges affecting the State Department and to develop or refine current action plans for the future. Last, but most important, the event was intended elicit commitment to improvements in the work place that better allow civil service and foreign service staffs to practice effective leadership behaviors.
DTIC
Leadership; Personnel

20040082960 Army War Coll., Carlisle Barracks, PA

Strengthening The Bonds of Environmental Cooperation Between Security Forces and Environmental Institutions

Griffard, Bernard F.; Jun. 2002; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A423910; No Copyright; Avail: CASI; A01, Hardcopy

Environmental cooperation promotes overall regional and hemispheric stability and strengthens military and civilian relationships. Participation in discussions and activities that assist in changing the environmental impact of militaries from the negative to the neutral to the positive is in the interests of the Southern Cone nations and the USA. Long-term success however depends on effective follow-up. Three target areas appear promising: cooperation to minimize the environmental impact of military operations; improving regional capabilities to respond to disasters; and training and information exchange to better manage the trans- boundary rivers of the Plata Basin.

DTIC

Bonding; Environmental Surveys; Personnel; Security

20040084056 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Technical Standards Program

Gill, Paul S.; Vaughan, WIlliam W.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 7 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The NASA Technical Standards Program was officially established in 1997 as result of a directive issued by the Administrator. It is responsible for Agency wide technical standards development, adoption (endorsement), and conversion of Center-unique standards for Agency wide use. One major element of the Program is the review of NSA technical standards products and replacement with non-Government Voluntary Consensus Standards in accordance with directions issued by the Office of Management and Budget. As part of the Program s function, it developed a NASA Integrated Technical Standards Initiative that consists of and Agency wide full-text system, standards update notification system, and lessons learned - standards integration system. The Program maintains a ″one stop-shop″ Website for technical standards ad related information on aerospace materials, etc. This paper provides information on the development, current status, and plans for the NAS Technical Standards Program along with metrics on the utility of the products provided to both users within the nasa.gov Domain and the Public Domain.

Author

Aircraft Construction Materials; Spacecraft Construction Materials; Texts

20040084077 Qualis Corp., Huntsville, AL, USA

Fracture Control Requirements for Composite and Bonded Structures

Faile, Gwyn C.; [2004]; 7 pp.; In English; NASA Fracture Control Methodology Panel, 2-4 Jun. 2004, San Antonio, TX, USA

Contract(s)/Grant(s): 794-40-4C

Report No.(s): MG-04-0205; No Copyright; Avail: CASI; A02, Hardcopy

Current new requirements document are top level or specific to shuttle payloads. NASA-STD-5007 top level requirement that imposes fracture control on all manned spacecraft hardware. Composites addressed at very top level. NASA_SDT-5003 imposes fracture control on payloads for the space shuttle. Imposes fracture control on composite and bonded structures. Silent on many important issues such as post proof NDE, residual strength, and reuse. Not adequate for or directly applicable to next generation of spacecraft.

Derived from text

Fracturing; Residual Strength; Nondestructive Tests; Requirements; Documents

20040084101 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Protection of the FM12-Respirator During Operational Conditions, Part 2

vanderGijp, S.; Kievit, O.; March 2004; 36 pp.; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A96/KL/517; TNO Proj. 014.11809

Report No.(s): PML-2004-A19-Pt-2; TD-2004-0019-Pt-2; Copyright; Avail: Other Sources

A system has been developed, capable of measuring the protection factor in the field. It was used to compare a laboratory (NATO) protocol with a field protocol, by testing a statistically sound panel of 25 people. The field protocol was found to be more challenging than the NATO protocol. Applying the field protocol the protection factor of 16% of the panel dropped below the threshold of 10.000; with the NATO protocol all subjects were protected above this level. A new test method using the

Portacount was validated by comparison with standard methods like the SF6 and the sodium chloride method. Attempts were made to correlate movement and pressure inside the mask with a reduction in protection factor, but without much success. It is concluded that other, un- known factors, play an important role in the leakage process.
Author
Respirators; Masks; Protection

20040084102 Prins Maurits Lab. TNO, Rijswijk, Netherlands
A Case Study for Non Penetrating Projectiles with Model EON
Krabbendam, A. J.; February 2004; 41 pp.; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): V901-WP2; TNO Proj. 014.15435
Report No.(s): PML- 2003-A94; TD-2002-0268; Copyright; Avail: Other Sources

A case-study was performed to determine the possibilities and restraints of the NLW effectiveness model EON. The case-study considered the evaluation of 5 types of Non Penetrating Projectile ammunitions. Several ideas of the NATO SAS-035 group were incorporated in the EON implementation. The weapon effects within EON are described by three factors concerning task achievement, target effect recovery and collateral unintended effects. The case study results and conclusions could be compared to earlier conclusions, drawn from experimental trials. The EON results add quantitative insight to the performance of NPP. The main restraint seems to be the lack of detailed knowledge about direct NLW effects on targets.
Author
Weapons; Effectiveness

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20040081372 Nebraska Univ., Omaha, NE, USA
The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1
Bowen, Brent, Editor; Gudmundsson, Sveinn, Editor; Oum, Tae, Editor; July 2003; 157 pp.; In English; 2003 Air Transport Research Society World Conference, 10-12 Jul. 2003, Toulouse, France; See also 20040081373 - 20040081381
Report No.(s): UNOAI-03-5-Vol-1; Copyright; Avail: CASI; A08, Hardcopy

The following reports from the 2003 Air Transport Research Society (ATRS) World Conference were included for processing into the NA&SD database:The Yield of Emigration - Ethnic Air Transport as an Overlooked Customer Segment; Simulated Consumer Decisions: An Appication of Synthetically Generated Consumer Profiles; The Analyzing of Airport Accessibility in Incheon International Airport; Future Requirments and Concepts for Cabins of Blended Wing Body Configurations - A Scenario Based Approach; Future Scenarios for the European Airline Industry: A Marketing-Based Perspective; The Dynamics of Multilateral Alliancing: A Process Perspective on Airline Alliance Groups; New Insights into the Single Versus Dual-Till Airport Pricing Debate; Effects of Welfare on Different Airport Charge Systems; and Theory and Practice in Aircraft Financial Evaluation.
Derived from text
Marketing; Air Transportation; Airline Operations

20040081373 European Centre for the Aerospace and Aviation Industries, Blagnac, France
Theory and Practice in Aircraft Financial Evaluation
Gibson, William; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 17 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

The world s airlines are continually challenged to deal effectively with uncertainty in the transport sector and the inevitable downturns faced by any business. These cyclical swings are exaggerated by the periodic need to replace older equipment with more modern aircraft. Financial innovations provide a certain number of solutions to the problem of matching transport capacity to the fluctuations of demand.The objective of this paper is to stimulate discussion, research and debate about potential innovations for practitioners in the aviation field. The scope of the paper - like the air- line industry itself - is global, which means that we attempt to point up solutions for airlines in developing as well as mature economies.
Derived from text
Airline Operations; Financial Management

20040081375 Helsinki School of Economics and Business Administratrion, Helsinki, Finland

The Dynamics of Multilateral Alliancing: A Process Perspective on Airline Alliance Groups

Kleymann, Birgit; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 29 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

The proposed paper is a summary of a larger research project that was started in 1998 and that set out to contribute to the understanding of (a) the factors which shape the structuring of multilateral, horizontal alliances and (b) the implications for corporate governance of firms within such an alliancing environment. The paper argues that the positioning of an airline within an alliance group depends on the airline s resource configuration and is furthermore a function of environmental constraints forcing certain types of airlines into certain choices; of conscious, rational strategy devising; and of the degree to which alliance membership (or alliancing itself) gains institutional legitimacy. Because the organisational phenomenon under study can be understood as both a social and a technical phenomenon, the study uses a dual theoretical approach. On one hand, the positioning of airlines in the alliancing environment is examined using a resource dependence perspective. Introducing the terms standalone capability and specific and unspecific dependence , the mitigation of power imbalances in a formal network of firms and the management of interdependencies between partners will be discussed. It will be suggested that the success of an airline within an alliance group depends on that airline s resource configuration and on its ability to position itself in the alliance network according to that configuration. In addition, it will be suggested that in a federated environment, partners fare best if they specialise. The second perspective used is that of institutional theory. Based mainly on the interview material gathered, the aim is to identify the lines along which alliancing is becoming a part of actors mindset, or the institutionalisation of alliancing. Hence, this part deals with the invention of alliances, in other words, how rationally devised structures are enacted in practice. It introduces a concept called countervailing myths , which seems to be a prominent factor in the shaping of the institution alliance . This second part is based on extensive interviews with senior management fiom ten different airlines. The paper concludes with the discussion of a model depicting the factors that influence the dsvehpment of multilateral alliances between autonomous, but interdependent firms, accounting for both centripetal forces (pushing toward tighter member integration) and centrifugal forces (pushing for looser coupling).

Author

Airline Operations; Resources Management

20040081376 Hanseo Univ., Chungnam, Korea, Republic of

The Analyzing of Airport Accessibility in Incheon International Airport

Kim, Woong-Yi; Lee, Kang-Seok; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 11 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

Incheon Interntional Airport have been in constant efforts to establish hub airport in Northeast Asia since its opening of 2001 and is in process to build a variety of infrastructure. To be a hub airport, the airport access problem causin some trouble from opening the airport is one of the certainly solved problems. Right now there isn't any other access road except Yeonyuk Bridge to go Incheon airport. Therefore if the situation such as large traffic accidents or heavy snow happens the airport access would be limited and it would result in a lot of loss.This study identifies best set of explanatory variables to explain in mode choice, using the observation of trip making behavior in Incheon International Auport. Logit h e is used explain the choice behavior between car and bus. The different models are compared; using the variables of different components of travel time and costs, and attitudinal variable, seconcf, total travel time and costs and income level, and finally, components of travel time and cost only. All models are proven to be statistically significant for overall explanatory power.

Author

Consumers; Transportation; Airports

20040081377 Luigi Bocconi Commercial Univ., Milan, Italy

Future Scenarios for the European Airline Industry: A Marketing-Based Perspective

Jarach, David; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 15 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

After an introductory but compulsory parenthesis on the rise of the low-cost phenomenon in the airline industry this paper aims to analyse the new market scenario for the airline industry, focusing on the European context. Furthermore, the paper will analyse the main marketing tactics UE carriers might adopt to cope with the huge wave of low-cost entities and survive in the current tough environment.

Author (revised)

Airline Operations; Marketing

20040081378 Cranfield Univ., Cranfield, UK

New Insights into the Single-Till Versus Dual-Till Airport Pricing Debate

Lu, Ching-Chyuan; Pagliari, Romano I.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 15 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

Some countries have recently leviewed how they regulate the pricing of aeronautical services (landing charges, aircraft parking charges, terminal facility charges etc.) at their principal airports. One major issue that has emerged from each of these reviews is whether it is preferable to adopt a single-till or duaLtill approach to pricing aeronautical services. In this paper the arguments for or against each approach are discussed within the context of reasonableness, implementation, the effects on economic efficiency and the influence of other policy considerations. The paper also finds that the criteria by regulators used to decide between different approaches have often been influenced by a range of non economic factors. The paper suggests a number of alternative approaches to adopting pure duaL till and single-till models such as, asset re- valuation, redeking the scope of reguiaied acnviiies, applyimg dualtill to new investments only, adjusting the allocation of common costs between tills and allowing airport users to secure a financial stake in the airport. Furthermore, it is also recommended that in order to reduce uncertainty, the regulatory approach should be specified in the relevant legislation.

Author

Airports; Financial Management

20040081379 Royal Air Maroc, Toulouse, France

The Yield of ″Migration″: 'Ethnic' Air Transport as an Overlooked Customer Segment

Mehadji, Zouhair Saifeddine; Barzantny, Cordula; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 19 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

Following worker migration, mainly to Northern America and Western Europe, several cultural and ethnic communities live far away fkom their country of origin, they may still consider their home country. In order to stay connected with the wider family life in their country of origin, e.g. to take part in religious and other festive celebrations, these migrants need to return regularly. Since the geographical distance is rather important, air travel is mostly the preferred choice because of convenience. Nevertheless these customers are not necessarily specifically addressed by the airlines. This article focuses on the potential impact of airline marketing and service strategies for these ethnic groups. An explorative field study is used to assess research questions. The results indicate that ethnic transport customers show specific expectations in terms of marketing, ticket pricing and senice for airline policies. Furthermore the generation changes start to impact this customer segment leading to alter the key issues. Some suggestions for airline policies are made. Regardless of different views of customer orientation and corporate policy airlines are not sure to share a lucrative and growing market in the near future any longer, when certain key issues are not carefully addressed.

Author

Airline Operations; Marketing; Ethnic Factors

20040081380 Porto Univ., Portugal

A Note on Welfare Effects of Different Systems of Airport Charges

Barbot, Cristina; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003, pp. 1-17; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

According to theoretica1 predictions, the application of peak-load pricing to utilities usually results in higher levels of welfare and is recommended on this basis. In what concerns airports, this pricing system is adopted by some of EU airports, in order to alleviate congestion by means of demand shifting, while others charge according to aircrafts weigh. This paper provides an insight on the effects on welfare of both pricing systems. Within the framework of a vertical differentiation model, and using a two-stage game with two airlines and one airport, I find that peak-load pricing actually decreases consumer surplus and welfare, but is the preferred system for the airport and for the low quality firm. These results are opposite to previous ones, and some particular features of the model, and of the airports particular case, account for this difference.

Author

Airline Operations; Commercial Aircraft; Financial Management

20040081381 Commonwealth Treasury, Canberra, Australia

Simulated Consumer Decisions: An Application of Synthetically Generated Consumer Profiles

Battersby, Bryn D.; Peacock, Gabriel C.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 1; July 2003; 13 pp.; In English; See also 20040081372; Copyright; Avail: CASI; A03, Hardcopy

This presentation offers a methodology for the construction of a simulation of consumer decisions within the context of the air-travel market. The simulation's primary strength is in the provision of individually structured decision making possibilities across many consumers. The methodology enables the synthetic generation of a profile for each individual consumer thereby providing a rich and adaptive consumer base from which to generate a market. By this method the calculated utility of a product in the market can be shown to be different per individual decision-maker. The methodology is well grounded but commercially successful application depends on the efficacy of the available data.
Author
Air Transportation; Consumers; Prediction Analysis Techniques

20040081384 Instituto Tecnologico de Aeronautica, Sao Paulo, Brazil
Application of the Techniques of Date Envelopment Analysis (DEA) in the Study of the Operational Effectiveness of the Main Venezuelan Airports and the Behavior with the Presence of Military Air Bases
Curiel, Marcos Ramon Flores; Porto, Protogenes Pires; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 15 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The airports will leave of being publish job organizations for converted in enterprise complex system able to generate incomes to the state through the scanning of the different activities that carries through, being the evaluation of the performance of these activities a useful tool in analyze it of this type of companies who articulate its activities through multiple ingressions (input) to get multiples Products (output). The Objective of this study is to present one technique for the global measurement of the operative performance based in the The Application Date Envelopment Analysis, (DEAL) of the main Venezuelan airports, where a general matching was effected by major the movement that they accumulate 95% of national traffic, and the behavior of the efficiency with the Military Air Bases, getting itself as resulted a significant increase of the performance with these installations. We discuss the comparison of some international airports of Latin America, North America and Europe, demonstrating the low performance of this sector in the country, proper feature of country in development way.
Author
Data Processing; Airline Operations; System Effectiveness

20040081385 Monash Univ., Australia
Air Transport Policy and the Measurement of Tourism Benefits
Forsyth, Peter; vanHo, Thiep; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 20 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

Economic benefits which come about as the result of increased tourism to a country are often central in the evaluation of air transport policies. For example, tourism benefits may constitute a large proportion of the benefits to a country from liberalizing a bilateral. Expansion of an airport will often be justified in terms of stimulating tourism, and thus creating to,.a'ism benefits, and a significant proportion of the benefits from a strategic alliance of airlines may be in the form of tourism benefits. While these effects and benefits are recognized, they are usually not measured rigorously. Often simple tourism expenditures, or impacts on output estimated using Input Output multipliers, are used as measures of benefit; such measures greatly exaggerate benefits as they do not take into account the costs of providing goods and services to the tourists. This paper reports on research directed towards obtaining rigorous measures of tourism economic benefits, and applies them to analyse air transport policy issues. The impacts of changes in tourism expenditure on GDP, for example stimulated by bilateral liberalisation, are estimated using a computable general equilibrium model of the Australian economy. The costs of additional resources used in producing this output are then deducted to obtain a measure of net benefits. Additional tourism is found to produce positive net benefits- a result which was not guaranteed. These benefits are much smaller than those obtained from conventionally used approaches. The measures are then used to analyse two aviation policy issues- the liberalisation of bilateral agreements, and the approval of a strategic alliance between two airlines.
Author
Air Transportation; Airline Operations; Tourism; Economic Impact

20040081386 Universidade Federal do Rio de Janeiro, Brazil
Introducing the Low Cost-Low Fare Concept in Brazil: Gol Airlines
NovaesdeAlmeidaSilva, Erik; AntoniodoEspiritoSanto, Respicio, Jr.; The Conference Proceedings of the 2003 Air Transport

Research Society (ATRS) World Conference, Volume 4; July 2003; 25 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

This paper presents the introduction of a low-cost/low-fare (LC/LF) concept in Brazil by Gol Airlines, beginning from January 2001. We will show that some of the core LC/LF strategies of operations and management decisions put into action by North American and European carriers like Southwest and Jetblue, and Ryanair and easyjet, respectively, could not be implemented by Gol in the beginning of its operations, while several others still cannot be implemented at all. Moreover, the paper analyses the impacts and contributions that have resulted from the introduction of (3ol Airlines and its ″Brazilian LC/LF concept″, while presenting and discussing the main issues within the crisis involving the major airlines of Brazil. The recently announced possible-future merger between the two largest Brazilian carriers, VARIG and TAM, is addressed as a major adversary to the growth of Gol's operations and its desired expansion in the Brazilian air transport market. While discussing some of the possible outcomes of this merger to the Brazilian domestic market, we will present some of the strategies already being implemented by the LC/LF carrier to counter this threat, plus another major step towards Gol's future growth: the go-ahead of the Brazilian government on the injection of capital from AIG, to buy 20% of the airline's shares in the first quarter of 2003.

Author

Low Cost; Brazil; Civil Aviation; Airline Operations

20040081390 Cranfield Univ., Cranfield, UK

Comparison of Passenger Selection Criteria: A Study of London-Amsterdam Passengers

Turner, Sheelah; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 18 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The direct competition between no-frills carrier easyJet and network carrier British Airways on the London Gatwick-Amsterdam route led to interest in the profile of passengers using the different types of services, as well as the selection criteria of each type of passenger. A survey was carried out at London Gatwick airport of passengers on all easyJet and British Airways flights to Amsterdam on 22 January 2003. The results lead to the conclusion that the passenger profiles on each of the carriers are slightly different. Furthermore, the selection criteria for each airline type are different: most no-frills passengers rate price as most important while most network carrier passengers rate flight timings. Frequent flier points are still rated highly by network carrier passengers.

Author

Airline Operations; Passengers; Decision Making

20040081393 Imperial Coll. of Science, Technology and Medicine, London, UK

Low Fare Airlines In Asia: An Exploratory Study of Cost Competition, Market Dynamics and Sustainable Advantage

Lawton, Thomas C.; Solomko, Stanislav; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 26 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

Following late on the global trend, low fare airlines (LFAs) have begun to emerge in Asia in recent years. However, while some countries have seen a few minor LFAs enter the market, the long-term survival of these carriers will depend on their ability to compete with Asia's traditional, full service airlines. The prevailing sentiment among the Asian majors, expressed by the Asia Pacific Airlines Association in early 2003, is that ″no-frill fliers are not a threat to Asian airlines″. This paper examines whether such optimism from full-service Asian carriers is based on real facts or if these companies are misjudging the strengths and adaptability of the LFA business model. We will address both revenue and costs aspects of the potential for LFA growth in Asia. The revenue side is important to understand as some industry experts argue that the average domestic and intra-Asian fares are already very price competitive as compared to the historical situation in Western Europe or North America prior to the emergence of LFAs. Another key revenue focus is to examine which Asian countries provide the most favourable market environment for low fare entrants with the least regulatory barriers together with a mobile and open-minded consumer population. On the cost side, we argue that the fundamental difference between the Asian and the North American or Western European aviation markets derives from the fact that Asian majors already possess a lower operating cost structure. Both their network and fleet structures allow them to achieve a lower cost per seat than their European or North American full-service counterparts. Most Asian majors operate in high volume markets with wide-body aircraft that provide them with a lower cost per seat and ensure their market dominance between major population centres. Any emerging LFA will find it more challenging to compete with majors that possess such inherent cost advantages, combined with Asia's more flexible hiring practices and labour.

Author

Airline Operations; Operating Costs; Market Research

20040081394 Cranfield Univ., Cranfield, UK

An Analysis of Competing No-Frills and Full-Service Carrier Fares: A Study of the London-Amsterdam Route

Foster, Andy; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 4; July 2003; 19 pp.; In English; See also 20040081382; Copyright; Avail: CASI; A03, Hardcopy

The development of no-frills scheduled airlines in Europe, most especially in the UK, has led to some key changes in the air transport system. These include major changes in traffic on certain routes, the switch by some carriers to secondary airports, the reduction or with&awl in services by full-service airlines and last but not least, change in fares. EasyJet pioneered a new pricing system for its routes using one-way pricing and a yield management system oriented to increasing fare as day of departure approaches. As a means of competing against easyJet and other low cost carriers, full service airlines have recently adopted what appear to be similar fare schemes and have, through advertising, promoted these low fares to the travelling public. This research sets out to compare the different fares offered by no-frills carriers and full service carriers on one city pair, London to Amsterdam. The analysis was based on a daily view of fares offered between London airports and Amsterdam Schiphol over a six week period in January and February 2003. The research seeks to investigate the dynamics of fare levels as the departure date approaches, as well as the relative changes in fares between carriers and between airports. Amongst the findings are that easyJet offered the lowest fares on the route for the majority of the study period, partly as a result of the fact that during that time they introduced a fare sale. Despite the fare sale, easyJet's fares increased steadily in the last two weeks before departure date. By way of contrast the fares noted for British Airways, who have services fi'om London Heathrow and Gatwick Airports, seemed to suggest a different fare model is being followed both in comparison with easy Jet and between the two airports. At Gatwick, where British Airways compete directly with easy Jet, fares were higher than easy Jet, though not significantly. However, it was noticed that fares do not always rise over time and some reductions were noted as departure date nears. At Heathrow, while some low fires were available, generally the fare levels were significantly higher than on British Airways from Gatwick.

Author

Airline Operations; Commercial Aircraft; Management Systems; Low Cost

20040082366 NASA Marshall Space Flight Center, Huntsville, AL, USA

Ground-Based Telescope Parametric Cost Model

Stahl, H. Philip; Rowell, Ginger Holmes; [2004]; 1 pp.; In English; Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

A parametric cost model for ground-based telescopes is developed using multi-variable statistical analysis, The model includes both engineering and performance parameters. While diameter continues to be the dominant cost driver, other significant factors include primary mirror radius of curvature and diffraction limited wavelength. The model includes an explicit factor for primary mirror segmentation and/or duplication (i.e.. multi-telescope phased-array systems). Additionally, single variable models based on aperture diameter are derived. This analysis indicates that recent mirror technology advances have indeed reduced the historical telescope cost curve.

Author

Telescopes; Mathematical Models; Cost Analysis; Statistical Analysis; Diffraction; Cost Reduction

20040083994 Centor Software Corp., Irvine, CA, USA

Improving Profits with Materials Optimization in Manufacturing

Nunez, Chris E.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 1 pp.; In English; See also 20040083973; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A materials optimization system in a large manufacturing firm can save millions of dollars annually by reducing raw material costs. The system puts a best practice process in place that encourages design engineers to optimize product attributes such as part weight, thickness, and material selections. This leads to a higher engineering confidence level with improved product quality and a reduction in overall product weight.

Author

Manufacturing; Optimization; Materials Selection; Financial Management

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20040082292 NASA Marshall Space Flight Center, Huntsville, AL, USA
Accelerating Exploration Through the Sharing of Best Practices in Research Partnerships
Nall, Mark; Casas, Joseph; [2004]; 1 pp.; In English; 24th International Symposium on Space Technology and Science, 30 May - 6 Jun. 2004, Miyazaki, Japan; No Copyright; Avail: Other Sources

This paper proposes the formation of an international panel of space related public/private partnerships for the purposes of sharing best practices among members. The exploration and development of space is too costly to be conducted by governments alone. Private industry has a significant role in creating needed technologies, and developing commercial space infrastructure, thereby allowing sustainable exploration to take place. Public/private partnerships between government and industry are key to fostering industrial participation in space. The spacefaring nations have, or are developing these partnerships. Those organizations forming these partnerships can benefit from sharing among each other best practices and lessons learned. In this way the common goal of space exploration and development can be more effectively pursued.
Author
Research and Development; Space Exploration; Technology Utilization

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040084158 California Univ., Santa Barbara, CA, USA
Direct Numerical Simulation of Gas-liquid Systems in Variable Gravity Environments
Nave, Jean-Christophe; Banerjee, Sanjoy; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 119-120; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

Liquid films are present in many processes that occur in space applications. It is important to understand interfacial behavior as gravity becomes less important because, depending on the flow regime, interface motion may change dramatically. For instance, we observe enhancement of waves in film flow, when gravity decreases. An understanding of the influence of gravity as a controlling mechanism related to interface structure is important for both fundamental and design purposes. For instance, large topology changes of the gas liquid interface are responsible for enhancement of transfer processes. The types of problems studied here are of interest for condensers and evaporator performance in microgravity. The numerical simulations presented here show different regimes in both gravity and microgravity environments where deformation of the gas/liquid interface is important. We use a finite difference method on a staggered grid, and the projection method to solve the Navier-Stokes equations. In order to deal with large density ratios, we use a ghost fluid method [1], This method allows for a sharp treatment of the interface and also, for first order accurate treatment of surface tension forces. Time integration is performed using a 3rd order Runge-Kutta TVD scheme. The numerical challenges associated with the problem of simulating gas/liquid systems are numerous. The aspect ratio of the waves demands that the physical domain be long, forcing us to use very fine nodalization. Also, the high density ratio between the gas phase and the liquid phase leads to poor convergence of the equations. We have developed a solution technique for the Poisson pressure equation that is quite efficient in this situation. We use a BiConjugate Gradient Stabilized method along with a Incomplete Lower/Upper preconditioner. Using periodic boundary conditions, we present two cases of a horizontal liquid film being driven by a pressure gradient, one with wall normal gravity, the other one with zero gravity. The different simulations are performed in three-dimension and the interface is implicitly tracked using a level set method. Figure 1 shows interfacial waves on falling films at low Reynolds numbers (Re) that agree with experiments, providing validation of the methods.
Derived from text
Gas-Liquid Interactions; Direct Numerical Simulation; Topology; Navier-Stokes Equation; Liquid Phases; Vapor Phases; Technology Utilization

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20040082303 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra Overview
Weisskopf, Martin C.; [2004]; 1 pp.; In English; Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasglow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

We present the status of the instrumentation aboard the Chandra X-Ray Observatory and highlight some of the many many discoveries made over the almost five years of operation.
Author
X Rays; X Ray Astrophysics Facility

20040084023 NASA Marshall Space Flight Center, Huntsville, AL, USA
Microgravity Manufacturing: Extending Rapid Prototyping Past the Horizon
Cooper, Ken; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 26 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Over the last decade, rapid prototyping (RP) technologies have continued to advance in all aspects of operation and application. From continuously advanced materials and processes development to more hard-core manufacturing uses, the RP realm has stretched considerably past its original expectations as a prototyping capability. This paper discusses the unique applications for which NASA has chosen these manufacturing techniques to be utilized in outer space.
Author
Manufacturing; Microgravity; Rapid Prototyping

20040084061 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Integrated Modeling Activities for the James Webb Space Telescope (JWST): Structural-Thermal-Optical Analysis
Johnston, John D.; Parrish, Keith; Howard, Joseph M.; Mosier, Gary E.; McGinnis, Mark; Bluth, Marcel; Kim, Kevin; Ha, Hong Q.; January 2004; 1 pp.; In English; SPIE Astronomical Telescopes Meeting, 21-25 Jun. 2004, Glasgow, Scotland, UK Report No.(s): SPIE Paper 5487-123; Copyright; Avail: Other Sources; Abstract Only

This is a continuation of a series of papers on modeling activities for JWST. The structural-thermal- optical, often referred to as ″STOP″, analysis process is used to predict the effect of thermal distortion on optical performance. The benchmark STOP analysis for JWST assesses the effect of an observatory slew on wavefront error. The paper begins an overview of multi-disciplinary engineering analysis, or integrated modeling, which is a critical element of the JWST mission. The STOP analysis process is then described. This process consists of the following steps: thermal analysis, structural analysis, and optical analysis. Temperatures predicted using geometric and thermal math models are mapped to the structural finite element model in order to predict thermally-induced deformations. Motions and deformations at optical surfaces are input to optical models and optical performance is predicted using either an optical ray trace or WFE estimation techniques based on prior ray traces or first order optics. Following the discussion of the analysis process, results based on models representing the design at the time of the System Requirements Review. In addition to baseline performance predictions, sensitivity studies are performed to assess modeling uncertainties. Of particular interest is the sensitivity of optical performance to uncertainties in temperature predictions and variations in metal properties. The paper concludes with a discussion of modeling uncertainty as it pertains to STOP analysis.
Author
James Webb Space Telescope; Structural Analysis; Thermal Analysis; Optical Properties; Temperature Distribution; Performance Prediction

20040084176 Idaho Univ., ID, USA
Oscillatory Flows as a Means of Separation of Contaminants From Air
Thomas, Aaron; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 171; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Oscillatory flows in tubes can be used as a mechanical means to separate species and enhance mass transport. This work applies the theory of oscillating flows toward the removal of trace organic contaminants and submicron particles from air that

can be the result of off gassing, chemical spills, or even a fire that may occur in areas occupied by humans. For long-manned space missions, oscillating flows will reduce the load placed on traditional separation methods such as membranes, molecular sieves, and the like. These separation devices require replacement and/or regeneration of materials, so decreasing the load on these materials will increase their effective life and reduce the amount of material and man-hours needed (at some cost to extra power requirements). The current focus of our work is in a) optimization of the separation process using the tuning of geometric length scales with transport length scales in irregular geometries b) the enhancement of separation by operating the flows under increased concentration gradients and c) extension of this work to heat transfer as well as liquid phase systems. This research is of use in space-enabling technologies but also has terrestrial applications to a) enhanced heat transport, b) separation of species in the liquid phase for biomedical devices and c) pre concentrators for detection of small concentration species in Homeland Security. Past results on experiments in regular geometries as well as preliminary results on velocity profiles and mass transfer in irregular geometries (wavy-walled tubes) will be presented during this poster session.
Author
Oscillating Flow; Contaminants; Trace Contaminants; Air Flow; Mass Transfer

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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.

20040081362 National Optical Astronomy Observatories, Tucson, AZ, USA, National Solar Observatory, Tucson, AZ, USA
NOAO/NSO Newsletter, No. 78
Isbell, Douglas, Editor; Najita, Joan, Editor; Bell, Dave, Editor; Hartman, Mia, Editor; vanderBliek, Nicole, Editor; Green, Richard, Editor; Hinkle, Ken, Editor; Adams, Sally, Editor; Leibacher, John, Editor; Piano, Priscilla, Editor, et al.; June 2004; 46 pp.; In English; Copyright; Avail: Other Sources

The articles in this issue arranged into the following sections: 1) Science Highlights; 2) Director's Office; 3) NOAO Gemini Science Center; 4) Observational Programs; 5) Cerro Tololo Inter-American Observatory; 6) Kitt Peak National Observatory; 7) National Solar Observatory/GONG; 8) Public Affairs and Educational Outreach. The Science Highlights include the following articles: A Luminous Lyman-alpha Galaxy at z=6.535; A Spectroscopic Survey for Superwinds in Massive Starbursts; Faint Galaxy Counts and the Normalization of the Galaxy Luminosity Function; Metal Hydride Opacities in Brown Dwarfs; Predicting the Maximum of Solar Activity with NSO Coronal Data. Some of the articles in the other sections contain information on observatory operations and equipment.
CASI
Astronomical Observatories; Space Observations (From Earth)

20040081369 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Spectrum of the Cosmic X-ray Background Observed by RTXE/PCA
Revnivtsev, M.; Gilfanov, M.; Sunyaev, R.; Jahoda, K.; Markwardt, C.; Astronomy and Astrophysics; 2004; Volume 411, pp. 329-334; In English; Copyright; Avail: Other Sources

We have analyzed a large set of Rossi X-ray Timing Explorer/Proportional Counter Array (RXTE/PCA) scanning and slewing observations performed between April 1996 and March 1999. We obtained the 3-20 keV spectrum of the cosmic X-ray background (CXB) by subtracting Earth-occulted observations from observations of the X-ray sky at high galactic latitude and far away from sources. The sky coverage is approximately 22.6 x 10(exp 3) square degrees. The PCA spectrum of CXB in 3-20 keV energy band is adequately approximated by a single power law with photon index GAMMA approximately 1.4 and normalization at 1 keV approximately 9.5 phot/s/square centimeter/keV/sr. Instrumental background uncertainty precludes accurate RXTE/PCA measurements of the spectrum of cosmic X-ray background at energies above 15 keV and therefore we cannot detect the high energy cutoff observed by the High Energy Astronomical Observatory (HEAO)-1 A2 experiment. Deep observations of the 6 high latitude points used to model the PCA background provide a coarse measure of the spatial variation of the CXB. The CXB variations are consistent with a fixed spectral shape and variable normalization characterized by a fractional rms amplitude of approximately 7% on angular scales of approximately 1 square deg.
Author
X Ray Timing Explorer; Astronomical Observatories; Spectra; Cosmic X Rays; Background Radiation; Proportional Counters; Arrays

20040081403 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Correlations of Power-law Spectral and QPO Features In Black Hole Candidate Sources

Fiorito, Ralph; Titarchuk, Lev; 2004; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Recent studies have shown that strong correlations are observed between low frequency QPO s and the spectral power law index for a number of black hole candidate sources (BHCs), when these sources exhibit quasi-steady hard x-ray emission states. The dominant long standing interpretation of QPO's is that they are produced in and are the signature of the thermal accretion disk. Paradoxically, strong QPO's are present even in the cases where the thermal component is negligible. We present a model which identifies the origin of the QPO's and relates them directly to the properties of a compact coronal region which is bounded by the adjustment from Kepleriaa to sub-Kelperian inflow into the BH, and is primarily responsible for the observed power law spectrum. The model also predicts the relationship between high and low frequency QPO's and shows how BH's can be unique identified from observations of the soft states of NS's and BHC's.

Author

Black Holes (Astronomy); Mathematical Models; Correlation; Oscillations; Power Spectra

20040081412 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Absolute Timing of the Crab Pulsar with RXTE

Rots, Arnold H.; Jahoda, Keith; Lyne, Andrew G.; 2004; 11 pp.; In English

Contract(s)/Grant(s): NAS8-39073; NAG5-7346; Copyright; Avail: CASI; A03, Hardcopy

We have monitored the phase of the main X-ray pulse of the Crab pulsar with the Rossi X-ray Timing Explorer (RXTE) for almost eight years, since the start of the mission in January 1996. The absolute time of RXTE's clock is sufficiently accurate to allow this phase to be compared directly with the radio profile. Our monitoring observations of the pulsar took place bi-weekly (during the periods when it was at least 30 degrees from the Sun) and we correlated the data with radio timing ephemerides derived from observations made at Jodrell Bank. We have determined the phase of the X-ray main pulse for each observation with a typical error in the individual data points of 50 microseconds. The total ensemble is consistent with a phase that is constant over the monitoring period, with the X-ray pulse leading the radio pulse by 0.01025 plus or minus 0.00120 period in phase, or 344 plus or minus 40 microseconds in time. The error estimate is dominated by a systematic error of 40 microseconds, most likely constant, arising from uncertainties in the instrumental calibration of the radio data. The statistical error is 0.00015 period, or 5 microseconds. The separation of the main pulse and interpulse appears to be unchanging at time scales of a year or less, with an average value of 0.4001 plus or minus 0.0002 period. There is no apparent variation in these values with energy over the 2-30 keV range. The lag between the radio and X-ray pulses ma be constant in phase (i.e., rotational in nature) or constant in time (i.e., due to a pathlength difference). We are not (yet) able to distinguish between these two interpretations.

Author

Pulsars; Crab Nebula; X Ray Timing Explorer; X Ray Astronomy

20040081414 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Life Extension Activities for the Hubble Space Telescope

Walyus, Keith D.; Pepe, Joyce A. K.; Prior, Michael; March 2004; 1 pp.; In English; Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, USA

Report No.(s): SPIE-5488-128; No Copyright; Avail: Other Sources; Abstract Only

With the cancellation of the Hubble Space Telescope (HST) Servicing Mission 4 (SM4), the HST Project will face numerous challenges to keep the Telescope operating during the remainder of the decade. As part of the SM4, the HST Project had planned to install various upgrades to the Telescope including the installation of new batteries and new rate integrating gyros. Without these upgrades, reliability analysis indicates that the spacecraft will lose the capability to conduct science operations later this decade. The HST team will be severely challenged to maximize the Telescope's remaining operational lifetime, while still trying to maximize - its science output and quality. Two of the biggest areas of concern are the age and condition of the batteries and gyros. Together they offer the largest potential extension in Telescope lifetime and present the biggest challenges to the HST team. The six Ni-H batteries on HST are the original batteries from launch. With fourteen years of operational life, these batteries have collectively lasted longer than any other comparable mission. Yet as with all batteries, their capacity has been declining. Engineers are examining various methods to prolong the life of these mission critical batteries, and retard the rate of degradation. This paper will focus on these and other efforts to prolong the life of the HST, thus enabling it to remain a world-class observatory for as long as possible.

Author

Hubble Space Telescope; Service Life; Reliability Analysis; Astronomy

20040082015 NASA Goddard Space Flight Center, Greenbelt, MD, USA

XMM-Newton Observations of Solar Wind Charge Exchange Emission

Snowden, S. L.; Collier, M. R.; Kuntz, K. D.; [2004]; 23 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We present an XMM-Newton spectrum of diffuse X-ray emission from within the solar system. The spectrum is dominated by O VII and O VIII lines at 0.57 keV and 0.65 keV, O VIII (and possibly Fe XVII) lines at approximately 0.8 keV, Ne IX lines at approximately 0.92 keV, and Mg XI lines at approximately 1.35 keV. This spectrum is consistent with what is expected from charge exchange emission between the highly ionized solar wind and either interstellar neutrals in the heliosphere or material from Earth's exosphere. The emission is clearly seen as a low-energy (E less than 1.5 keV) spectral enhancement in one of a series of observations of the Hubble Deep Field North. The X-ray enhancement is concurrent with an enhancement in the solar wind measured by the ACE satellite. The solar wind enhancement reaches a flux level an order of magnitude more intense than typical fluxes at 1 AU, and has ion ratios with significantly enhanced higher ionization states. Whereas observations of the solar wind plasma made at a single point reflect only local conditions which may only be representative of solar wind properties with spatial scales ranging from less than half of an Earth radii (approximately 10 s) to 100 Earth radii, X-ray observations of solar wind charge exchange are remote sensing measurements which may provide observations which are significantly more global in character. Besides being of interest in its own right for studies of the solar system, this emission can have significant consequences for observations of more cosmological objects. It can provide emission lines at zero redshift which are of particular interest (e.g., O VII and O VIII) in studies of diffuse thermal emission, and which can therefore act as contamination in objects which cover the entire detector field of view. We propose the use of solar wind monitoring data, such as from the ACE and Wind spacecraft, as a diagnostic to screen for such possibilities.
Author

Xmm-Newton Telescope; Solar Wind; Resonance Charge Exchange; Remote Sensing; Solar System; Emission Spectra

20040082052 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Witnessing the Gradual Slowdown of Powerful Extragalactic Jets: The X-Ray-Optical-Radio Connection

Georganopoulos, Markos; Kazanas, Demosthenes; [1 Apr. 2004]; 4 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

A puzzling feature of the Chandra-detected quasar jets is that their X-ray emission decreases faster along the jet than their radio emission, resulting from an outward-increasing radio-to-X-ray ratio. In some sources this behavior is so extreme that the radio emission peak is located clearly downstream of that of the X-rays. This is a rather unanticipated behavior given that the inverse Compton nature of the X-rays and the synchrotron radio emission are attributed to roughly the same electrons of the jet's nonthermal electron distribution. In this letter we show that this morphological behavior can result from the gradual deceleration of a relativistic flow and that the offsets in peak emission at different wavelengths carry the imprint of this deceleration. This notion is consistent with another recent finding, namely, that the jets feeding the terminal hot spots of powerful radio galaxies and quasars are still relativistic with Lorentz factors GAMMA approximately 2-3. The picture of the kinematics of powerful jets emerging from these considerations is that they remain relativistic as they gradually decelerate from kiloparsec scales to the hot spots, where, in a final collision with the intergalactic medium, they slow down rapidly to the subrelativistic velocities of the hot spot advance speed.
Author

X Ray Optics; Radio Jets (Astronomy); Mathematical Models; Deceleration

20040082084 NASA Goddard Space Flight Center, Greenbelt, MD, USA

WMAP Detection of Early Reionization

Kogut, A.; [2003]; 1 pp.; In English; International Union of Radio Science Conference, 6-9 Jan. 2003, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The Wilkinson Microwave Anisotropy Probe (WMAP) has mapped the full sky in Stokes I, Q, and U parameters at frequencies 23, 33, 41, 61, and 94 GHz. We detect correlations between the temperature and polarization maps significant at more than 10 standard deviations. The correlations are inconsistent with instrument noise and are significantly larger than the upper limits established for potential systematic errors. The correlations are present in all WMAP frequency bands with similar amplitude from 23 to 94 GHz, and are consistent with a superposition of a CMB signal with a weak foreground. The fitted CMB component is robust against different data combinations and fitting techniques. On small angular scales the WMAP data show the temperature-polarization correlation expected from adiabatic density perturbations. The data for $\ell \g 20$ agree well with the signal predicted solely from the temperature power spectra, with no additional free parameters. The existence of correlations on super-horizon scales provides significant support for inflationary cosmologies. We detect excess power on large angular scales compared to predictions based on the temperature power spectra alone. The excess power is well described by reionization at redshift $11 \h z \h 30$ at 95\% confidence. A model-independent fit to reionization optical depth yields

results consistent with the best-fit ΛCDM model, with best fit value $\tau = 0.17 \pm 0.04$ at 68\% confidence, including systematic and foreground uncertainties. This trough in the absorption spectra of distant quasars, and implies that the universe has a complex ionization history. I will discuss the WMAP data and its implications for reionization in the early universe.
Author
Microwave Anisotropy Probe; Detection; Ionization; Universe; Correlation

20040082086 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status and Performance of HSTNVide Field Camera 3
Kimble, Randy; MacKenty, J. W.; OConnell, R. W.; [2004]; 1 pp.; In English; AAS Conference, 4-8 Jan. 2004, Atlanta, GA, USA; No Copyright; Avail: Other Sources; Abstract Only

The HST Wide Field Camera 3 is a panchromatic UV-visible-near infrared camera whose development is currently nearing completion, for a planned installation into the Hubble Space Telescope during Servicing Mission 4. WFC3 provides two imaging channels. The UVIS channel features a 4096 x 4096 pixel CCD focal plane with sensitivity from 200 to 1000 nm and a 160 x 160 arcsec field of view. The UVIS channel provides unprecedented sensitivity and field of view in the near ultraviolet for HST. The IR channel features a 1014 x 1014 pixel HgCdTe focal plane covering 850 to 1700 nm with a 135 x 135 arcsec field of view, providing an order of magnitude increase in J+H band surveying efficiency for HST. WFC3 offers a rich complement of filters and grisms in each channel. The construction of WFC3 is nearly complete, and the instrument is well into its integration and test program. We present the current status of the instrument and its projected scientific performance.
Author
Hubble Space Telescope; Faint Object Camera

20040082090 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hierarchical Velocity Structure in the Core of Abell 2597
Still, Martin; Mushotzky, Richard; [2004]; 14 pp.; In English
Contract(s)/Grant(s): NAGW-2166; No Copyright; Avail: CASI; A03, Hardcopy

We present XMM-Newton RGS and EPIC data of the putative cooling flow cluster Abell 2597. Velocities of the low-ionization emission lines in the spectrum are blue shifted with respect to the high-ionization lines by 1320 (sup +660) (sub -210) kilometers per second, which is consistent with the difference in the two peaks of the galaxy velocity distribution and may be the signature of bulk turbulence, infall, rotation or damped oscillation in the cluster. A hierarchical velocity structure such as this could be the direct result of galaxy mergers in the cluster core, or the injection of power into the cluster gas from a central engine. The uniform X-ray morphology of the cluster, the absence of fine scale temperature structure and the random distribution of the the galaxy positions, independent of velocity, suggests that our line of sight is close to the direction of motion. These results have strong implications for cooling flow models of the cluster Abell 2597. They give impetus to those models which account for the observed temperature structure of some clusters using mergers instead of cooling flows.
Author
Galactic Clusters; Velocity Distribution; Galactic Structure; Line Spectra; Mathematical Models

20040082139 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Precession Index, A Nonlinear Energy Balance Model, And Seversmith Psychroterms
Rubincam, David Parry; 2004; 45 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

An important component of Milankovitch's astronomical theory of climate change is the precession index. The precession index, along with the Earth's tilt and orbital eccentricity, are believed to be the major controlling factors of climate change in the last few million years. The precession index is e sin omega(sub s) where e is the Earth's orbital eccentricity and omega(sub s) measures how close the Sun is to the Earth at midsummer. When omega(sub s) = 90deg the Sun is close to the Earth during northern summer, and at 270deg it is far from the Earth during northern summer. The precession index varies with time, because both the eccentricity e and the parameter omega(sub s) are constantly changing due to disturbances in the Earth's orbit by other planets, and due to the precession of the Earth, The change is largely periodic, with a period of about 23,000 years.
Author
Climate Change; Precession; Solar Orbits; Eccentricity

20040082144 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gamma Ray Pulsars: Multiwavelength Observations
Thompson, David J.; 2004; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

High-energy gamma rays are a valuable tool for studying particle acceleration and radiation in the magnetospheres of energetic pulsars. The seven or more pulsars seen by instruments on the Compton Gamma Ray Observatory (CGRO) show that: the light curves usually have double-peak structures (suggesting a broad cone of emission); gamma rays are frequently the dominant component of the radiated power; and all the spectra show evidence of a high-energy turnover. For all the known gamma-ray pulsars, multiwavelength observations and theoretical models based on such observations offer the prospect of gaining a broad understanding of these rotating neutron stars. The Gamma-ray Large Area Space Telescope (GLAST), now in planning for a launch in 2006, will provide a major advance in sensitivity, energy range, and sky coverage.
Author
Pulsars; Wavelengths; Gamma Ray Astronomy; Observation

20040082187 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Automated Classification of ROSAT Sources Using Heterogeneous Multiwavelength Source Catalogs
McGlynn, Thomas; Suchkov, A. A.; Winter, E. L.; Hanisch, R. J.; White, R. L.; Ochsenbein, F.; Derriere, S.; Voges, W.; Corcoran, M. F.; [2004]; 14 pp.; In English
Contract(s)/Grant(s): NAG5-11019; No Copyright; Avail: CASI; A03, Hardcopy

We describe an on-line system for automated classification of X-ray sources, ClassX, and present preliminary results of classification of the three major catalogs of ROSAT sources, RASS BSC, RASS FSC, and WGACAT, into six class categories: stars, white dwarfs, X-ray binaries, galaxies, AGNs, and clusters of galaxies. ClassX is based on a machine learning technology. It represents a system of classifiers, each classifier consisting of a considerable number of oblique decision trees. These trees are built as the classifier is 'trained' to recognize various classes of objects using a training sample of sources of known object types. Each source is characterized by a preselected set of parameters, or attributes; the same set is then used as the classifier conducts classification of sources of unknown identity. The ClassX pipeline features an automatic search for X-ray source counterparts among heterogeneous data sets in on-line data archives using Virtual Observatory protocols; it retrieves from those archives all the attributes required by the selected classifier and inputs them to the classifier. The user input to ClassX is typically a file with target coordinates, optionally complemented with target IDs. The output contains the class name, attributes, and class probabilities for all classified targets. We discuss ways to characterize and assess the classifier quality and performance and present the respective validation procedures. Based on both internal and external validation, we conclude that the ClassX classifiers yield reasonable and reliable classifications for ROSAT sources and have the potential to broaden class representation significantly for rare object types.
Author
Heterogeneity; Rosat Mission; Automatic Control; Astronomical Catalogs; X Ray Sources

20040082212 Illinois Univ., Urbana-Champaign, IL, USA
Late-Type Membership of the Open Cluster NGC 2232
Orban, Chris; Patten, Brian; [2004]; 10 pp.; In English
Contract(s)/Grant(s): NAG5-9131; No Copyright; Avail: CASI; A02, Hardcopy

NGC 2232 is one of the nearest open clusters (approx.360 pc) with an age of approx.25 Myr. This places it in the unique position to study the transition from T Tauri activity to the Zero Age Main Sequence. In order for those studies to begin, late-type members must be identified for the cluster. X-ray observations combined with ground-based photometry and spectroscopy offers the best way to accomplish this goal. We present photometry in the VRI bands, 2MASS near-infrared measurements in the J, H , Ks bands and spectra for the suspected optical counterparts to the X-ray sources in the field of NGC 2232. 46 candidate members were identified through these efforts ranging from F5 to M5.
Author
Open Clusters; T Tauri Stars; Main Sequence Stars; Photometry

20040082229 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observations of Magnetars
Kouveliotou, C.; [2004]; 1 pp.; In English; Electromagnetic Spectrum of Neutron Stars, 13-18 Jun. 2004, Marmaris, Turkey; No Copyright; Avail: Other Sources; Abstract Only

Magnetars (Soft Gamma Repeaters and Anomalous X-ray Pulsars) are a subclass of neutron stars characterized by their

recurrent X-ray bursts. While in an active (bursting) state, they are emitting hundreds of predominantly soft (kT=30 keV), short (0.1 - 100ms long) events. Active states last anywhere between days and years. Their quiescent source X-ray light curves exhibit pulsations in the narrow range of 5-1 1 s; estimates of these rotational period rate changes (spin-down) indicate that their magnetic fields are extremely high, of the order of 10(exp 14)-10(exp 15) G. Such high B-field objects, dubbed ″magnetars″, had been predicted to exist in 1992, but the first concrete observational evidence were obtained in 1998 for two of these sources. I will discuss here the history of magnetars, and their spectral, timing and flux characteristics both in the persistent and their burst emission.
Author
Magnetars; Neutron Stars; Unsteady Flow; A Stars; Pulsars

20040082274 NASA Marshall Space Flight Center, Huntsville, AL, USA
Triggering of the Two X-class Flares of 28 and 29 October 2003
Choudhary, Debi Prasad; Moore, Ronald L.; Falconer, David; Pojoga, Sorin; Huang, Tian-Sen; Krucker, Sam; Uddin, Wahab; [2004]; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA; Copyright; Avail: Other Sources; Abstract Only

From H-alpha movies from Aryabhatta Research Institute of Observational Sciences and from Prairie View Solar Observatory, hard X-ray movies from RHESSI, line-of-sight magnetogram movies from SOHO/MDI, and vector magnetograms from Marshal Space Flight Center, we examine the magnetic structure and evolution of the large delta-sunspot active region NOAA 10486 in relation to the onset and development of the two X-class flares that occurred in this active region on 28 and 29 October 2003. We find evidence that each of these flares was triggered by strongly sheared magnetic field via ″tether-cutting″ reconnection with adjacent/overlying strongly sheared field. In the first flare, the initial brightening in H-alpha: (1) was partly rooted in emerging sheared magnetic field along the edge of the large positive-polarity flux domain of the delta sunspot, and (2) consisted of four flare kernels, two in negative magnetic flux and two in positive magnetic flux. In the second flare, the brightening started in the core of a Z-shaped sigmoidal sheared magnetic field and the inner two of four H-alpha kernels were visible in 30-50 Kev hard X-ray image from RHESSI. Each flare spread from the initial quadrupolar brightening to develop into a much larger two-ribbon flare straddling a much more extensive swath of strongly sheared field along the edge of the large positive-flux domain of the delta sunspot, the first flare on the leading side and the second flare on the trailing side of this domain. Thus, localized internal reconnection triggered the explosion of these extensive sheared magnetic fields.
Author
X Rays; Solar Observatories; Magnetic Signatures; Magnetic Field Configurations; H Alpha Line; Flared Bodies

20040082306 Washington Univ., Saint Louis, MO, USA
Multiwavelength Observations of Strong Flares from the TeV Blazar 1ES 1959+650
Krawczynski, H.; Hughes, S. B.; Horan, D.; Aharonian, F.; Aller, M. F.; Aller, H.; Boltwood, P.; Buckley, J.; Coppi, P.; Fossati, G., et al.; The Astrophysical Journal; January 20, 2004; Volume 601, pp. 151-164; In English
Contract(s)/Grant(s): NAG5-12974; NSF AST-00-98579; Copyright; Avail: Other Sources

Following the detection of strong TeV gamma ray flares from the BL Lac object 1 ES 1959+650 with the Whipple 10 m Cerenkov telescope on 2002 May 16 and 17, we performed intensive target of opportunity radio, optical, X-ray, and TeV ?ray observations from 2002 May 18 to August 14. Observations with the X-ray telescope RossiX-Ray Timing Explorer and the Whipple and HEGRA gamma-ray telescopes revealed several strong flares, enabling us to sensitively test the X-ray--gamma-ray flux correlation properties. Although the X-ray and gamma-ray fluxes seemed to be correlated in general, we found an orphan gamma-ray flare that was not accompanied by an X-ray flare. While we detected optical flux variability with the Boltwood and Abastumani observatories, the data did not give evidence for a correlation of the optical flux variability with the observed X-ray and 7-ray flares. Within statistical errors of about 0.03 Jy at 14.5 GHz and 0.05 Jy at 4.8 GHz, the radio fluxes measured with the University of Michigan Radio Astronomy Observatory stayed constant throughout the campaign; the mean values agreed well with the values measured on 2002 May 7 and June 7 at 4.9 and 15 GHz with the Very Large Array and at 4.8 GHz with archival flux measurements. After describing in detail the radio, optical, X-ray and gamma-ray light curves, and spectral energy distributions (SEDs), we present initial modeling of the SED with a simple synchrotron self-Compton model. With the addition of another TeV blazar with good broadband data, we consider the set of all TeV blazars, to begin to look for a connection of the jet properties to the properties of the central accreting black hole thought to drive the jet. Remarkably, the temporal and special X-ray and gamma-ray emission characteristics of TeV blazars are very similar, even though the mass estimates of their central black holes differ by up to 1 order of magnitude.
Author
Blazars; Gamma Rays

20040082316 NASA Marshall Space Flight Center, Huntsville, AL, USA

Performance of Gas Scintillation Proportional Counter Array for High-Energy X-Ray Observatory

Gubarev, Mikhail; Ramsey, Brian; Apple, Jeffery; [2004]; 1 pp.; In English; SPIE Astronomical Telescope and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

A focal plane array of high-pressure gas scintillation proportional counters (GSPC) for a High Energy X-Ray Observatory (HERO) is developed at the Marshall Space Flight Center. The array is consisted from eight GSPCs and is a part of balloon born payload scheduled to flight in May 2004. These detectors have an active area of approximately 20 square centimeters, and are filled with a high pressure (10(exp 6) Pa) xenon-helium mixture. Imaging is via crossed-grid position-sensitive phototubes sensitive in the UV region. The performance of the GSPC is well matched to that of the telescopes x-ray optics which have response to 75 keV and a focal spot size of approximately 500 microns. The detector's energy resolution, 4% FWHM at 60 keV, is adequate for resolving the broad spectral lines of astrophysical importance and for accurate continuum measurements. Results of the on-earth detector calibration will be presented and in-flight detector performance will be provided, as available.

Author

Observatories; Proportional Counters; Scintillation Counters; X Ray Astronomy; High Pressure; Focal Plane Devices; Gas Mixtures

20040082345 NASA Marshall Space Flight Center, Huntsville, AL, USA

Leon X-1, the First Chandra Source

Weisskopf, Martin C.; Aldcroft, Tom; Cameron, Robert A.; Gandhi, Poshak; Foellmi, Cedric; Elsner, Ronald F.; Patel, Sandeep K.; ODell, Stephen L.; [2004]; 18 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Here we present an analysis of the first photons detected with the Chandra X-ray Observatory and an identification of the brightest source in the field which we named Leon X-1 to honor the momentous contributions of the Chandra Telescope Scientist, Leon Van Speybroeck. The observation took place immediately following the opening of the last door protecting the X-ray telescope. We discuss the unusual operational conditions as the first extra-terrestrial X-ray photons reflected from the telescope onto the ACIS camera. One bright source was a p parent to the team at the control center and the small collection of photons that appeared on the monitor were sufficient to indicate that the telescope had survived the launch and was approximately in focus, even prior to any checks and subsequent adjustments.

Author

Active Galaxies; X Rays; X Ray Telescopes; X Ray Astrophysics Facility

20040082377 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Ultra-Luminous X-ray Source Population from the Chandra Archive of Galaxies

Swartz, Douglas A.; Ghosh, Kajal K.; Tennant, Allen F.; Wu, Kinwah; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

One hundred fifty-four discrete non-nuclear Ultra-Luminous X-ray (ULX) sources, with spectroscopically-determined intrinsic X-ray luminosities greater than 1 e39 ergs/s, are identified in 82 galaxies observed with Chandra's Advanced CCD Imaging Spectrometer. Source positions, X-ray luminosities, and spectral and timing characteristics are tabulated. Statistical comparisons between these X-ray properties and those of the weaker discrete sources in the same fields (mainly neutron star and stellar-mass black hole binaries) are made. Sources above approximately le38 ergs per second display similar spatial, spectral, color, and variability distributions. In particular, there is no compelling evidence in the sample for a new and distinct class of X-ray object such as the intermediate-mass black holes. 83% of ULX candidates have spectra that can be described as absorbed power laws with index \hG\g = 1.74 and column density \hn H\g = 2.24e21 l per square centimeter, or approximately 5 times the average Galactic column. About 20% of the ULX's have much steeper indices indicative of a soft, and likely thermal, spectrum. The locations of ULXs in their host galaxies are strongly peaked towards their galaxy centers. The deprojected radial distribution of the ULX candidates is somewhat steeper than an exponential disk, indistinguishable from that of the weaker sources. About 5--15% of ULX candidates are variable during the Chandra observations (which average 39.5 ks). Comparison of the cumulative X-ray luminosity functions of the ULXs to Chandra Deep Field results suggests approximately 25% of the sources may be background objects including 14% of the ULX candidates in the sample of spiral galaxies and 44% of those in elliptical galaxies implying the elliptical galaxy ULX population is severely compromised by background active galactic nuclei. Correlations with host galaxy properties confirm the number and total X-ray luminosity of the ULXs are associated with recent star formation and with galaxy merging and interactions. The preponderance of ULXs in star-forming galaxies as well as their similarities to less-luminous sources suggest they originate in a young but short-lived population such as the high-mass X-ray binaries with a smaller contribution (based on spectral

slope) from recent supernovae. The number of ULXs in elliptical galaxies scales with host galaxy mass and can be explained most simply as the high-luminosity end of the low-mass X-ray binary population.
Author
Luminosity; X Ray Sources; X Ray Astrophysics Facility; Galaxies; Spectroscopy

20040082613 Naval Observatory, Washington, DC
The Circumstellar Envelope of Zeta Tauri through Optical Interferometry
Tycner, Christopher; Hajian, Arsen R.; Armstrong, J. T.; Benson, J. A.; Gilbreath, G. C.; Feb. 2004; 11 pp.; In English
Report No.(s): AD-A423086; No Copyright; Avail: CASI; A03, Hardcopy

We present optical interferometric observations of the Be star Zeta Tauri obtained using the Navy Prototype Optical Interferometer (NPOI). The multichannel capability of the NPOI allows a high-quality internal calibration of the squared visibilities corresponding to the H(alpha) emission from the circumstellar environment. The observations suggest a strong departure from circular symmetry and thus are described by an elliptical Gaussian model. We use a nonlinear least- squares fit to the data to obtain the likeliest parameters and the corresponding uncertainties are determined using a Monte Carlo simulation. We obtain 3.14 +/- 0.21 mas for the angular size of the major axis -62.3 deg +/-4.4 deg for the position angle and 0.310 +/- 0.072 for the axial ratio. By comparing our results with those already in the literature we conclude that the model parameters describing the general characteristics of the circumstellar envelope of Zeta Tau appear to be stable on timescales of years. We also compare our results with the known parameters describing the binary nature of Zeta Tau and we conclude that the envelope surrounds only the primary component and is well within its Roche lobe.
DTIC
B Stars; Interferometers; Interferometry; Optical Measurement; Stellar Envelopes; Taurus Constellation

20040082646 Naval Observatory, Washington, DC
Analysis of Ancient Chinese Records of Occultations between Planets and Stars
Hilton, James L.; Seidelmann, P. K.; Ciyuan, Liu; Oct. 1988; 14 pp.; In English
Report No.(s): AD-A423606; No Copyright; Avail: CASI; A03, Hardcopy

One hundred seventy-three historical Chinese records of occultations and appulses (conjunctions with small least separations) of planets with stars, other planets, and extended objects were examined. The observations were made by the Chinese imperial astronomers from 12 December 146 B.C. to 3 February 1761 A. D. and preserved in the Chinese dynastic histories. Sixty-six of the records were of occultations, 83 records were of appulses, and 24 records were questionable as to the objects involved. These observations were compared to both ephemerides derived from the Bretagnon (1982) planetary theory and the JPL planetary ephemeris DE1O2. Both of the ephemerides verified that all of the well-recorded events occurred, and usually on the recorded day. This constitutes the first comparison of planetary theories and integration with ancient Chinese observations giving a weak check of the theories over moderately long periods of time. The results of this check show no evidence within the accuracy of these observations, inferred to be about 300″, for secular discrepancies in the present theories on the timescale of two thousand years. When the deceleration of the Earth's rotation was taken into account, it was also found that the events usually took place at the time of night recorded by the Chinese observers, approx. 1/10 of the night. This constitutes a check on the DELTA TAU determinations independent of solar eclipse observations. Therefore, these records reveal that to the accuracy of these observations there are no serious flaws in the presently accepted planetary theories or determinations of the rotational deceleration of the Earth (DELTA TAU). Also, this study gives some insight into how the Chinese imperial astronomers charted the motions of the planets in the heavens. (3 tables, 19 refs.)
DTIC
China; Ephemerides; Occultation; Planets

20040082797 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Infrared Methods for Daylight Acquisition of LEO Satellites
Nelson, Joel E.; Mar. 2004; 128 pp.; In English; Original contains color illustrations
Report No.(s): AD-A423941; AFIT/GSS/ENG/04-02; No Copyright; Avail: CASI; A07, Hardcopy

Raven is an award-winning optical system design paradigm that couples commercially available hardware and software along with custom data analysis and control software to produce low-cost, autonomous, and very capable space surveillance systems. The first product of the Raven program was a family of telescopes capable of generating world-class optical observation data of deep-space satellites. The key to this system was the use of astrometric techniques for position and brightness data. Astrometry compares a satellite to the star background within the sensor field of view; since the position and

brightness of the star-field is well known in star catalogs, accurate knowledge of the satellite position and brightness can be deduced from this comparison. Efforts are now underway to produce a similar system capable of tracking low Earth orbiting (LEO) satellites: the LEO Raven. Tracking LEO objects presents several new challenges, most notably the speed of the satellite relative to the star-field and the lighting conditions. The current system works in the visible light band that requires terminator tracking conditions where the ground station is in the dark and the satellite is solar illuminated. Since this is not typically the case for LEO satellites, the first LEO Raven is being designed to use infrared light bands for daylight tracking. This thesis presents the results of risk-reduction daylight astrometry experiments using the Maui Space Surveillance Site's Daylight Acquisition Sensor.
DTIC
Attitude (Inclination); Daytime; Infrared Radiation; Low Earth Orbits; Telescopes

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040081413 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Methods of Determining the Radio Emission Geometry in Pulsar Magnetospheres
Dyks, J.; Rudak, B.; Harding, Alice K.; [Jun. 2004]; 23 pp.; In English
Contract(s)/Grant(s): 2P03D.004.24; No Copyright; Avail: CASI; A03, Hardcopy

We present a modification of the relativistic phase shift method of determining the radio emission geometry from pulsar magnetospheres proposed by Gangadhara & Gupta (2001). Our modification provides a method of determining radio emission altitudes which does not depend on the viewing geometry and does not require polarization measurements. We suggest application of the method to the outer edges of averaged radio pulse profiles to identify magnetic field lines associated with'the edges of the pulse and, thereby, to test the geometric method based on the measurement of the pulse width at the lowest intensity level. We show that another relativistic method proposed by Blaskiewicz et al. (1991) provides upper limits for emission altitudes associated with the outer edges of pulse profiles. A comparison of these limits with the altitudes determined with the geometric method may be used to probe the importance of rotational distortions of magnetic field and refraction effects in the pulsar magnetosphere. We provide a comprehensive discussion of the assumptions used in the relativistic methods.
Author
Pulsar Magnetospheres; Radio Emission; Magnetic Fields; Magnetic Effects; Viewing

20040082047 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An X-Ray Investigation of the NGC346 Field in the SMC (3): XMM-Newton Data
Naze, Yael; Manfroid, Jean; Corcoran, Michael F.; Stevens, Ian R.; 2004; 23 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

We present new XMM-Newton results on the field around the NGC346 star cluster in the SMC. This continues and extends previously published work on Chandra observations of the same field. The two XMM-Newton observations were obtained, respectively, six months before and six months after the previously published Chandra data. Of the 51 X-ray sources detected with XMM-Newton, 29 were already detected with Chandru. Comparing the properties of these X-ray sources in each of our three datasets has enabled us to investigate their variability on times scales of a year. Changes in the flux levels and/or spectral properties were observed for 21 of these sources. In addition, we discovered long-term variations in the X-ray properties of the peculiar system HD5980, a luminous blue variable star, that is likely to be a colliding wind binary system, which displays the largest luminosity during the first XMM-Newton observation.
Author
X Ray Sources; Blue Stars; Star Clusters

20040082064 Massachusetts Inst. of Tech., Cambridge, MA, USA
X-Ray Pulsar Studies With RXTE
Rappaport, Saul; June 27, 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9189; No Copyright; Avail: CASI; A01, Hardcopy

Our activities here at MIT have largely concentrated on four different binary X-ray pulsars: LMC X-4; 4UO352+3O/XPer; 4U0115+63; and X1908+075. We have also recently initiated a search for millisecond X-ray pulsations in RXTE archival data

for several bright LMXBs using a new technique. Since this study is just getting under way, we will not report any results here. Using RXTE timing observations of LMC X-4 we have definitively measured, for the first time, the orbital decay of this high-mass X-ray binary. The e-folding decay time scale is very close to lo6 years, comparable to, but somewhat longer than, the corresponding orbital decay times for SMC X-1 and Cen X-3. We find that the orbital decay in LMC X-4 is likely driven by tidal interactions, where the asynchronism between the orbital motion and the rotation of the companion star is maintained by the evolutionary expansion of the companion. Under NASA grant NAGS7479 we carried out RXTE observations of X Per/4U0352+30 in order to track the pulse phase over a one year interval. This effort was successful in tentatively identifying a N 250-day orbital period. However, due to the fact that the observing interval was only somewhat longer than the orbital period, we asked for the observations of X Per to continue as public, or non-proprietary observations. Dr. Jean Swank kindly agreed to the continuation of the observations and they were carried out on a less frequent basis over the next year and a half. After 72 separate observations of X Per, we have the orbital period and semimajor axis firmly determined. In addition, we were able to measure the orbital eccentricity-which turns out to be remarkably small (e = 0.10) for such a wide binary orbit. This has led us establish the birth of a neutron star with a very small (or zero) natal kick.
Author
X Ray Binaries; Neutron Stars; Orbitals

20040082076 Washington Univ., Saint Louis, MO, USA
RXTE Observations of Several Strong Flares from the TeV Blazar 1ES 1959+650
Krawczynski, Henric; 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12974; No Copyright; Avail: CASI; A01, Hardcopy

Responding to the RXTE Cycle 7 NASA Research Announcement, we proposed to use the RXTE X-ray telescopes to intensively observe the TeV Gamma-ray Blazars Markarian 421, Markarian 501, 1ES 1959+650 and 1ES 1426+428, when their X-ray or TeV Gamma-ray fluxes would surpass preset trigger thresholds. In May and June, 2002, the Blazar 1ES 1959+650 (z=0.048) showed a series of spectacular X-ray and gamma-ray flares. Following the detection of a strong Gamma-ray flare on May 16 and 17 with the VERITAS 10 m Cherenkov Telescope, we invoked intensive RXTE observations, as well as complementary radio, optical and GeV/TeV Gamma-ray observations. From May 18 to August 14, more than 150 ksec RXTE observations were taken, yielding a unique data set with simultaneous RXTE and GeV/TeV Gamma-ray coverage.We used the financial support from the ADP program of NASA s Office for Space Science to perform a comprehensive analysis of the RXTE data. We studied in detail the temporal and spectral characteristics of the source. We collected multiwavelength data from a large number of collaborators, and performed a detailed cross-correlation analysis. Eventually, we interpreted the results in the framework of a Synchrotron-Self Compton model. The most important discovery of our research has been the detection of an orphan gamma-ray flare , not associated with an X-ray flare. The discovery showed conclusively that most models invoked to describe the non-thermal emission from blazars are overly simplistic.
Author
Blazars; Markarian Galaxies; X Ray Timing Explorer

20040082083 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Undiscovered World: Cosmology from WMAP
Bennett, Charles; [2004]; 1 pp.; In English; American Physical Society Conference, 30 Apr. - 4 May 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The first findings from a year of WMAP satellite operations provide a detailed full sky map of the cosmic microwave background radiation. The observed temperature anisotropy, combined with the associated polarization information, encodes a wealth of cosmological information. The results have implications for the history, content, and evolution of the universe, and its large scale properties. These and other aspects of the mission will be discussed.
Derived from text
Cosmic Microwave Background Radiation; Anisotropy; Cosmology; Evolution (Development)

20040082137 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Hot Envelope Around the Southern Coalsack: X-ray and Far-Ultraviolet Observations
Anderson, B.-G.; Knauth, David C.; Snowden, S. L.; Shelton, Robin; Wanner, Peter G.; February 02, 2004; 12 pp.; In English
Contract(s)/Grant(s): NAS5-32985; NRA-98-02(399-3201); FUSE-A120; Copyright; Avail: Other Sources

We present Far Ultraviolet Spectroscopic Explorer and ROSAT X-ray observations toward the Southern Coalsack. An

almost complete X-ray halo can be seen around the cloud in the 0.75 and 1.5 keV images, and most of the observed stars show O VI absorption. Both the cloud and the stars have highly accurate distance determinations, allowing us to reliably place the stars and the cloud relative to each other. Using these distance determinations, we find no O VI-bearing gas in the foreground of the Coalsack, while for stars in the background of the cloud, O VI absorption is the norm. The column density of O VI correlates with the 0.75 and 1.5 keV intensities. These results suggest that the X-ray-emitting hot plasma is associated with the dense cloud. We propose that the heating of the Coalsack envelope is due to the hot gas in the interior of the Upper Cen-Lup superbubble. The Coalsack interaction region provides a nearby example of the hot-cold gas interfaces thought to be responsible for the O VI absorptions seen on many sight lines throughout the Galaxy.
Author
Far UV Spectroscopic Explorer; X Ray Astronomy; Ultraviolet Astronomy; High Temperature Gases; High Temperature Plasmas; Stellar Envelopes

20040082165 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An XMM-Newton Observation of the Seyfert 1 Galaxy 1H 0419-577 in an Extreme Low State
Pounds, K. A.; Reeves, J. N.; Page, K. L.; OBrien, P. T.; [2004]; 25 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Previous observations of the luminous Seyfert 1 galaxy 1H 0419-577 have found its X-ray spectrum to range from that of a typical Seyfert 1 with 2-10 keV power law index Gamma approx. 1.9 to a much flatter power law of Gamma approx. 1.5 or less. We report here a new XMM-Newton observation which allows the low state spectrum to be studied in much greater detail than hitherto. We find a very hard spectrum (Gamma approx. 1.0), which exhibits broad features that can be modelled myth the addition of an extreme relativistic Fe K emission line or with partial covering of the underlying continuum by a substantial column density of near-neutral gas. Both the EPIC and RGS data show evidence for strong line emission of OVII and OVIII requiring an extended region of low density photoionised gas in 1H 0419-577. Comparison with an earlier XMM-Newton observation when 1H 0419-577 was 'X-ray bright' indicates the dominant spectral variability occurs via a steep power law component.
Author
Seyfert Galaxies; X Ray Astronomy; X Ray Spectra

20040082177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
INTEGRAL Studies of Nonthermal Emission From the Supernova Remnants Cassiopeia A, CTA 1, and MSH 11-61A
Sturner, S. J.; Beckmann, V.; Bykov, A.; Lebrun, F.; Terrier, R.; [2004]; 4 pp.; In English; 5th INTEGRAL Workshop, 16-20 Feb. 2004, Munich, Germany; Copyright; Avail: CASI; A01, Hardcopy

We present the initial results from our study of the nonthermal continuum emission from the supernova remnants Cassiopeia A, MSB 11-61-4, a d CT-4 1. We used the INTEGRAL Core Program data to conduct this study. During the INTEGRAL mission a significant fraction of the total observing time (e.g. 35% in year one) is allocated to the Core Program and is analyzed under the auspices of the INTEGRAL Science Working Team. We report no statistically significant detections thus far but we will continue to analyze the data as more is taken. The results so far are consistent with previous measurements from e.g. RXTE and ASCA.
Author
Supernova Remnants; Emission Spectra; Cassiopeia A

20040082186 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evolving a Puncture Black Hole with Fixed Mesh Refinement
Imbiriba, Breno; Baker, John; Choi, Dae-II; Centrella, Joan; Fiske. David R.; Brown, J. David; vanMeter, James R.; Olson, Kevin; 2004; 13 pp.; In English
Contract(s)/Grant(s): ATP02-0043-0056; NSF PHY-00-70892; Copyright; Avail: CASI; A03, Hardcopy

We present a detailed study of the effects of mesh refinement boundaries on the convergence and stability of simulations of black hole spacetimes. We find no technical problems. In our applications of this technique to the evolution of puncture initial data, we demonstrate that it is possible to simulaneously maintain second order convergence near the puncture and extend the outer boundary beyond 100M, thereby approaching the asymptotically flat region in which boundary condition problems are less difficult.
Author
Black Holes (Astronomy); Mathematical Models

20040082213 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Observations of PSR B1509-58 Using INTEGRAL Core Program Data

Sturner, S. J.; Forot, M.; Laurent, P.; 2004; 4 pp.; In English; 5th INTEGRAL Workshop, 16-20 Feb. 2004, Munich, Germany; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

We present spectral and imaging results from the analysis of the first year of INTEGRAL Core Program Data for the pulsar PSR B1509-58 and its associated supernova remnant MSH 15-52. PSR B1509-58 is a gamma-ray emitting, rotation-powered pulsar with a period of approx. = 150 ms and a characteristic age of roughly 1600 years. This pulsar is unusual among the gamma-ray pulsars in that its gamma-ray spectrum is cut-off at the lowest energy (approx. 10 - 30 MeV) and it has the highest surface magnetic field strength (1.54 x 10(exp 13) G). We find that IBIS/ISGRI and SPI detect PSR B1509-58/MSH 15-52 up to approx. 200 keV. The spectral shape and flux level are in agreement with previous results. Key words: pu1sars:individual:PSR B1509-58 - Gamma rays:observations.

Author

Imaging Techniques; Supernova Remnants; Gamma Ray Spectra

20040082368 NASA Marshall Space Flight Center, Huntsville, AL, USA

Cusp and LLBL as Sources of the Isolated Dayside Auroral Feature During Northward IMF

Chang, S.; Gallagher, D. L.; Spann, J. F., Jr.; Mende, S.; Greenwald, R.; Newell, P. T.; June 07, 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

An intense dayside proton aurora was observed by IMAGE FUV for an extensive period of northward interplanetary magnetic field (IMF) on 17 and 18 September, 2000. This aurora partially coincided with the auroral oval and intruded farther poleward into the polar cap, and it showed longitudinal motions in response to IMF $B-y$ variation. Intense magnetosheath-like electron and ion precipitations have been simultaneously detected by DMSP above the poleward portion of the high-latitude dayside aurora. They resemble the typical plasmas observed in the low-altitude cusp. However, less intense electrons and more intense energetic ions were detected over the equatorward part of the aurora. These plasmas are closer to the low-latitude boundary layer (LLBL) plasmas. Under strongly northward IMF, global ionospheric convection derived from SuperDARN radar measurements showed a 4-cell pattern with sunward convection in the middle of the dayside polar cap and the dayside aurora corresponded to two different convection cells. This result further supports two source regions for the aurora. The cusp proton aurora is on open magnetic field lines convecting sunward whereas the LLBL proton aurora is on closed field lines convecting antisunward. These IMAGE, DMSP and SuperDARN observations reveal the structure and dynamics of the aurora and provide strong evidence for magnetic merging occurring at the high-latitude magnetopause poleward from the cusp. This merging process was very likely quasi-stationary.

Author

Auroras; Boundary Layer Plasmas; Interplanetary Magnetic Fields; Polar Caps

20040082386 Washington Univ., Saint Louis, MO, USA

TeV Blazars: Observations and Models

Krawczynski, Henric; New Astronomy Reviews; 2004; ISSN 1387-6473; Volume 48, pp. 367-373; In English

Contract(s)/Grant(s): NAG5-12974; Copyright; Avail: Other Sources; Abstract Only

Since the first TeV blazar Markarian (Mrk) 421 was detected in 1992, the number of established TeV gamma-ray emitting BL Lac objects has grown to 6, with redshifts ranging from 0 031 (Mrk 421) to 0.129 (H 1426+428). The intensive study of these sources has had a major impact on our understanding of the blazar phenomenon. The most notable observational results have been extremely fast large amplitude flux and spectral variability on hour time scales, and a pronounced X-ray - TeV gamma-ray flux correlation. In this paper, we discuss recent observational results and report on progress in their theoretical interpretation.

Author

Blazars; Bl Lacertae Objects; Markarian Galaxies

20040082401 NASA Marshall Space Flight Center, Huntsville, AL, USA

Chandra Observations of the X-ray Environs of SN 1998bw/GRB 980425

Kouveliotou, C.; Woosley, S. E.; Patel, S. K.; Levan, A.; Blandford, R.; Ramirez-Ruiz, E.; Wijers, R. A. M. J.; Weisskopf, M. C.; Tennant, A.; Pian, E., et al.; The Astrophysical Journal; June 20, 2004; Volume 608, pp. 872-882; In English; Original contains black and white illustrations

Contract(s)/Grant(s): DE-FC02-01ER-41176; EEC-HPRN-CT-2002-00294; SAO-GO1-2055X; NAG5-12036; Copyright; Avail: CASI; A03, Hardcopy

We report X-ray studies of the environs of SN 1998bw and GRB 980425 using the Chandra X-Ray Observatory 1281 days after the gamma-ray burst (GRB). Eight X-ray point sources were localized, three and five each in the original error boxes, S1 and S2, assigned for variable X-ray counteparts to the GRB by BeppoSAX. The sum of the discrete X-ray sources plus continuous emission in S2 observed by Chandra on day 1281 is within a factor of 1.5 of the maximum and the upper limits seen by BeppoSAX. We conclude that S2 is the sum of several variable sources that have not disappeared and therefore is not associated with the GRB. Within S1, clear evidence is seen for a decline of approximately a factor of 12 between day 200 and day 1281. One of the sources in S 1, S 1 a, is coincident with the well-determined radio location of SN 1998bw and is certainly the remnant of that explosion. The nature of the other sources is also discussed. Combining our observation of the supernova with others of the GRB afterglow, a smooth X-ray light curve, spanning approx. 1400 days, is obtained by assuming that the burst and supernova were coincident at 35.6 Mpc. When this X-ray light curve is compared with those of the X-ray af ″erglows″ of ordinary GRBs, X-ray flashes, and ordinary supernovae, evidence emerges for at least two classes of light curves, perhaps bounding a continuum. By 3-10 yr, all these phenomena seem to converge on a common X-ray luminosity, possibly indicative of the supernova underlying them all. This convergence strengthens the conclusion that SN 1998 bw aid GRB 980425 took place in the same object.One possible explanation for the two classes is that a (nearly) standard GRB was observed at different angles, in which case X-ray afterglows with intermediate luminosities should eventually be discovered. Finally, we comment on the contribution of GRB afterglows to the ultraluminous X-ray source population.

Author

X Ray Sources; Supernovae; Light Curve; Afterglows

20040082501 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Mass and Dynamical Structures of the Lensing Clusters CL0024+17 and CL2244+02

Forman, William; Mushotzky, Richard, Technical Monitor; July 2004; 2 pp.; In English

Contract(s)/Grant(s): NAG5-9942; No Copyright; Avail: Other Sources; Abstract Only

We present a detailed gravitational mass measurement based on the XMM-Newton imaging spectroscopy analysis of the lensing cluster of galaxies CL0024+17 at $z = 0.395$. The emission appears approximately symmetric. However, on the scale of $r\sim3.3'$, some indication of elongation is visible in the northwest-southeast direction from the hardness ratio map. Within $3'$, we measure a global gas temperature of 3.52 ± 0.17 keV, metallicity of 0.22 ± 0.07, and a bolometric luminosity of $2.9\pm0. l\times10(exp 44)$ erg/s. We derive a temperature distribution with an isothermal temperature of 3.9 keV up to a radius of $1.5'$ and a strong temperature gradient in the outskirts ($1.3' less than r less than 3.3'$). Under the assumption of hydrostatic equilibrium, we measure the gravitational mass and gas mass fraction to be $M-{200} = 2.0\pm0.3\times 10(exp 14)$ solar masses and $f-{gas} = 0.20\pm0.03$ at $r-{200} = 1.05$ Mpc (all for a Hubble constant of 70 km/sec/Mpc) using the observed gas temperature profile. The complex core structure is the key to explaining the discrepancy between the gravitational mass determined from the XMM-Newton observations and HST optical lensing measurements.

Author

Dynamic Characteristics; Stellar Mass; Optical Measurement; Imaging Techniques; Galactic Clusters

20040082517

Deciphering the X-ray Emission of the Nearest Herbig Ae Star

Skinner, Stephen L.; [2004]; 2 pp.; In English

Contract(s)/Grant(s): NAG5-10326; No Copyright; Avail: CASI; A01, Hardcopy

In this research program, we obtained and analyzed an X-ray observation of the young nearby intermediate mass pre-main sequence star HD 104237 using the XMM-Newton space-based observatory. The observation was obtained on 17 Feb. 2002. This observation yielded high-quality X-ray images, spectra, and timing data which provided valuable information on the physical processes responsible for the X-ray emission. This star is a member of the group of so-called Herbig Ae/Be stars, which are young intermediate mass (approx. 2 - 4 solar masses) pre-main sequence (PMS) stars a few million years old that have not yet begun core hydrogen burning. The objective of the XMM-Newton observation was to obtain higher quality data than previously available in order to constrain possible X-ray emission mechanisms. The origin of the X-ray emission from Herbig Ae/Be stars is not yet known. These intermediate mass PMS stars lie on radiative tracks and are not expected to emit X-rays via solar-like magnetic processes, nor are their winds powerful enough to produce X-rays by radiative wind shocks as in more massive O-type stars. The emission could originate in unseen low-mass companions, or it may be intrinsic to the

Herbig stars themselves if they still have primordial magnetic fields or can sustain magnetic activity via a nonsolar dynamo. Derived from text

A Stars; X Ray Spectra; Emission; Pre-Main Sequence Stars; Massive Stars

20040082746 Air Force Research Lab., Hanscom AFB, MA

Source Regions of Major Solar Energetic Particle Events

Nitta, N. V.; Cliver, E. W.; Tylka, A. J.; Smit, P.; Jan. 2003; 6 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A423842; AFRL-VS-HA-TR-2004-1118; No Copyright; Avail: CASI; A02, Hardcopy

We examine the source regions of the largest prompt solar energetic particle (SEF) events (J(sub proton)\g10 MeV \g100 pr/sq cm/s/sr) occurring between 1992 and 2002. We find that the 25 such events originated in a broad spectrum of solar regions, ranging from large complex active regions with delta sunspot groups (e.g., 30 October 1992) to a very weak active region in which the major feature was a large filament that erupted to produce the SEP event (12 September 2000). Most source regions are less than two rotation old. In terms of recent work to identify two types of large SEP events on the basis of composition, spectra, and charge state, we find that large complex active regions can give rise to both types, whereas simple and magnetically weak regions are preferentially linked to one type.

DTIC

Coronal Mass Ejection; Energetic Particles; Solar Activity; Solar Corpuscular Radiation; Solar Flares; Solar Storms

20040082750 Air Force Research Lab., Hanscom AFB, MA

Comments on Estimating the Solar Proton Environment that May Affect Mars Missions

Smart, D. F.; Shea, M. A.; Jan. 2003; 6 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A423847; AFRL-VS-HA-TR-2004-1120; No Copyright; Avail: CASI; A02, Hardcopy

Estimates of the energetic proton environment for a Mars mission are generally extrapolated from the solar proton observations at 1 AU. We find that solar particle events may be divided into two general classes. Events dominated by a near-sun injection of particles onto interplanetary magnetic field lines leading to the spacecraft position represent the ″classical″ solar particle event associated with solar activity. This class of event will scale in radial distance by the classical power law extrapolation. The extended- interplanetary-shock source generates a maximum flux as the shock passes the detection location. This class of event typically generates maximum fluence, but in this case, the flux and fluence will not scale in the classical manner with radial distance.

DTIC

Estimating; Mars Missions; Protons; Solar Cosmic Rays

20040082752 Air Force Research Lab., Hanscom AFB, MA

The Space-Developed Dynamic Vertical Cutoff Rigidity Model and its Applicability to Aircraft Radiation Dose

Smart, D. F.; Shea, M. A.; Feb. 17, 2003; 7 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A423850; AFRL-VS-HA-TR-2004-1121; No Copyright; Avail: CASI; A02, Hardcopy

We have developed a dynamic geomagnetic vertical cutoff rigidity model that predicts the energetic charged particle transmission through the magnetosphere. Initially developed for space applications, we demonstrate. the applicability of this library of cutoff rigidity models for computing aircraft radiation dose. The world grids of vertical cutoff rigidities were obtained by particle trajectory tracing in a magnetospheric model. This reference set of world grids of vertical cutoff rigidities calculated for satellite altitudes covers all magnetic activity levels from super quiet to extremely disturbed (i.e., Kp indices ranging from 0 to 9+) for every three hours in universal time. We utilize the McIlwain ″L″ parameter as the basis of the interpolation technique to reduce these initial satellite altitude vertical cutoff rigidities to cutoff rigidity values at aircraft altitudes.

DTIC

Cosmic Rays; Dosage; Dynamic Models; Geomagnetism; Radiation Dosage

20040082755 Air Force Research Lab., Hanscom AFB, MA

The Limitations of Using Vertical Cutoff Rigidities Determined From the IGRF Magnetic Field Models for Computing Aircraft Radiation Dose

Smart, D. F.; Shea, M. A.; Feb. 17, 2003; 9 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A423853; AFRL-VS-HA-TR-2004-1122; No Copyright; Avail: CASI; A02, Hardcopy

Vertical cutoff rigidities derived from the International Geomagnetic Reference Fields (IGRF) are normally used to compute the radiation dose at a specific location and to organize the radiation dose measurements acquired at aircraft altitudes. This paper presents some of the usually ignored limits on the accuracy of the vertical cutoff rigidity models and describes some of the computational artifacts present in these models. It is noted that recent aircraft surveys of the radiation dose experienced along specific flight paths is sufficiently precise that the secular variation of the geomagnetic field is observable.

DTIC

Aircraft Models; Cosmic Rays; Dosage; Geomagnetism; Magnetic Fields; Radiation Dosage

20040084064 Illinois Univ., Urbana-Champaign, IL, USA

Evolutionary Models of Cold, Magnetized, Interstellar Clouds

Gammie, Charles F.; Ostriker, Eve; Stone, James M.; June 17, 2004; 3 pp.; In English

Contract(s)/Grant(s): NAG5-9180; No Copyright; Avail: CASI; A01, Hardcopy

We modeled the long-term and small-scale evolution of molecular clouds using direct 2D and 3D magnetohydrodynamic (MHD) simulations. This work followed up on previous research by our group under auspices of the ATP in which we studied the energetics of turbulent, magnetized clouds and their internal structure on intermediate scales. Our new work focused on both global and smallscale aspects of the evolution of turbulent, magnetized clouds, and in particular studied the response of turbulent proto-cloud material to passage through the Galactic spiral potential, and the dynamical collapse of turbulent, magnetized (supercritical) clouds into fragments to initiate the formation of a stellar cluster. Technical advances under this program include developing an adaptive-mesh MHD code as a successor to ZEUS (ATHENA) in order to follow cloud fragmentation, developing a shearing-sheet MHD code which includes self-gravity and externally-imposed gravity to follow the evolution of clouds in the Galactic potential, and developing radiative transfer models to evaluate the internal ionization of clumpy clouds exposed to external photoionizing UV and CR radiation. Gammie's work at UIUC focused on the radiative transfer aspects of this program.

Derived from text

Interstellar Matter; Molecular Clouds; Computerized Simulation; Mathematical Models; Magnetization

20040084093 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Regularizing the r-mode Problem for Nonbarotropic Relativistic Stars

Lockitch, Keith H.; Andersson, Nils; Watts, Anna L.; [2004]; 12 pp.; In English

Contract(s)/Grant(s): HPRN-CT-2000-00137; NSF PHY-00-90091; NSF AST-00-96399; Copyright; Avail: CASI; A03, Hardcopy

We present results for r-modes of relativistic nonbarotropic stars. We show that the main differential equation, which is formally singular at lowest order in the slow-rotation expansion, can be regularized if one considers the initial value problem rather than the normal mode problem. However, a more physically motivated way to regularize the problem is to include higher order terms. This allows us to develop a practical approach for solving the problem and we provide results that support earlier conclusions obtained for uniform density stars. In particular, we show that there will exist a single r-mode for each permissible combination of 1 and m. We discuss these results and provide some caveats regarding their usefulness for estimates of gravitational-radiation reaction timescales. The close connection between the seemingly singular relativistic r-mode problem and issues arising because of the presence of co-rotation points in differentially rotating stars is also clarified.

Author

Neutron Stars; Stellar Rotation; Relativistic Theory; Modes

20040084100 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Neutral Middle Atmospheric Influences by the Extremely Large October 2003 Solar Proton

Jackman, C. H.; Fleming, E. L.; [2004]; 1 pp.; In English; 2004 Joint Assembly Meeting: Violent Sun-Earth Connection Events of October-November 2003, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The huge coronal mass ejection (CME) on October 28, 2003 caused an extremely large solar proton event (SPE) 3t the

Earth, which impacted the middle atmospheric polar cap regions. The highly energetic protons produce ionizations, excitations, dissociations, and dissociative ionizations of the background constituents, which lead to the production of HO(x) (H, OH, HO2) and NO(y) (N, NO, NO2, NO3, N2O5, HNO3, HO2NO2, ClONO2, BrONO2). The total production of middle atmospheric NO(y) molecules by individual SPEs can be used to compare their sizes. Using this scale, the extremely large October 2003 SPE was the fourth largest in the past 40 years and the second largest of solar cycle 23. Only the October 1989, August 1972, and July 2000 SPEs were larger. The Goddard Space Flight Center (CSFC) Two-dimensional (2D)) Model was used in computing the influence of this gigantic SPE The NO(y) amount was increased by over two orders of Atmosphere Research Satellite (UARS) Halogen Occultation Experiment (HALOE) measurements as a result of this noteworthy SPE. The model also calculated polar middle mesosphere ozone decreases of over 70% during the SPE. Other atmospheric impacts from both model predictions and measurements as a result of this major SPE will be discussed in this paper.
Author
Atmospheric Chemistry; Solar Cycles; Protons; Coronal Mass Ejection

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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*.

20040081365 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Meridional Variations of C2H2 and C2H6 in Jupiter's Atmosphere from Cassini CIRS Infrared Spectra
Nixon, C. A.; Achterberg, R. K.; Conrath, B. J.; Irwin, P. G. J.; Fouchet, T.; Parrish, P. D.; Romani, P. N.; Abbas, M.; LeClair, A.; Strobel, D., et al.; 2004; 70 pp.; In English; Copyright; Avail: CASI; A04, Hardcopy

Hydrocarbons such as acetylene (C2H2) and ethane (C2H6) are important tracers in Jupiter's atmosphere, constraining our models of the chemical and dynamical processes. However, our knowledge of the vertical and meridional variations of their abundances has remained sparse. During the flyby of the Cassini spacecraft in December 2000, the Composite Infrared Spectrometer (CIRS) instrument was used to map the spatial variation of emissions from 10-1400 cm(sup -1) (1000-7 microns). In this paper we analyze a zonally-averaged set of CIRS spectra taken at the highest (0.5 cm(sup -1)) resolution, to infer atmospheric temperatures in the stratosphere at 0.5-20 mbar via the v4 band of CH4, and in the troposphere at 150-400 mbar, via the H2 absorption at 600-800 cm(sup -1). Simultaneously, we retrieve the abundances of C2H2 and C2H6 via the v5 and vg bands respectively. Tropospheric absorption and stratospheric emission are highly anti-correlated at the CIRS resolution, introducing a non-uniqueness into the retrievals, such that vertical gradient and column abundance cannot both be found without additional constraints. Assuming profile gradients from photochemical calculations, we show that the column abundance of C2H2 decreases sharply towards the poles by a factor approximately 4, while C2H6 is unchanged in the north and increasing in the south, by a factor approximately 1.8. An explanation for the meridional trends is proposed in terms of a combination of photochemistry and dynamics. Poleward, the decreasing UV flux is predicted to decrease the abundances of C2H2 and C2H6 by factors 2.7 and 3.5 respectively at a latitude 70 deg. However, the lifetime of C2H6 in the stratosphere (5 x 10(exp 9)) is much longer than the dynamical timescale for meridional motions inferred from SL-9 debris (5 x 10(exp 8 s)), and therefore the constant or rising abundance towards high latitudes likely indicates that meridional mixing dominates over photochemical effects. For C2H2, the opposite occurs, with the relatively short photochemical lifetime (3 x 10(exp 7 s)), compared to meridional mixing times, ensuring that the expected photochemical trends are visible.
Author
Cassini Mission; Meridional Flow; Acetylene; Ethane; Jupiter Atmosphere; Infrared Spectra; Infrared Spectrometers; Parameterization

20040081419 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Time Scale for Major Events in Early Mars Crustal Evolution
Frey, Herbert V.; 2004; 2 pp.; In English; 35th Lunar and Planetary Science Conference, March 2004, Houston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy

The population of visible and buried impact basins \g 200 km diameter revealed by high resolution gridded MOLA data and the cumulative frequency curves derived for these pvide a basis for a chronology of major events in early martian history. The relative chronology can be given in terms of N(200) crater retention ages; 'absolute ages' can be assigued using the Hartmann-Neukum (H&N) model chronology. In terms of billions of H&N years, the crustal dichotomy formed by large impact basins at 4.12 +/- 0.08 BYA (N(200) = 3.0-3.2) and the global magnetic field died at about or slightly before the same

time (4.15 +/- 0.08 BYA (N(200) = 3.5). In this chronology, the buried lowlands are approx. 120 my younger than the buried highlands, approx. 160 my younger than the highlands overall and approx. 340 my younger than the oldest crater retention surface we see, defined by the largest impact basins.
Author
Planetary Evolution; Planetary Crusts; Mars (Planet); Planetary Geology

20040082070 Arizona State Univ., Tempe, AZ, USA
High-Pressure Minerals in Meteorites: Constraints on Shock Conditions and Duration
Sharp, Thomas G.; [2004]; 8 pp.; In English
Contract(s)/Grant(s): NAG5-9381; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this research was to better understand the conditions and duration of shock metamorphism in meteorites through microstructural and microanalytical characterization of high-pressure minerals. A) Continue to investigate the mineralogy and microstructures of melt-veins in a suite of chondritic samples ranging from shock grades S3 through S6 to determine how the mineral assemblages that crystallize at high-pressure and are related to shock grade. B) Investigate the chemical, mineralogical, and microstructural heterogeneities that occur across melt veins to interpret crystallization histories. C) Use static high-pressure experiments to simulate crystallization of melt veins for mineralogical and textural comparisons with the melt veins of naturally shocked samples. D) Characterize the compositions and defect microstructures of polycrystalline ringwoodite, wadsleyite, majorite, (Mg,Fe)Si03-ilmenite and (Mg,Fe)SiO3-perovskite in S6 samples to understand the mechanisms of phase transformations that occur during shock. These results will combined with kinetic data to constrain the time scales of kinetic processes. E) Investigate the transformations of metastable high-pressure minerals back to low- pressure forms to constrain post-shock temperatures and estimates of the peak shock pressure. Of these objectives, we have obtained publishable data on A, B and D. I am currently doing difficult high-pressure melting and quench experiments on an L chondrite known as Mbale. These experiments will provide additional constraints on the mineral assemblages that are produced during rapid quench of an L chondrite at pressures of 16 to 25 GPa. Results from published or nearly published research is presented below. Lists of theses, dissertations and publications are given below.
Derived from text
Meteorites; Chondrites; High Pressure; Microstructure; Polycrystals

20040082082 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coronagraphic Methods for the Detection of Terrestrial Planets
Heap, Sally; [2004]; 1 pp.; In English; Terrestrial Planet Finder Workshop, 2-6 Feb. 2004, Leiden, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

I will contribute (i.e. join in writing the TPF-C Report) for the following workshop topics: 1) Science Topics (target list): I describe a new target list for the TPF-C based on General TPF target list maintained at the US Naval Observatory; 2) Science Topics (spectroscopy): I describe the need for optical, imaging, pulse-counting detectors for spectroscopy of terrestrial planets; 3) Simulation and Modeling Techniques: I describe work at Goddard Space Flight Center to simulate wide-band imagery and spectroscopic imagery that will be obtained by TPF-C.
Derived from text
Coronagraphs; Imaging Techniques; Planet Detection

20040082225 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Pickup Ion Velocity Distributions at Titan: Effects of Spatial Gradients
Hartle, R. E.; Sittler, E. C.; February 18, 2004; 1 pp.; In English; 2004 Spring AGU Meeting, 17-19 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The principle source of pickup ions at Titan is its neutral exosphere, extending well above the ionopause into the magnetosphere of Saturn or the solar wind, depending on the moon's orbital position. Thermal and nonthermal processes in the thermosphere generate the distribution of neutral atoms and molecules in the exosphere. The combination of these processes and the range of mass numbers, 1 to over 28, contribute to an exospheric source structure that produces pickup ions with gyroradii that are much larger or smaller than the corresponding scale heights of their neutral sources. The resulting phase space distributions are dependent on the spatial structure of the exosphere as well as that of the magnetic field and background plasma. When the pickup ion gyroradius is less than the source gas scale height, the pickup ion velocity distribution is characterized by a sharp cutoff near the maximum speed, which is twice that of the ambient plasma times the sine of the angle between the magnetic field and the flow velocity. This was the case for pickup H(sup +) ions identified during the Voyager

1 flyby. In contrast, as the gyroradius becomes much larger than the scale height, the peak of the velocity distribution in the source region recedes from the maximum speed. Iri addition, the amplitude of the distribution near the maximum speed decreases. These more beam like distributions of heavy ions were not observed from Voyager 1 , but should be observable by more sensitive instruments on future spacecraft, including Cassini. The finite gyroradius effects in the pickup ion velocity distributions are studied by including in the analysis the possible range of spatial structures in the neutral exosphere and background plasma.
Author
Ion Distribution; Velocity Distribution; Titan; Planetary Magnetospheres

20040084165 Cornell Univ., Ithaca, NY, USA
Aeolian Sand Transport with Collisional Suspension
Jenkins, James T.; Pasini, Jose Miguel; Valance, Alexandre; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 87; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Aeolian transport is an important mechanism for the transport of sand on Earth and on Mars. Dust and sand storms are common occurrences on Mars and windblown sand is responsible for many of the observed surface features, such as dune fields. A better understanding of Aeolian transport could also lead to improvements in pneumatic conveying of materials to be mined for life support on the surface of the Moon and Mars. The usual view of aeolian sand transport is that for mild winds, saltation is the dominant mechanism, with particles in the bed being dislodged by the impact of other saltating particles, but without in-flight collisions. As the wind becomes stronger, turbulent suspension keeps the particles in the air, allowing much longer trajectories, with the corresponding increase in transport rate. We show here that an important regime exists between these two extremes: for strong winds, but before turbulent suspension becomes dominant, there is a regime in which in-flight collisions dominate over turbulence as a suspension mechanism, yielding transport rates much higher than those for saltation. The theory presented is based on granular kinetic theory, and includes both turbulent suspension and particle-particle collisions. The wind strengths for which the calculated transport rates are relevant are beyond the published strengths of current wind tunnel experiments, so these theoretical results are an invitation to do experiments in the strong-wind regime. In order to make a connection between the regime of saltation and the regime of collisional suspension, it is necessary to better understand the interaction between the bed and the particles that collide with it. This interaction depends on the agitation of the particles of the bed. In mild winds, collisions with the bed are relatively infrequent and the local disturbance associated with a collision can relax before the next nearby collision. However, as the wind speed increases, collision become more frequent and the agitation need not decay completely. In the regime of collisional suspension, the particles near the surface of the bed are assumed to be in a state of constant agitation. We indicate the conditions at the bed corresponding to the limits of saltation and collisional suspension and outline experiments, simulations, and modeling that have been undertaken to bridge these limits.
Author
Sands; Sediment Transport; Dust Storms; Mars Surface; Particle Collisions

20040084166 Cornell Univ., Ithaca, NY, USA
Particle Segregation in Collisional Shearing Flows
Jenkins, James T.; Louge, Michel Y.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 19; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This research concerns flowing granular materials and the development of ways to prodict the behavior of such flows and the means to control them. The research treats flows in which the particles interact through collisions rather than enduring contacts. This is expected to be important in materials processing activities carried out in space and in mining operations on the surface of the Moon and Mars.The specific phenomenon of interest is the segregation of the particles in a flow due to differences in their size and/or mass. In many industrial processes a homogeneous aggregate is desired; in these. segregation is undesirable. However, in the mining industry, segregation is exploited in sorting and crushing operations. Because segregation is not well understood, attempts to suppress it or exploit proceed on an ad hoc basis and are expensive. In systems that do not involve much agitation of the grains, several mechanisms that involve gravity have been identified as leading to segregation, However, in highly agitated flows there is a mechanism independent of gravity that is available to drive segregation. This is associated with spatial gradients in the energy of the velocity fluctuations of the grains. Collisional interactions between and among different types of grains require that, in general, differences in their concentrations exist to balance differences in particle fluctuation energy. This segregation mechanism is often masked by gravitational segregation

mechanisms on Earth. It is expected to be of equal importance to gravitational segregation in the reduced gravity on Mars and to be the dominant mechanism for segregation on the Moon. It is the only mechanism for segregation in space. The segregation of colliding particles of different size and mass wil be studied on the International Space Station in an axisymmetric shear cell in which the flow is created by the relative motion of bumpy boundaries of a cylindrical annulus. The profile of particle segregation is observed using digital video, image analysis, and sophisticated particle tracking algorithms, Two basic systems are to be examined: in one, the spheres are of equal size but differ in mass; in the other, they are of equal mass but differ in size. The observations will be compared to results of simulations and the predictions of theory to establish their respective limits and suggest possible improvements. Studies of a segregation mechanism that is especially important in reduced gravity should benefit mining and materials-handling activities with in-situ resource utilization on Mars and the Moon. It should also assist in the interpretation of geologic deposits, particularly in low gravity. It will eventually benefit the design of manufacturing operations and in-space fabrication technologies in zero gravity is support of exploration.
Author
Granular Materials; Solids Flow; Mars (Planet); Particle Size Distribution

20040084178 Vanderbilt Univ., Nashville, TN, USA
Separation of Carbon Monoxide and Carbon Dioxide for Mars ISRU
Walton, Krista S.; LeVan, M. Douglas; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 183-184; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The atmosphere of Mars has many resources that can be processed to produce things such as oxygen, fuel, buffer gas, and water for support of human exploration missions. Successful manipulation of these resources is crucial for safe, cost-effective, and self-sufficient long-term human exploration of Mars. In our research, we are developing enabling technologies that require fundamental knowledge of adsorptive gas storage and separation processes. In particular, we are designing and constructing an innovative, low mass, low power separation device to recover carbon dioxide and carbon monoxide for Mars ISRU (in-situ resource utilization). The technology has broad implications for gas storage and separations for gas-solid systems that are ideally suited for reduced gravitational environments. This paper describes our separation process design and experimental procedures and reports results for the separation of CO2 and CO by a four-step adsorption cycle.
Author
Mars Atmosphere; Carbon Dioxide; Carbon Monoxide; Adsorption

20040084181 Colorado Univ., Boulder, CO, USA
Lunar Surface Environment Laboratory
Colwell, Joshua E.; Horanyi, Mihaly; Robertson, Scott; Sture, Stein; Batiste, Susan; Sternovsky, Zoltan; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 67-68; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

The lunar surface is covered with a layer of fine dust, or lunar regolith, that is produced by the continuous bombardment of the surface by the interplanetary micrometeoroid flux. The dust on the lunar mare is an angular, basaltic material with a mean particle size of about 100 m and a broad size distribution extending down to at least 1 m. The relatively low lunar gravity makes it easy for small disturbances to the surface to kick up large amounts of dust which travel higher and farther than in terrestrial gravity. In addition, the airless lunar surface leads to a plasma sheath on the night side due to solar wind ions and a photoelectron sheath on the day side due to photoemission of electrons by the solar UV flux. The dust on the lunar surface charges in this plasma environment and levitates and moves across the surface. Any mission to the surface of the Moon, manned or unmanned, operates in this contaminating environment. A Surveyor photograph of the lunar horizon showing a cloud of small particles suspended 1 m above the surface is presented. A NASA photograph of the size and direction to the Sun is also shown. We have studied the charging, levitation, and transport of dust over planetary surfaces both experimentally and numerically. We have reproduced the stably levitating dust clouds seen on the Moon in our laboratory experiments. We have also studied the response of planetary regolith to gentle impacts in a reduced gravity environment.
Derived from text
Lunar Surface; Moon; Space Missions; Lunar Geology; Lunar Photographs

20040084206 Iowa Univ., Iowa City, IA, USA
Electrostatic Release of Fine Particles Adhered to Surfaces on the Moon or Mars
Goree, John; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 81; In English; See also 20040084137; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The adhesion of fine particles to surfaces is a concern for human exploration of the Moon and Mars. Airlocks, EVA suits, and photovoltaic cells have surfaces where dust can be an unwanted contaminant. When a particle rests on a surface, it is held in place by a van-der-Waals attraction, but this adhesion can be overcome by several mechanisms. One such mechanism for the Moon and Mars environments is the application of electrostatic forces. These forces occur spontaneously on the Moon. They could also be applied deliberately for the purpose of cleaning surfaces on the Moon or Mars.The Moon, unlike Mars, has no atmosphere. Instead, it is immersed in interplanetary plasma, which consists of free electrons and protons at a low number density. The Moon disturbs this plasma, so that there is an electric field perpendicular to the Moon s surface. This electric field applies a vertical force to any electrically-charged fine particle. Particles are known to become charged and levitated on the Moon. This was discovered in Apollo missions, where a thin cloud of dust was seen floating above the lunar horizon. Particles can be charged either photoelectrically by exposure to solar UV, or by collection of free electrons and ions from the surrounding plasma. This can lead to levitation, if the particle can first overcome van-der-Waals adhesion to surfaces such as a rock, a photovoltaic cell, or another dust particle. Laboratory experiments have demonstrated that one mechanism for overcoming adhesion is an electrostatic force. Dielectric particles on a surface are charged due to exposure to plasma, or UV. In a pile of particles, two neighboring particles can acquire charges of the same polarity, thereby applying an interparticle repulsion sufficient to overcome the adhesion. This particle release occurs with a surprising speed that remains unexplained. On Mars, there is an atmosphere of neutral gas instead of a natural plasma. However, it is possible to purposefully produce a localized plasma by ionizing the thin Martian atmosphere. This can be done by applying a voltage to an antenna or electrode. It is worth studying whether such a plasma could be used for cleaning surfaces. A similar method has been developed previously for the semiconductor industry to clean particulate contaminants from semiconductor wafer surfaces. Another application for these principles is ion thruster technology. Fine particles can flake from interior surfaces of an ion-thruster s plasma source. When these particles overcome adhesion from the surface, they move about and become lodged in the grids that accelerate ions, causing a malfunction by shorting the grids. For this reason, it is of interest to study the plasma-generated electrostatic forces that overcome adhesion of particles to surfaces. It is proposed to carry out laboratory experiments and possibly parabolic flights with lunar gravity conditions, to study these electrostatic mechanisms, using plasma sources and a UV lamp.
Author
Electrostatics; Lunar Dust; Lunar Surface; Mars Surface

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040081068 NASA Ames Research Center, Moffett Field, CA, USA
Analytical Instrument for Determining the Composition of Surface Materials and Ices in the Solar System: Mini-CIDEX to TIDE
Kojiro, Daniel R.; Holland, Paul M.; Stimac, Robert M.; Takeuchi, Noreshige; February 09, 2004; 1 pp.; In English; 227th American Chemical Society National Meeting, 28 Mar. - 1 Apr. 2004, Anaheim, CA, USA
Contract(s)/Grant(s): RTOP 344-52-50-37; No Copyright; Avail: Other Sources; Abstract Only

Exobiology experiments onboard spacecraft or space probes often require the detection and identification of a wide range of chemical species over vast concentration ranges. These experiments must be carried out under severely limited conditions utilizing minimal resources. The mini-Cometary Ice and Dust Experiment (mini-CIDEX) instrument was developed for the chemical analysis of a cometary environment. It combined a Gas Chromatograph (GC) with a helium-based Ion Mobility Spectrometer (IMS) to fulfill the analytical requirements of a cometary exobiology mission: universal response; ppb sensitivity; low mass, volume, and consumables. Mini-CIDEX has evolved into the Titan Ice and Dust Experiment (TIDE) for the chemical analysis of the surface (liquid and solid) and lower atmosphere of Titan. The complexity of the analyses will be similar to the comet application with a heavier emphasis on organic molecules. TIDE is a component of the Titan Orbiter Aero-Rover Mission (TOAM) proposed to NASA's New Visions Program. Advances to the Mini-CIDEX technology for the Titan application and the analytical capabilities of TIDE will be presented.
Author
Chemical Analysis; Comets; Detection; Dust; Exobiology; Gas Chromatography; Ice; Solar System

20040082012 NASA Goddard Space Flight Center, Greenbelt, MD, USA
INTEGRAL and XMM-Newton Spectral Studies of NGC 4388
Beckmann, V.; Gehrels, N.; Favre, P.; Walter, R.; Courvoisier, T. J.-L.; Petrucci, P.-O.; Malzac, J.; 2004; 9 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

We present first INTEGRAL and XMM-Newton observations of a Seyfert galaxy, the type 2 AGN NGC 4388. Several INTEGRAL observations performed in 2003 allow us to study the spectrum in the 20 - 300 keV range. In addition two XMM-Newton observations give detailed insight into the 0.2 - 10 keV emission. Comparison with previous observations by BeppoSAX, SIGMA and CGRO/OSSE show that the overall spectrum for soft X-rays up to the gamma-rays can be described by a highly absorbed (N(sub H approx. = 2.7 x 10(exp 23)/sq cm) and variable non-thermal component in addition to constant non-absorbed thermal emission (T approx. = 0.8 keV) of low abundance (Z approx. 5% Z (solar)), plus a constant Fe K a line. The hard X-ray component is well described by a simple power law with a mean photon index of Gamma = 1.7. During the INTEGRAL observations the flux at 100 keV increased by a factor of 1.5. The analysis of XMM-Newton data implies that the emission below 3 keV is decoupled from the AGN and probably due to extended emission as seen in Chandra observations. The constant iron line emission is apparently also decoupled from the direct emission of the central engine and likely to be generated in the obscuring material, e.g. in the molecular torus.
Author
X Rays; Thermal Emission; Seyfert Galaxies; K Lines

20040082069 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Heavy-Element Abundances in Solar Energetic Particle Events
Reames, Donald V.; 2004; 1 pp.; In English; Solar, Heliospheric, and Interplanetary Environment Workshop (SHINE), 27 Jun. - 2 Jul. 2004, Big Sky, MT, USA; No Copyright; Avail: Other Sources; Abstract Only

We survey the relative abundances of elements with 1 less than or = Z less than or = 82 in solar energetic particle (SEP) events observed at 2 - 10 MeV amu″ during nearly 9 years aboard the Wind spacecraft, with special emphasis on enhanced abundances of elements with 2Z greater than or = 34. Abundances of Fe/O again show a bimodal distribution with distinct contributions from impulsive and gradual SEP events as seen in earlier solar cycles. Periods with greatly enhanced abundances of (50 less than or = Z less than or = 56)/O, like those with enhanced He-3/He-4, fall prominently in the Fe-rich population of the impulsive SEP events. In a sample of the 39 largest impulsive events, 25 have measurable enhancements in (50 less than or = Z less than or = 56)/O and (76 less than or = Z less than or = 82)/O, relative to coronal values, ranging from approx. 100 to 10,000. By contrast, in a sample of 45 large gradual events the corresponding enhancements vary from approx. 0.2 to 20. However, the magnitude of the heavy-element enhancements in impulsive events is less striking than their strong correlation with the Fe spectral index and flare size, with the largest enhancements occurring in flares with the steepest Fe spectra, the smallest Fe fluence, and the lowest X-ray intensity, as reported here for the first time Thus it seem that small events with low energy input can produce only steep spectra of the dominant species but accelerate rare heavy elements with great efficiency, probably by selective absorption of resonant waves in the flare plasma. With increased energy input, enhancements diminish, as heavy ions are depleted, and spectra of the dominant species harden.
Author
Heavy Elements; Abundance; Solar Corpuscular Radiation; Energetic Particles

20040082185 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Heavy-Element Abundances in Solar Energetic Particle Events
Reames, D. V.; Ng, C. K.; 2004; 28 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We survey the relative abundances of elements with 1 \h or equal to Z \h or equal to 82 in solar energetic particle (SEP) events observed at 2-10 MeV/amu during nearly 9 years aboard the Wind spacecraft, with special emphasis on enhanced abundances of elements with Z \g or equal to 34. Abundances of Fe/O again show a bimodal distribution with distinct contributions from impulsive and gradual SEP events as seen in earlier solar cycles. Periods with greatly enhanced abundances of (50 \h or equal to Z \h or equal to 56)/O, like those with enhanced (3)He/(4)He, fall prominently in the Fe-rich population of the impulsive SEP events. In a sample of the 39 largest impulsive events, 25 have measurable enhancements in (50 \h or equal to z \h or equal to 56)/O and (76 \h or equal to Z \h or equal to 82)/O, relative to coronal values, ranging from approx. 100 to 10,000. By contrast, in a sample of 45 large gradual events the corresponding enhancements vary from approx. 0.2 to 20. However, the magnitude of the heavy-element enhancements in impulsive events is less striking than their strong correlation with the Fe spectral index and flare size, with the largest enhancements occurring in flares with the steepest Fe spectra, the smallest Fe fluence, and the lowest X-ray intensity, as reported here for the first time. Thus it seems that small events with low energy input can produce only steep spectra of the dominant species but accelerate rare heavy elements with

great efficiency, probably by selective absorption of resonant waves in the flare plasma. With increased energy input, enhancements diminish, as heavy ions are depleted, and spectra of the dominant species harden.
Author
Heavy Elements; Abundance; Solar Activity; Energetic Particles

20040082355 NASA Marshall Space Flight Center, Huntsville, AL, USA
What the Long-Term Sunspot Record Tells Us About Space Climate
Hathaway, D. H.; [2004]; 1 pp.; In English; First International Symposium on Space Weather, 20-23 Jun. 2004, Oulu, Finland; No Copyright; Avail: Other Sources; Abstract Only

Direct observations of sunspots span the nearly 400 years since the time of Galileo. Dedicated observing programs at several observatories over the last 150 years have provided detailed information not only on the number of sunspots but on their sizes and positions as well. The data acquired by those original observers, and by those who have more recently brought those observations to light, provide important clues about the nature of the solar cycle and its contribution to space climate. The period of the cycle, the equator-ward drift of the active latitudes, the asymmetry between the rise to maximum and the fill to minimum, shifting asymmetries between northern and southern hemisphere activity, the tilt of active regions, and the increasing amplitude of the cycles since the Maunder Minimum are all well established. Other, less well established characteristics such as multi-cycle and short-term periodicities, often depend upon the method of data analysis. The strong correlation between sunspot statistics and other measures of solar activity, coupled with the length of the sunspot record, make these observations extremely valuable for characterizing and understanding space climate.
Author
Solar Cycles; Sunspots; Climate; Aerospace Environments

20040082544 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar C: Scatter-Free Observatory for Limb Active Regions and Coronae
[2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-8330; No Copyright; Avail: Other Sources; Abstract Only

The SOLARC observatory is a 0.5m off-axis reflecting coronagraph. NASA SRT funding has allowed the completion of this telescope facility, which we believe is now the world's largest operational coronagraph. We have achieved our proposal goals both in the development of the new technology for this facility and in the demonstration of its scientific and educational potential: 1) The SOLARC engineering development was successful and has spawned other similar instruments. The off-axis design of ATST (a new 4m telescope) has benefited from the SOLARC development. The off-axis 1.6m NST facility at BBSO is also now under construction and will be the world's largest solar disk observing telescope until ATST is completed. Both of these telescope designs are derivatives of the SOLARC 0.5m off-axis. Some of this technical development is described in the publications. 2) The most important scientific goal of SOLARC has been to demonstrate that coronal magnetic fields can be measured using infrared spectropolarimetry techniques. With the completion of the optical fiber-bundle imaging spectropolarimeter we have measured the coronal field strength with a sensitivity to the line-of-sight field component of 2G at 150,OOOkm above the limb. We believe this capability opens new opportunities for space weather, and coronal physics research. In particular we have demonstrated a new tool for understanding the effect of the Sun on the terrestrial space environment. A paper reporting these results has recently been submitted to the Astrophysical Journal Letters.
Author
Coronagraphs; Imaging Techniques; Infrared Radiation; Solar Corona

20040084075 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Solar Chromosphere/Corona Interface. I. Far-Ultraviolet to Extreme-Ultraviolet Observations and Modeling of Unresolved Coronal Funnels
Martinez-Galarce, Dennis S.; Walker, Arthur C., III; Barbee, Troy W., II; Hoover, Richard B.; Astrophysical Journal; 2003; Volume 585, pp. 1095-1113; In English; Original contains black and white illustrations
Contract(s)/Grant(s): W-7405-Eng-48; NSG-5131; NGT-70284; Copyright; Avail: Other Sources

A coronal funnel model, developed by D. Rabin, was tested against a calibrated spectroheliogram recorded in the 170-1 75 A bandpass. This image was recorded on board a sounding-rocket experiment flown on 1994 November 3, called the Multi-Spectral Solar Telescope Array II (MSSTA II). MSSTA, a joint project of Stanford University, the NASA Marshall Space Flight Center, and the Lawrence Livermore National Laboratory' is an observing platform composed of a set of normal-incidence, multilayer-coated optics designed to obtain narrow-bandpass, high-resolution images (1 sec.- 3 sec.) at

selected far-ultraviolet (FUV), extreme-ultraviolet (EUV), and soft X-ray wavelengths (44-1550 A). Using full disk images centered at 1550 A (C IV) and 173 A (Fe IX/X), the funnel model, which is based on coronal back-heating, was tested against the data incorporating observed constraints on global coverage and measured flux. Found was a class of funnel models that could account for the quiescent, globally diffuse and unresolved emission seen in the 171-175 A bandpass, where the funnels are assumed to be rooted in the C IV supergranular network. These models, when incorporated with the CHIANTI spectral code, suggest that this emission is mostly of upper transition region origin and primarily composed of Fe IX plasma. The funnels are found to have constrictions, Gamma approx. 6-20, which is in good agreement with the observations. Further, the fitted models simultaneously satisfy global areal constraints seen in both images; namely,that a global network of funnels must cover approx. 700 - 95% of the total solar surface area seen in the 171-175 A image, and a 5% of the disk area seen in the 1550 A bandpass. These findings support the configuration of the EUV magnetic network as suggested by Reeves et al. and put forth in more detail by Gabriel. Furthermore, the models are in good agreement with differential emission measure estimates made of the transition region by J. C. Raymond & J. G. Doyle for temperatures 250,000 K less than or = T less than or = 650,000 K, based on full-disk observations made on board Skylab.
Author
Solar Corona; Solar Arrays; Chromosphere

20040084092 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Extra Solar Planetary Imaging Coronagraph and Science Requirements for the James Webb Telescope Observatory
Clampin, Mark; [2004]; 1 pp.; In English; SPIE Conference, 21-26 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

1) Extra solar planetary imaging coronagraph. Direct detection and characterization of Jovian planets, and other gas giants, in orbit around nearby stars is a necessary precursor to Terrestrial Planet Finder 0 in order to estimate the probability of Terrestrial planets in our stellar neighborhood. Ground based indirect methods are biased towards large close in Jovian planets in solar systems unlikely io harbor Earthlike planets. Thus to estimate the relative abundances of terrestrial planets and to determine optimal observing strategies for TPF a pathfinder mission would be desired. The Extra-Solar Planetary Imaging Coronagraph (EPIC) is such a pathfinder mission. Upto 83 stellar systems are accessible with a 1.5 meter unobscured telescope and coronagraph combination located at the Earth-Sun L2 point. Incorporating radiometric and angular resolution considerations show that Jovians could be directly detected (5 sigma) in the 0.5 - 1.0 micron band outside of an inner working distance of 5/D with integration times of -10 - 100 hours per observation. The primary considerations for a planet imager are optical wavefront quality due to manufacturing, alignment, structural and thermal considerations. pointing stability and control, and manufacturability of coronagraphic masks and stops to increase the planetary-to- stellar contrast and mitigate against straylight. Previously proposed coronagraphic concepts are driven to extreme tolerances. however. we have developed and studied a mission, telescope and coronagraphic detection concept, which is achievable in the time frame of a Discovery class NASA mission. 2) Science requirements for the James Webb Space Telescope observatory. The James Webb Space Observatory (JWST) is an infrared observatory, which will be launched in 201 1 to an orbit at L2. JWST is a segmented, 18 mirror segment telescope with a diameter of 6.5 meters, and a clear aperture of 25 mA2. The telescope is designed to conduct imaging and spectroscopic observations from 0.6-27 microns. The primary mirror find and understand predicted first light objects, observe galaxies back to their earliest precursors so that we can understand their growth and evolution, unravel the birth and early evolution of stars and planetary systems, and study planetary systems and the origins of life. In this paper we discuss the science goals for JWST in the context of the performance requirements they levy on the observatory.
Author
Coronagraphs; Imaging Techniques; Gas Giant Planets; Radiometric Resolution; Stellar Systems; Terrestrial Planets

20040084230 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evidence of ″Tether-Cutting″ Reconnection in the Onset of a Quadrupolar Solar Magnetic Eruption
Choudhary, Debi Prasad; Sterling, Alphonse C.; Moore, Ronald L.; Yurchyshyn, Vasyl; [2004]; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Extensive study of the near-limb solar filament eruption event on 2000 February 26, involving coronal images from YOHKOH, SOHO EIT and photospheric magnetogram from MID have shown that that both ″runaway-tether-cutting-type reconnection″ and ″fast breakout-type reconnection″ may have occurred early in the fast phase of the eruption and may have played an important role in unleashing the explosion (Sterling & Moore 2004). That study did not identify which or if either of these types of reconnection actually triggered the fast phase. Here, together with a magnetogram and He1 10830 A filtergram from NSO/KP, we present Halpha filtergrams from Big Bear Solar Observatory, that show evidence of

″tether-cutting-type reconnection″ before and during the eruption of the southern filament, situated at one of the neutral lines of the quadrupole magnetic structure.
Author
Tethering; Solar Magnetic Field; Magnetic Field Reconnection; Quadrupoles

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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*.

20040082168 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gamma-Ray Burst Intensity Distributions
Band, David L.; Norris, Jay P.; Bonnell, Jerry T.; [2004]; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We use the lag-luminosity relation to calculate self-consistently the redshifts, apparent peak bolometric luminosities L(sub B1), and isotropic energies E(sub iso) for a large sample of BATSE bursts. We consider two different forms of the lag-luminosity relation; for both forms the median redshift, for our burst database is 1.6. We model the resulting sample of burst energies with power law and Gaussian dis- tributions, both of which are reasonable models. The power law model has an index of a = 1.76 plus or minus 0.05 (95% confidence) as opposed to the index of a = 2 predicted by the simple universal jet profile model; however, reasonable refinements to this model permit much greater flexibility in reconciling predicted and observed energy distributions.
Author
Gamma Ray Bursts; Red Shift

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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.

20040082224 NASA Marshall Space Flight Center, Huntsville, AL, USA
FY 2002 Scientific and Technical Reports, Articles, Papers, and Presentations
Fowler, B. A., Compiler; December 2003; 76 pp.; In English
Report No.(s): NASA/TM-2003-212933; M-1098; No Copyright; Avail: CASI; A05, Hardcopy

This Technical Memorandum (TM) presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 2002. It also includes papers of MSFC contractors. The information in this TM may be of value to the scientific and engineering community in determining what information has been published and what is available.
Author
Research and Development; Composite Materials; Aerospace Engineering; Alloys; NASA Programs

20040083981 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Materials Related Lessons Learned
Garcia, Danny; Gill, Paul S.; Vaughan, William W.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 4 pp.; In English; See also 20040083973; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Lessons Learned have been the basis for our accomplishments throughout the ages. They have been passed down from father to son, mother to daughter, teacher to pupil, and older to younger worker. Lessons Learned have also been the basis for the nation s accomplishments for more than 200 years. Both government and industry have long recognized the need to systematically document and utilize the knowledge gained from past experiences in order to avoid the repetition of failures and mishaps. Through the knowledge captured and recorded in Lessons Learned from more than 80 years of flight in the Earth s atmosphere, NASA s materials researchers are constantly working to develop stronger, lighter, and more durable materials that can withstand the challenges of space. The Agency s talented materials engineers and scientists continue to build on that

rich tradition by using the knowledge and wisdom gained from past experiences to create futuristic materials and technologies that will be used in the next generation of advanced spacecraft and satellites that may one day enable mankind to land men on another planet or explore our nearest star. These same materials may also have application here on Earth to make commercial aircraft more economical to build and fly. With the explosion in technical accomplishments over the last decade, the ability to capture knowledge and have the capability to rapidly communicate this knowledge at lightning speed throughout an organization like NASA has become critical. Use of Lessons Learned is a principal component of an organizational culture committed to continuous improvement.
Derived from text
Earth Atmosphere; Commercial Aircraft; Engineers

20040084045 NASA Marshall Space Flight Center, Huntsville, AL, USA
Micro-Raman Analysis of Irradiated Diamond Films
Newton, Robert L.; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; 10 pp.; In English; See also 20040083973; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Owing to its unique and robust physical properties, diamond is a much sought after material for use in advanced technologies, even in Microelectromechanical Systems (MEMS). The volume and weight savings promised by MEMS-based devices are of particular interest to spaceflight applications. However, much basic materials science research remains to be completed in this field. Results of micro-Raman analysis of proton (10(exp 15) - 10(exp 17) H(+)/sq cm doses) irradiated chemical vapor deposited (CVD) films are presented and indicate that their microstructure is retained even after high radiation exposure.
Author
Diamond Films; Irradiation; Microelectromechanical Systems; Microstructure; Radiation Dosage

20040084145 California Univ., San Diego, CA, USA
Modeling and Analysis of Co-current Flame Spread Applied to the Upward Burning of PMMA
Buckley, Steven G.; Rangwala, Ali S.; Torero, Jose L.; Strategic Research to Enable NASA's Exploration Missions Conference; June 2004, pp. 61-62; In English; See also 20040084137; No Copyright; Avail: CASI; A01, Hardcopy

NASA uses tests involving upward flame spread as a flammability criterion to evaluate materials that could be potentially used in manned spacecraft. However, such tests remain an ON/OFF criterion, and no real translation of the ground based results to a micro-gravity environment has been proposed so far. The traditional 2-D solution proposed in 1956 by Emmons with extensions by Kodson, Williams and Buman (1968), Pagni and Shih (1978), and Annamalai and Sibulkin (1979) provides a baseline model for the Upward Flame Spread Test. Within this framework, measurements of the flame stand-off distance could be compared to predicted values obtained through this theory and used to establish a mass transfer number (B). The mass transfer number could then be used as a flammability criterion.
Author
Flame Propagation; Flammability; Manned Spacecraft; Microgravity

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