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Langley Research Center

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NASA STI Program ... in Profile

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- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
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  Hanover, MD 21076-1320

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- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

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

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

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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*.

20040031712 Stanford Univ., Stanford, CA, USA
Constrained Aeroacoustic Shape Optimization Using the Surrogate Management Framework
Marsden, Alison L.; Wang, Meng; Dennis, John E., Jr.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 399-412; In English
Contract(s)/Grant(s): NCC2-1371; N00014-01-1-0423; Copyright; Avail: CASI; A03, Hardcopy

Reduction of noise generated by turbulent flow past the trailing-edge of a lifting surface is a challenge in many aeronautical and naval applications. Numerical predictions of trailing-edge noise necessitate the use of advanced simulation techniques such as large-eddy simulation (LES) in order to capture a wide range of turbulence scales which are the source of broadband noise. Aeroacoustic calculations of the flow over a model airfoil trailing edge using LES and aeroacoustic theory have been presented in Wang and Moin and were shown to agree favorably with experiments. The goal of the present work is to apply shape optimization to the trailing edge flow previously studied, in order to control aerodynamic noise.
Author
Aeroacoustics; Shape Optimization; Turbulence Models

20040034084 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Effects of Inlet Modification and Rocket-Rack Extension on the Longitudinal Trim and Low-Lift Drag of the Douglas F5D-1 Airplane as Obtained with a 0.125-Scale Rocket-Boosted Model Between Mach Numbers of 0.81 and 1.64: TED No. NACA AD 399
Hastings, Earl C., Jr.; Dickens, Waldo L.; June 05, 1957; 27 pp.; In English
Report No.(s): NACA-RM-SL57D30; No Copyright; Avail: CASI; A03, Hardcopy

A flight investigation was conducted to determine the effects of inlet modification and rocket-rack extension on the longitudinal trim and low-lift drag of the Douglas F5D-1 airplane. The investigation was conducted with a 0.125-scale rocket-boosted model between Mach Numbers of 0.81 and 1.64. This paper presents the changes in trim angle of attack, trim lift coefficient, and low-lift drag caused by the modified inlets alone over a small part of the test Mach number range and by a combination of the modified inlets and extended rocket racks throughout the remainder of the test.
Author
Intake Systems; Aerodynamic Balance; Aerodynamic Drag; F-5 Aircraft

20040034180 NASA Langley Research Center, Hampton, VA, USA, National Inst. of Aerospace, Hampton, VA, USA
A Flight Dynamics Model for a Small Glider in Ambient Winds
Beeler, Scott C.; Moerder, Daniel D.; Cox, David E.; November 2003; 20 pp.; In English
Contract(s)/Grant(s): WU 23-762-40-41
Report No.(s): NASA/TM-2003-212665; L-18338; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we describe the equations of motion developed for a point-mass zero-thrust (gliding) aircraft model operating in an environment of spatially varying atmospheric winds. The wind effects are included as an integral part of the flight dynamics equations, and the model is controlled through the three aerodynamic control angles. Formulas for the aerodynamic coefficients for this model are constructed to include the effects of several different aspects contributing to the aerodynamic performance of the vehicle. Characteristic parameter values of the model are compared with those found in a different set of

small glider simulations. We execute a set of example problems which solve the glider dynamics equations to find the aircraft trajectory given specified control inputs. The ambient wind conditions and glider characteristics are varied to compare the simulation results under these different circumstances.
Author
Aerodynamics; Gliders; Wind Effects; Dynamic Models

20040034184 NASA Langley Research Center, Hampton, VA, USA
Transport Equation Based Wall Distance Computations Aimed at Flows With Time-Dependent Geometry
Tucker, Paul G.; Rumsey, Christopher L.; Bartels, Robert E.; Biedron, Robert T.; December 2003; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WU 23-719-10-50
Report No.(s): NASA/TM-2003-212680; L-18339; No Copyright; Avail: CASI; A04, Hardcopy

Eikonal, Hamilton-Jacobi and Poisson equations can be used for economical nearest wall distance computation and modification. Economical computations may be especially useful for aeroelastic and adaptive grid problems for which the grid deforms, and the nearest wall distance needs to be repeatedly computed. Modifications are directed at remedying turbulence model defects. For complex grid structures, implementation of the Eikonal and Hamilton-Jacobi approaches is not straightforward. This prohibits their use in industrial CFD solvers. However, both the Eikonal and Hamilton-Jacobi equations can be written in advection and advection-diffusion forms, respectively. These, like the Poisson's Laplacian, are commonly occurring industrial CFD solver elements. Use of the NASA CFL3D code to solve the Eikonal and Hamilton-Jacobi equations in advective-based forms is explored. The advection-based distance equations are found to have robust convergence. Geometries studied include single and two element airfoils, wing body and double delta configurations along with a complex electronics system. It is shown that for Eikonal accuracy, upwind metric differences are required. The Poisson approach is found effective and, since it does not require offset metric evaluations, easiest to implement. The sensitivity of flow solutions to wall distance assumptions is explored. Generally, results are not greatly affected by wall distance traits.
Author
Transport Theory; Time Dependence; Wall Flow

20040034216 Douglas Aircraft Co., Inc., USA
A Theoretical Investigation of the Drag of Generalized Aircraft Configurations in Supersonic Flow
Graham, E. W.; Lagerstrom, P. A.; Licher, R. M.; Beane, B. J.; January 1957; 113 pp.; In English
Report No.(s): NACA-TM-1421; No Copyright; Avail: CASI; A06, Hardcopy

It seems possible that, in supersonic flight, unconventional arrangements of wings and bodies may offer advantages in the form of drag reduction. It is the purpose of this report to consider the methods for determining the pressure drag for such unconventional configurations, and to consider a few of the possibilities for drag reduction in highly idealized aircraft. The idealized aircraft are defined by distributions of lift and volume in three-dimensional space, and Hayes' method of drag evaluation, which is well adapted to such problems, is the fundamental tool employed. Other methods of drag evaluation are considered also wherever they appear to offer amplifications. The basic singularities such as sources, dipoles, lifting elements and volume elements are discussed, and some of the useful inter-relations between these elements are presented. Hayes' method of drag evaluation is derived in detail starting with the general momentum theorem. In going from planar systems to spatial systems certain new problems arise. For example, interference between lift and thickness distributions generally appears, and such effects are used to explain the difference between the non-zero wave drag of Sears-Haack bodies and the zero wave drag of Ferrari's ring wing plus central body. Another new feature of the spatial systems is that optimum configurations generally are not unique, there being an infinite family of lift or thickness distributions producing the same minimum drag. However it is shown that all members of an optimum family produce the same flow field in a certain region external to the singularity distribution. Other results of the study indicate that certain spatial distributions may produce materially less wave drag and vortex drag than comparable planar systems. It is not at all certain that such advantages can be realized in practical aircraft designs, but further investigation seems to be warranted.
Author
Aircraft Configurations; Aerodynamic Drag; Supersonic Flow

20040034247 California Inst. of Tech., Pasadena, CA, USA
Turbulence in the Wake of a Thin Airfoil at Low Speeds
Campbell, George S.; January 1957; 64 pp.; In English
Report No.(s): NACA-TM-1427; No Copyright; Avail: CASI; A04, Hardcopy

Experiments have been made to determine the nature of turbulence in the wake of a two-dimensional airfoil at low speeds. The experiments were motivated by the need for data which can be used for analysis of the tail-buffeting problem in aircraft design. Turbulent intensity and power spectra of the velocity fluctuations were measured at a Reynolds number of 1.6 x 10(exp 5) for several angles of attack. Total-head measurements were also obtained in an attempt to relate steady and fluctuating wake properties. Mean-square downwash was found to have nearly the same dependence on vertical position in the wake as that shown by total-head loss. For this particular wing, turbulent intensity, integrated across the wake, increased roughly as the 3/2 power of the drag coefficient. Power-spectrum measurements indicated a decrease in frequency as wing angle of attack was increased. The average frequency in the wake was proportional to the ratio of mean wake velocity to wake width.
Author
Turbulent Wakes; Thin Airfoils; Low Speed; Turbulence

20040035646 Foersvarets Forskningsanstalt, Linkoeping (Sweden), Linkoeping, Sweden
Assignment Methods for Spatial Reuse TDMA
Groenkvist, J.; 2003; 46 pp.; In English
Report No.(s): PB2004-102700; FOI-R-0142-SE; No Copyright; Avail: CASI; A03, Hardcopy

Spatial reuse TDMA is an access scheme for multi-hop radio networks. The idea is to increase capacity by letting several radio terminals use the same time slot when possible. A time slot can be shared when the radio units are geographically separated such that small interference is obtained. In reuse scheduling there are several alternative assignment methods, traditionally, transmission rights are given to nodes or to links, i.e. , transmitter/receiver pairs. We present a comparison of these two approaches and show that both have undesirable properties in certain cases, e.g. link assignment gives a higher delay for low traffic loads but can achieve much higher throughout than node assignment. Furthermore, we propose a novel assignment strategy, achieving the advantages of both methods. Simulation results show that the proposed method can achieve the throughput of link assignment as well as the lower delay characteristics of node assignment for low traffic loads.
NTIS
Time Division Multiple Access; Frequency Reuse; Spatial Dependencies; Methodology

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*.

20040031743 NASA Ames Research Center, Moffett Field, CA, USA
Teaching Cockpit Automation in the Classroom
Casner, Stephen M.; January 2003; 48 pp.; In English
Contract(s)/Grant(s): 728-20-30
Report No.(s): NASA/TM-2003-211865; IH-034; No Copyright; Avail: CASI; A03, Hardcopy

This study explores the idea of teaching fundamental cockpit automation concepts and skills to aspiring professional pilots in a classroom setting, without the use of sophisticated aircraft or equipment simulators. Pilot participants from a local professional pilot academy completed eighteen hours of classroom instruction that placed a strong emphasis on understanding the underlying principles of cockpit automation systems and their use in a multi-crew cockpit. The instructional materials consisted solely of a single textbook. Pilots received no hands-on instruction or practice during their training. At the conclusion of the classroom instruction, pilots completed a written examination testing their mastery of what had been taught during the classroom meetings. Following the written exam, each pilot was given a check flight in a full-mission Level D simulator of a Boeing 747-400 aircraft. Pilots were given the opportunity to fly one practice leg, and were then tested on all concepts and skills covered in the class during a second leg. The results of the written exam and simulator checks strongly suggest that instruction delivered in a traditional classroom setting can lead to high levels of preparation without the need for expensive airplane or equipment simulators.
Author
Automatic Control; Avionics; Education; Cockpits

20040031766 NASA Ames Research Center, Moffett Field, CA, USA
A Gold Standards Approach to Training Instructors to Evaluate Crew Performance
Baker, David P.; Dismukes, R. Key; December 2003; 40 pp.; In English
Contract(s)/Grant(s): RTOP 727-05-00; 711-31-32
Report No.(s): NASA/TM-2003-212809; IH-048; No Copyright; Avail: CASI; A03, Hardcopy

The Advanced Qualification Program requires that airlines evaluate crew performance in Line Oriented Simulation. For this evaluation to be meaningful, instructors must observe relevant crew behaviors and evaluate those behaviors consistently and accurately against standards established by the airline. The airline industry has largely settled on an approach in which instructors evaluate crew performance on a series of event sets, using standardized grade sheets on which behaviors specific to event set are listed. Typically, new instructors are given a class in which they learn to use the grade sheets and practice evaluating crew performance observed on videotapes. These classes emphasize reliability, providing detailed instruction and practice in scoring so that all instructors within a given class will give similar scores to similar performance. This approach has value but also has important limitations; (1) ratings within one class of new instructors may differ from those of other classes; (2) ratings may not be driven primarily by the specific behaviors on which the company wanted the crews to be scored; and (3) ratings may not be calibrated to company standards for level of performance skill required. In this paper we provide a method to extend the existing method of training instructors to address these three limitations. We call this method the 'gold standards' approach because it uses ratings from the company's most experienced instructors as the basis for training rater accuracy. This approach ties the training to the specific behaviors on which the experienced instructors based their ratings. Author

Human Performance; Instructors; Qualifications; Civil Aviation; Computerized Simulation; Flight Crews

20040034051 NASA Langley Research Center, Hampton, VA, USA
Autonomous Aircraft Operations using RTCA Guidelines for Airborne Conflict Management
Krishnamurthy, Karthik; Wing, David J.; Barmore, Bryan E.; Barhydt, Richard; Palmer, Michael T.; Johnson, Edward J.; Ballin, Mark G.; Eischeid, Todd M.; [2003]; 12 pp.; In English; 22nd Digital Avionics Systems Conference, October 2003, Indianapolis, IN, USA
Contract(s)/Grant(s): 23-727-01-26; No Copyright; Avail: CASI; A03, Hardcopy

A human-in-the-loop experiment was performed at the NASA Langley Research Center to study the feasibility of DAG-TM autonomous aircraft operations in highly constrained airspace. The airspace was constrained by a pair of special-use airspace (SUA) regions on either side of the pilot's planned route. Traffic flow management (TFM) constraints were imposed as a required time of arrival and crossing altitude at an en route fix. Key guidelines from the RTCA Airborne Conflict Management (ACM) concept were applied to autonomous aircraft operations for this experiment. These concepts included the RTCA ACM definitions of distinct conflict detection and collision avoidance zones, and the use of a graded system of conflict alerts for the flight crew. Three studies were conducted in the course of the experiment. The first study investigated the effect of hazard proximity upon pilot ability to meet constraints and solve conflict situations. The second study investigated pilot use of the airborne tools when faced with an unexpected loss of separation (LOS). The third study explored pilot interactions in an over-constrained conflict situation, with and without priority rules dictating who should move first. Detailed results from these studies were presented at the 5th USA/Europe Air Traffic Management R&D Seminar (ATM2003). This overview paper focuses on the integration of the RTCA ACM concept into autonomous aircraft operations in highly constrained situations, and provides an overview of the results presented at the ATM2003 seminar. These results, together with previously reported studies, continue to support the feasibility of autonomous aircraft operations.
Author

Autonomy; Flight Operations; Air Traffic Control; Airborne Equipment

20040034066 NASA Langley Research Center, Hampton, VA, USA
Synthetic Vision CFIT Experiments for GA and Commercial Aircraft: 'A Picture Is Worth A Thousand Lives'
Prinzel, Lawrence J., III; Hughes, Monica F.; Arthur, Jarvis J., III; Kramer, Lynda J.; Glaab, Louis J.; Bailey, Randy E.; Parrish, Russell V.; Uenking, Michael D.; [2003]; 5 pp.; In English; 47th Annual Human Factors and Ergonomics Society Meeting, 13-17 Oct. 2003, Denver, CO, USA
Contract(s)/Grant(s): RTA 728-60-10-03; No Copyright; Avail: CASI; A01, Hardcopy

Because restricted visibility has been implicated in the majority of commercial and general aviation accidents, solutions will need to focus on how to enhance safety during instrument meteorological conditions (IMC). The NASA Synthetic Vision Systems (SVS) project is developing technologies to help achieve these goals through the synthetic presentation of how the outside world would look to the pilot if vision were not reduced. The potential safety outcome would be a significant reduction

in several accident categories, such as controlled-flight-into-terrain (CFIT), that have restricted visibility as a causal factor. The paper describes two experiments that demonstrated the efficacy of synthetic vision technology to prevent CFIT accidents for both general aviation and commercial aircraft.
Author
Commercial Aircraft; Flight Control; Terrain; Enhanced Vision; Psychophysiology; General Aviation Aircraft

20040034179 NASA Langley Research Center, Hampton, VA, USA
Terrain Portrayal for Head-Down Displays Flight Test
Hughes, Monica F.; Glaab, Louis J.; [2003]; 14 pp.; In English; 22nd Digital Avionics Systems Conference, 12-16 Oct. 2003, Indianapolis, IN, USA
Contract(s)/Grant(s): 728-60-20; No Copyright; Avail: CASI; A03, Hardcopy

The Synthetic Vision Systems General Aviation (SVS-GA) element of NASA's Aviation Safety Program is developing technology to eliminate low visibility induced General Aviation (GA) accidents through the application of synthetic vision techniques. SVS displays present computer generated 3-dimensional imagery of the surrounding terrain to greatly enhance pilot's situation awareness (SA), reducing or eliminating Controlled Flight into Terrain (CFIT), as well as Low-Visibility Loss of Control (LVLOC) accidents. In addition to substantial safety benefits, SVS displays have many potential operational benefits that can lead to flight in instrument meteorological conditions (IMC) resembling those conducted in visual meteorological conditions (VMC). Potential benefits could include lower landing minimums, more approach options, reduced training time, etc. SVS conducted research will develop display concepts providing the pilot with an unobstructed view of the outside terrain, regardless of weather conditions and time of day. A critical component of SVS displays is the appropriate presentation of terrain to the pilot. The relationship between the realism of the terrain presentation and resulting enhancements of pilot SA and pilot performance has been largely undefined. Comprised of coordinated simulation and flight test efforts, the terrain portrayal for head-down displays (TP-HDD) test series examined the effects of two primary elements of terrain portrayal: variations of digital elevation model (DEM) resolution and terrain texturing. Variations in DEM resolution ranged from sparsely spaced (30 arc-sec/2,953ft) to very closely spaced data (1 arc-sec/98 ft). Variations in texture involved three primary methods: constant color, elevation-based generic, and photo-realistic, along with a secondary depth cue enhancer in the form of a fishnet grid overlay. The TP-HDD test series was designed to provide comprehensive data to enable design trades to optimize all SVS applications, as well as develop requirements and recommendations to facilitate the implementation and certification of SVS displays. The TP-HDD flight experiment utilized the NASA LaRC Cessna 206 Stationaire and evaluated eight terrain portrayal concepts in an effort to confirm and extend results from the previously conducted TP-HDD simulation experiment. A total of 15 evaluation pilots, of various qualifications, accumulated over 75 hours of dedicated research flight time at Newport News (PHF) and Roanoke (ROA), VA, airports from August through October, 2002. This report will present results from the portion of testing conducted at Roanoke, VA.
Author
Flight Tests; General Aviation Aircraft; Terrain; Enhanced Vision; Display Devices; Weather

20040034209 NASA Langley Research Center, Hampton, VA, USA
Considering Object Oriented Technology in Aviation Applications
Hayhurst, Kelly J.; Holloway, C. Michael; [2003]; 8 pp.; In English; 22nd Digital Avionics Systems Conference, 12-16 Oct. 2003, Indianapolis, IN, USA
Contract(s)/Grant(s): 728-30-10; No Copyright; Avail: CASI; A02, Hardcopy

Few developers of commercial aviation software products are using object-oriented technology (OOT), despite its popularity in some other industries. Safety concerns about using OOT in critical applications, uncertainty about how to comply with regulatory requirements, and basic conservatism within the aviation community have been factors behind this caution. The Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) have sponsored research to investigate and workshops to discuss safety and certification concerns about OOT and to develop recommendations for safe use. Two Object Oriented Technology in Aviation (OOTiA) workshops have been held and numerous issues and comments about the effect of OOT features and languages have been collected. This paper gives a high level overview of the OOTiA project, and discusses selected specific results from the March 2003 workshop. In particular, results in the form of questions to consider before making the decision to use OOT are presented.
Author
Object-Oriented Programming; Technology Utilization; Commercial Aircraft; Computer Programs

20040034745 NASA Langley Research Center, Hampton, VA, USA

The Effectiveness of Various Attitude Indicator Display Sizes and Extended Horizon Lines On Attitude Maintenance in a Part-Task Simulation

Comstock, J. Raymond, Jr.; Jones, Leslie C.; Pope, Alan T.; June 10, 2003; 5 pp.; In English; Human Factors and Ergonomics Society 47th Annual Meeting, 13-17 Oct. 2003, Denver, CO, USA

Contract(s)/Grant(s): RTA 728-60-10-03; No Copyright; Avail: CASI; A01, Hardcopy

Spatial disorientation (SD) is a constant contributing factor to the rate of fatal aviation accidents. SD occurs as a result of perceptual errors that can be attributed in part to the inefficient presentation of synthetic orientation cues via the attitude indicator when external visual conditions are poor. Improvements in the design of the attitude indicator may help to eliminate instrumentation as a factor in the onset of SD. The goal of the present study was to explore several display concepts that may contribute to an improved attitude display. Specifically, the effectiveness of various display sizes, some that are used in current and some that are anticipated in future attitude displays that may incorporate Synthetic Vision Systems (SVS) concepts, was assessed. In addition, a concept known as an extended horizon line or Malcolm Horizon (MH) was applied and evaluated. Paired with the MH, the novel concept of a fixed reference line representing the central horizontal plane of the aircraft was also tested. Subjects performance on an attitude control task and secondary math workload task was measured across the various display sizes and conditions. The results, with regard to display size, confirmed the bigger is better concept, yielding better performance with the larger display sizes. A clear and significant improvement in attitude task performance was found with the addition of the extended horizon line. The extended or MH seemed to equalize attitude performance across display sizes, even for a central or foveal display as small as three inches in width.

Author

Attitude Control; Peripheral Vision; Light (Visible Radiation); Gyro Horizons; Computerized Simulation; Attitude (Inclination); Flat Panel Displays

20040035527 Massachusetts Inst. of Tech., Cambridge, MA, USA

Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions

Hansman, Robert John; Vigeant-Langlois, Laurence N.; August 2003; 80 pp.; In English; Tenth International Symposium on Aviation Psychology, 3-6 May 1999, Columbus, OH, USA; See also 20040035528 - 20040035532

Contract(s)/Grant(s): NAG3-2178; Copyright; Avail: CASI; A05, Hardcopy

This document contains five papers on coping with ice formation during the operation of aircraft. The first paper uses a pilot survey to identify the desired attributes of future information systems for aircraft icing. The second paper investigates the influence of potential remote ice-detection system features on pilot decision making. The third paper investigates the effectiveness of aviation weather forecasting along aircraft trajectories. The fourth paper applied a human-centered systems analysis to the adverse aircraft weather encounter problem in order to identify desirable functions of weather and icing information. The objective of the fifth paper, a viewgraph presentation, is to propose means to improve aviation weather information, training, and procedures based on a human-centered systems approach.

CASI

Systems Analysis; Aircraft Icing; Decision Making; Pilot Performance; Aircraft Pilots

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20040034087 NASA Ames Research Center, Moffett Field, CA, USA

Development and Demonstration of a Prototype Free Flight Cockpit Display of Traffic Information

Johnson, Walter W.; Battiste, Vernol; Delzell, Susanne; Holland, Sheila; Belcher, Sean; Jordan, Kevin; September 2003; 28 pp.; In English

Contract(s)/Grant(s): 727-05-00

Report No.(s): NASA/TM-2003-212273; IH-042; No Copyright; Avail: CASI; A03, Hardcopy

Two versions of a prototype Free Flight cockpit situational display (Basic and Enhanced) were examined in a simulation at the NASA Ames Research Center. Both displays presented a display of traffic out to a range of 120 NM, and an alert when the automation detected a substantial danger of losing separation with another aircraft. The task for the crews was to detect

and resolve threats to separation posed by intruder aircraft. An Enhanced version of the display was also examined. It incorporated two additional conflict alerting levels and tools to aid in trajectory prediction and path planning. Ten crews from a major airline participated in the study. Performance analyses and pilot debriefings showed that the Enhanced display was preferred, and that minimal separation between the intruder and the ownship was larger with the Enhanced display. In addition, the additional information on the Enhanced display did not lead crews to engage in more maneuvering. Instead an opposite trend was indicated. Finally, crews using the Enhanced display responded more proactively, tending to resolve alerts earlier. Author

Fabrication; Performance Tests; Prototypes; Air Traffic; Free Flight; Display Devices

20040034210 NASA Langley Research Center, Hampton, VA, USA

Graphical and Statistical Analysis of Airplane Passenger Cabin RF Coupling Paths to Avionics

Jafri, Madiha; Ely, Jay; Vahala, Linda; [2003]; 13 pp.; In English; 22nd Digital Avionics Systems Conference, 12-16 Oct. 2003, Indianapolis, IN, USA

Contract(s)/Grant(s): RTA 728-30-10-01; No Copyright; Avail: CASI; A03, Hardcopy

Portable wireless technology provides many benefits to modern day travelers. Over the years however, numerous reports have cited portable electronic devices (PEDs) as a possible cause of electromagnetic interference (EMI) to aircraft navigation and communication radio systems. PEDs may act as transmitters, both intentional and unintentional, and their signals may be detected by the various radio receiver antennas installed on the aircraft. Measurement of the radiated field coupling between passenger cabin locations and aircraft communication and navigation receivers, via their antennas is defined herein as interference path loss (IPL). IPL data is required for assessing the threat of PEDs to aircraft radios, and is very dependent upon airplane size, the interfering transmitter position within the airplane, and the location of the particular antenna for the aircraft system of concern. NASA Langley Research Center, Eagles Wings Inc., and United Airlines personnel performed extensive IPL measurements on several Boeing 737 airplanes.

Author

Aircraft Compartments; Avionics; Passenger Aircraft; Statistical Analysis; Air Navigation; Aircraft Communication

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*.

20040031602 Lawrence Livermore National Lab., Livermore, CA

UAV Cooperation Architectures for Persistent Sensing

Roberts, R. S.; Kent, C. A.; Jones, E. D.; Mar. 20, 2003; 18 pp.; In English

Report No.(s): DE2003-15004867; UCRL-ID-150006; No Copyright; Avail: Department of Energy Information Bridge

The number of small, inexpensive Unmanned Air Vehicles (UAV'S) increasing, it is feasible to build multi-UAV sensing networks. In particular, by using UAV's in conjuction with unattended ground sensors, a degree of persistent sensing can be achieved. With proper UAV cooperation algorithms, sensing in maintained even though exceptional events, e.g., the loss of a UAV, have occurred. In this paper a cooperation technique that allows multiple UAVs to perform coordinated, persistent sensing with unattended ground sensors over a wide area is described. The technique automatically adapts the UAV paths so that on the average, the amount of time that any sensor has to wait for a UAV revisit is minimized. We also describe the Simulation, Tactical Operations and Mission Planning (STOMP) software architecture. This architecture is designed to help simulate and operate distributed sensor networks where multiple UAVs are used to collect data.

NTIS

Detection; Mission Planning; Architecture (Computers); Remotely Piloted Vehicles

20040031658 Swedish Defence Research Establishment, Stockholm

Sigge V1.0 Theory, Implementation and Verification

Andersson, M.; 2003; In English

Report No.(s): PB2004-101815; FOI-R-0828-SE; No Copyright; Avail: National Technical Information Service (NTIS)

To be able to predict the IR-signature of an aircraft, the heat radiated, in form of IR-radiation, has to be calculated. A program package, SIGGE, has been developed for this purpose. The already existing code has been improved. The code can

now handle radiation from hot gases and from walls with complex geometries, including specular reflections. This report describes some key equations used and a detailed description of SIGGE is presented. The code has been verified against other calculations with satisfactory result.
NTIS
High Temperature Gases; Infrared Signatures

20040031785 NASA Langley Research Center, Hampton, VA, USA
Aerospace Applications of Optimization under Uncertainty
Padula, Sharon; Gumbert, Clyde; Li, Wu; July 02, 2003; 6 pp.; In English; 4th International Symposium on Uncertainty Modeling and Analysis, 21-24 Sep. 2003, College Park, MD, USA
Contract(s)/Grant(s): 762-20-61-01; No Copyright; Avail: CASI; A02, Hardcopy

The Multidisciplinary Optimization (MDO) Branch at NASA Langley Research Center develops new methods and investigates opportunities for applying optimization to aerospace vehicle design. This paper describes MDO Branch experiences with three applications of optimization under uncertainty: (1) improved impact dynamics for airframes, (2) transonic airfoil optimization for low drag, and (3) coupled aerodynamic/structures optimization of a 3-D wing. For each case, a brief overview of the problem and references to previous publications are provided. The three cases are aerospace examples of the challenges and opportunities presented by optimization under uncertainty. The present paper will illustrate a variety of needs for this technology, summarize promising methods, and uncover fruitful areas for new research.
Author
Multidisciplinary Design Optimization; Aerospace Vehicles; Three Dimensional Models; Aerodynamic Configurations; Sensitivity Analysis

20040033375 NASA Langley Research Center, Hampton, VA, USA
Persistence Characteristics of Wind-Tunnel Pressure Signatures From Two Similar Models
Mack, Robert J.; January 2004; 23 pp.; In English
Contract(s)/Grant(s): WU 23-706-92-02
Report No.(s): NASA/TM-2004-212671; L-18340; No Copyright; Avail: CASI; A03, Hardcopy

Pressure signatures generated by two sonic-boom wind-tunnel models and measured at Mach 2 are presented, analyzed, and discussed. The two wind-tunnel models differed in length and span by a factor of fourteen, but were similar in wing-body planform shape. The geometry of the larger model had been low-boom tailored to generate a flat top ground pressure signature, and the nacelles-off pressure signatures from this model became more flattop in shape as the model-probe separation distances increased from 0.94 to 4.4 span lengths. The geometry of the smaller model had not been low-boom tailored, yet its measured pressure signatures had non-N-wave shapes that persisted as model-probe separation distances increased from 26.0 to 104.2 span lengths. Since the overall planforms of the two wind-tunnel models were so similar, it was concluded that the shape-persistence trends in the pressure signatures of the smaller, non-low-boom tailored model would also be present at very large distances in the pressure signatures of the larger, low-boom-tailored model.
Author
Wind Tunnel Models; Sonic Booms; Computational Fluid Dynamics; Supersonic Speed; Body-Wing Configurations; Pressure Distribution

20040033924 NASA Langley Research Center, Hampton, VA, USA
Evaluation of a Hydrogen Fuel Cell Powered Blended-Wing-Body Aircraft Concept for Reduced Noise and Emissions
Guynn, Mark D.; Freh, Joshua E.; Olson, Erik D.; February 2004; 45 pp.; In English
Contract(s)/Grant(s): WU 23-755-81-11
Report No.(s): NASA/TM-2004-212989; L-18342; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the analytical modeling and evaluation of an unconventional commercial transport aircraft concept designed to address aircraft noise and emission issues. A blended-wing-body configuration with advanced technology hydrogen fuel cell electric propulsion is considered. Predicted noise and emission characteristics are compared to a current technology conventional configuration designed for the same mission. The significant technology issues which have to be addressed to make this concept a viable alternative to current aircraft designs are discussed. This concept is one of the 'Quiet Green Transport' aircraft concepts studied as part of NASA's Revolutionary Aerospace Systems Concepts (RASC) Program. The RASC Program was initiated to develop revolutionary concepts that address strategic objectives of the NASA Enterprises,

such as reducing aircraft noise and emissions, and to identify advanced technology requirements for the concepts.
Author
Mathematical Models; Evaluation; Aircraft Design; Aircraft Noise; Noise Reduction

20040034028 Computer Sciences Corp., Huntsville, AL, USA
Simulation of Wind Profile Perturbations for Launch Vehicle Design
Adelfang, S. I.; February 05, 2004; 14 pp.; In English
Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: CASI; A03, Hardcopy

Ideally, a statistically representative sample of measured high-resolution wind profiles with wavelengths as small as tens of meters is required in design studies to establish aerodynamic load indicator dispersions and vehicle control system capability. At most potential launch sites, high- resolution wind profiles may not exist. Representative samples of Rawinsonde wind profiles to altitudes of 30 km are more likely to be available from the extensive network of measurement sites established for routine sampling in support of weather observing and forecasting activity. Such a sample, large enough to be statistically representative of relatively large wavelength perturbations, would be inadequate for launch vehicle design assessments because the Rawinsonde system accurately measures wind perturbations with wavelengths no smaller than 2000 m (1000 m altitude increment). The Kennedy Space Center (KSC) Jimsphere wind profiles (150/month and seasonal 2 and 3.5-hr pairs) are the only adequate samples of high resolution profiles approx. 150 to 300 m effective resolution, but over-sampled at 25 m intervals) that have been used extensively for launch vehicle design assessments. Therefore, a simulation process has been developed for enhancement of measured low-resolution Rawinsonde profiles that would be applicable in preliminary launch vehicle design studies at launch sites other than KSC.
Author
Wind Profiles; Aerodynamic Loads; Launch Vehicles; Design Analysis; Weather Forecasting

20040034716 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Overview of OBPR Free Flyer System Concept
Leung, Ronald Y.; Lieberman, Alvin S.; [2003]; 39 pp.; In English; Free Flyer Research Workshop, 2-3 Dec. 2003, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following:OBPR free flyer theme. OBPR free flyer technical activity last 2 years. GSFC integrated mission design center (IMDC) studies. Free flyer assumptions and goals. Free flyer total payload reference concept capabilities. FFM reference payload requirements. FFM mission. FFM medium summary. FFH block diagram FFH spacecraft configuration.concept.
CASI
Unmanned Spacecraft; Payloads; Free Flight

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20040031829 NASA Ames Research Center, Moffett Field, CA, USA
Context-Aware Intelligent Assistant Approach to Improving Pilot's Situational Awareness
Spirkovska, Lilly; Lodha, Suresh K.; February 2004; 23 pp.; In English
Contract(s)/Grant(s): 21-714-09-01
Report No.(s): NASA/TM-2004-212804; No Copyright; Avail: CASI; A03, Hardcopy

Faulty decision making due to inaccurate or incomplete awareness of the situation tends to be the prevailing cause of fatal general aviation accidents. Of these accidents, loss of weather situational awareness accounts for the largest number of fatalities. We describe a method for improving weather situational awareness through the support of a contextaware,domain and task knowledgeable, personalized and adaptive assistant. The assistant automatically monitors weather reports for the pilot's route of flight and warns her of detected anomalies. When and how warnings are issued is determined by phase of flight, the pilot s definition of acceptable weather conditions, and the pilot's preferences for automatic notification. In addition to automatic warnings, the pilot is able to verbally query for weather and airport information. By noting the requests she makes during the approach phase of flight, our system learns to provide the information without explicit requests on subsequent

flights with similar conditions. We show that our weather assistant decreases the effort required to maintain situational awareness by more than 5.5 times when compared to the conventional method of in-flight weather briefings.
Author
Situational Awareness; Decision Making; Automatic Pilots

20040033930 NASA Glenn Research Center, Cleveland, OH, USA
Performance Evaluation of Fiber Bragg Gratings at Elevated Temperatures
Juergens, Jeffrey; Adamovsky, Grigory; Floyd, Bertram; January 2004; 14 pp.; In English; Photonics East Symposium, 27-30 Oct. 2003, Providence, RI, USA
Contract(s)/Grant(s): WBS 22-708-87-08
Report No.(s): NASA/TM-2004-212888; E-14303; No Copyright; Avail: CASI; A03, Hardcopy

The development of integrated fiber optic sensors for smart propulsion systems demands that the sensors be able to perform in extreme environments. In order to use fiber optic sensors effectively in an extreme environment one must have a thorough understanding of the sensor s limits and how it responds under various environmental conditions. The sensor evaluation currently involves examining the performance of fiber Bragg gratings at elevated temperatures. Fiber Bragg gratings (FBG) are periodic variations of the refractive index of an optical fiber. These periodic variations allow the FBG to act as an embedded optical filter passing the majority of light propagating through a fiber while reflecting back a narrow band of the incident light. The peak reflected wavelength of the FBG is known as the Bragg wavelength. Since the period and width of the refractive index variation in the fiber determines the wavelengths that are transmitted and reflected by the grating, any force acting on the fiber that alters the physical structure of the grating will change what wavelengths are transmitted and what wavelengths are reflected by the grating. Both thermal and mechanical forces acting on the grating will alter its physical characteristics allowing the FBG sensor to detect both temperature variations and physical stresses, strain, placed upon it. This ability to sense multiple physical forces makes the FBG a versatile sensor. This paper reports on test results of the performance of FBGs at elevated temperatures. The gratings looked at thus far have been either embedded in polymer matrix materials or freestanding with the primary focus of this paper being on the freestanding FBGs. Throughout the evaluation process, various parameters of the FBGs performance were monitored and recorded. These parameters include the peak Bragg wavelength, the power of the Bragg wavelength, and total power returned by the FBG. Several test samples were subjected to identical test conditions to allow for statistical analysis of the data. Test procedures, calibrations, and referencing techniques are presented in the paper along with directions for future research.
Author
Bragg Gratings; Fiber Optics; High Temperature; Strain Measurement; Annealing; Temperature Measuring Instruments

20040034077 NASA Ames Research Center, Moffett Field, CA, USA
Sensitivity and Bias in Searches of Cockpit Display of Traffic Information Utilizing Highlighting/Lowlighting
Johnson, Walter W.; Jordan, Kevin; Liao, Min-Ju; Granada, Stacy; October 2003; 12 pp.; In English; Symposium on Aviation Psychology, 14-17 Apr. 2003, Columbus, OH, USA
Contract(s)/Grant(s): 727-01-23
Report No.(s): NASA/TM-2003-212798; IH-046; No Copyright; Avail: CASI; A03, Hardcopy

A previous investigation showed that when bright and dim traffic symbols were mixed together on a cockpit display of traffic information, dim targets required longer search times than bright targets. The current experiment utilized Signal Detection methodology to determine the cause of this effect. Two factors were manipulated, Intensity and Mixture. The Intensity manipulation varied whether targets were bright or dim. The Mixture manipulation varied whether the brightness of all aircraft symbols was the same, or if half were bright and half dim. Participants were given 1.25 s to search a display of eight aircraft and determine whether a target was present or absent (50% of the time a target was present) and then rated their confidence in the accuracy of their decision. A Mixture by Intensity repeated-measures ANOVA on the signal detectability measure, A (a non- parametric variant of d), revealed that targets presented at the dim intensity in the mixed condition yielded significantly lower sensitivity than either of the pure (homogenous) conditions or the bright targets in the mixed condition. There was not a significant difference in False Alarm rates between any conditions, indicating no change in decision criterion. Findings are discussed in terms of possible masking effects evoked by bright aircraft over the dim aircraft. Funding for this work was provided by the Advanced Air Transportation Technologies Project of NASA s Airspace Operation Systems Program.
Author
Sensitivity; Bias; Cockpits; Display Devices; Brightness; Air Traffic

20040034719 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Usability and Effectiveness of Advanced General Aviation Cockpit Displays for Instrument Flight Procedures
Williams, Kevin W.; Ball, Jerry D.; November 2003; 23 pp.; In English
Contract(s)/Grant(s): FAA-AHRR-521
Report No.(s): DOT/FAA/AM-03/17; No Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to assess 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 conditions, once using conventional instrumentation, and once using a moving-mapiGPS 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 instruments.
Author
Navigation Instruments; Display Devices; Pilot Ratings

20040035528 Massachusetts Inst. of Tech., Cambridge, MA, USA
Implications of Contingency Planning Support for Weather and Icing Information
Vigeant-Langlois, Laurence; Hansman, R. John, Jr.; Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions; [2003]; 9 pp.; In English; SAE/FAA In-Flight Icing/Ground De-Icing International Conference, Chicago, IL, USA; See also 20040035527; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2178
Report No.(s): SAE-2003-01-2089; Copyright; Avail: CASI; A02, Hardcopy

A human-centered systems analysis was applied to the adverse aircraft weather encounter problem in order to identify desirable functions of weather and icing information. The importance of contingency planning was identified as emerging from a system safety design methodology as well as from results of other aviation decision-making studies. The relationship between contingency planning support and information on regions clear of adverse weather was investigated in a scenario-based analysis. A rapid prototype example of the key elements in the depiction of icing conditions was developed in a case study, and the implications for the components of the icing information system were articulated.
Author
Ice Formation; Pilot Support Systems

20040035529 Massachusetts Inst. of Tech., Cambridge, MA, USA
Trajectory-Based Performance Assessment for Aviation Weather Information
Vigeant-Langlois, Laurence; Hansman, R. John, Jr.; Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions; [2003]; 4 pp.; In English; 10th AMS Conference on Aviation, Range and Aerospace Meteorology, Portland, OR, USA; See also 20040035527; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2178; Copyright; Avail: CASI; A01, Hardcopy

Based on an analysis of aviation decision-makers' time-related weather information needs, an abstraction of the aviation weather decision task was developed, that involves 4-D intersection testing between aircraft trajectory hypertubes and hazardous weather hypervolumes. The framework builds on the hypothesis that hazardous meteorological fields can be simplified using discrete boundaries of surrogate threat attributes. The abstractions developed in the framework may be useful in studying how to improve the performance of weather forecasts from the trajectory-centric perspective, as well as for developing useful visualization techniques of weather information.
Author
Weather Forecasting; Pilot Support Systems

20040035530 Massachusetts Inst. of Tech., Cambridge, MA, USA
Human-Centered Systems Analysis of Aircraft Separation from Adverse Weather: Implications for Icing Remote Sensing
Vigeant-Langlois, Laurence; Hansman, R. John, Jr.; Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions; [2003]; 48 pp.; In English; See also 20040035527; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2178; Copyright; Avail: CASI; A03, Hardcopy

The objective of this project was to propose a means to improve aviation weather information, training procedures based on a human-centered systems approach. Methodology: cognitive analysis of pilot's tasks; trajectory-based approach to weather information; contingency planning support; and implications for improving weather information.
Derived from text
Ice Formation; Pilot Support Systems

20040035531 Massachusetts Inst. of Tech., Cambridge, MA, USA
Influence of Icing Information on Pilot Strategies for Operating in Icing Conditions
Vigeant-Langlois, Laurence; Hansman, R. John, Jr.; Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions; [2003]; 10 pp.; In English; AIAA 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; See also 20040035527; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2178
Report No.(s): AIAA Paper 2000-0365; Copyright; Avail: CASI; A02, Hardcopy

The influence of potential remoteice-deteetion system features on pilot decision making was investigated through a Web-based experiment. Display features including a graphical plan view depiction of icing severity, vertical view depiction, single and multiple icing Severity levels as well as sensor range were varied in a part-task simulation experiment. Using information from each display, pilots were presented with a set of four flight scenarios and probed on their routing decisions and comfort level with those decisions. The experiment also included a subjective display preference evaluation. Results show that all of the displays improved pilot decision making over existing text-based icing information. The three-dimensional displays that included vertical depiction of icing conditions were found to support improved decision making. Range was not found to be a strong factor in the experiment; however, the minimum range tested was 25 n miles, which may be in excess of current technical capabilities. The depiction of the severity of icing conditions was not found to be as important as accurate information on the location of icing conditions.
Author
Ice Formation; Pilot Support Systems; Pilot Performance; Display Devices

20040035532 Massachusetts Inst. of Tech., Cambridge, MA, USA
Pilots' Information Needs and Strategies for Operating in Icing Conditions
Vigeant-Langlois, Laurence N.; Hansman, R. John; Integrated Human Centered Systems Analysis for Aircraft Separation from Icing Conditions; [2003]; 7 pp.; In English; Tenth International Symposium on Aviation Psychology, 3-6 May 1999, Columbus, OH, USA; See also 20040035527; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2178; Copyright; Avail: CASI; A02, Hardcopy

Pilot current use of icing information, pilot encounters and strategies for dealing with in-flight aircraft structural icing situations, and desired attributes of new icing information systems were investigated through a survey of pilots of several operational categories. The survey identified important information elements and fiequently used information paths for obtaining icing-related information. Free- response questions solicited descriptions of significant , icing encounters, and probed key icing-related decision and information criteria. Results indicated the information needs for the horizontal and vertical location of icing conditions and the identification of icing-free zones.
Author
Ice Formation; Pilot Support Systems

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*.

20040031756 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Future Hypersonic Scramjet-Propelled Threats for ASMD
Komduur, H. J.; July 2003; 27 pp.; In English
Contract(s)/Grant(s): A99/KM/405; TNO Proj. 014.11273
Report No.(s): TD-2002-0231; PML-2003-A57; Copyright; Avail: Other Sources

For the Royal Netherlands Navy, a literature study has been performed into future hypersonic threats for antiship missile

defence (ASMD) systems. Trends in the speed of anti-ship missile have been identified, the differences between ramjets and scramjets have been described, and critical technologies for the application of scramjet missiles have been identified. Countries working on scramjet propulsion and the projects they are working on have been described, along with the challenges hypersonic threats pose to ASMD systems. Based on the technological difficulties associated with the development of scramjet engines, and the difficulties associated with the application of hypersonic speed to anti-ship missiles, it has been concluded that hypersonic scramjet-propelled missiles will not pose a threat to surface ships in the near future (10-15 years).
Author
Antiship Missiles; Hypersonic Speed; Supersonic Combustion Ramjet Engines

20040033929 Pratt and Whitney Aircraft Group, West Palm Beach, FL, USA
RQL Integrated Module Rig Test
Koopman, Frederick S.; Ols, John T.; Padget, Frederick C., IV; Siskind, Kenneth S.; Holdeman, James D., Technical Monitor; February 2004; 217 pp.; In English
Contract(s)/Grant(s): NAS3-27235; WBS 22-714-01-39
Report No.(s): NASA/CR-2004-212881; MTD211A5; No Copyright; Avail: CASI; A10, Hardcopy
This report documents the activities conducted under Work Breakdown Structure (WBS) 1.0.2.7 of the NASA Critical Components (CPC) Program to evaluate the low emissions potential of a Rich-Quench-Lean combustor capable of achieving the program goal of emissions of nitrogen oxides (NOxEI) less than 5 gm/Kg fuel at the supersonic light condition while maintaining combustion efficiencies in excess of 99.9 percent. The chosen combustor module would then be tested in the subscale annular rig test prior to testing in the subscale core engine demonstrator, if the RQL concept were to be chosen at the Combustor Downselect.
Author
Combustion Chambers; Test Facilities; Wall Jets; Technology Utilization; Systems Integration; Modules

20040034191 Pratt and Whitney Aircraft, West Palm Beach, FL, USA
RQL Fuel Shifting Sector Rig Test
Holdeman, James D., Technical Monitor; Haid, Daniel A.; Koopman, Frederick S.; Peschke, William O. T.; Siskind, Kenneth S.; February 2004; 103 pp.; In English
Contract(s)/Grant(s): NAS3-27235; WBS 22-714-01-39
Report No.(s): NASA/CR-2004-212879; E-14293; No Copyright; Avail: CASI; A06, Hardcopy
The low emissions potential of a Rich-Quench-Lean (RQL) combustor for use in the HIgh Speed Civil transport (HSCT) application was evaluated as part of the NASA Critical Propulsion Components (CPC) Program. Fuel shifting as an approach to combustor control was evaluated in a multiple bank RQL combustor, utilizing reduced scale quench technology implemented in a convoluted linear with quench plate concept.
Author (revised)
Combustion Chambers; Supersonic Transports

20040034762 Purdue Univ., West Lafayette, IN, USA
Low and High Speed STOVL Configurations in Ground Effect
Holdeman, James D., Technical Monitor; Vukits, Thomas J.; February 2004; 170 pp.; In English
Contract(s)/Grant(s): NAG3-943; WBS 22-708-90-21
Report No.(s): NASA/CR-2004-212609; E-14167; No Copyright; Avail: CASI; A08, Hardcopy
The problem of hot gas ingestion in V/STOL and STOVL aircraft has motivated a set of experimental studies. Two-, three-, and four-jet configurations in cross flow were studied in ground effect. The results presented here were based on a quantitative, concentration measurement technique know as marker nephelometry. The effects of configuration, velocity ratio (freestream over jet velocity), model height, and inlet suction were investigated. The experiments were conducted in three parts. In the first part, comparisons of low speed two-, three-, and four-jet configurations were made. Measurements were made in the planes beneath the models in ground effect. As the number of jets increased, the vortical structures in the flowfield were found to move further upstream due to the increased total momentum. In the second part of the experiments, measurements were made at the inlet entry plane of the low speed two- and three-jet configurations in ground effect. The results indicated that ingestion occurred intermittently, especially in the upper portions of the inlets. The highest levels of concentrations were measured at a model height of two jet diameters. As the model height increased, the concentration levels decreased. Finally, a high speed, two-jet configuration without inlet suction was studied. The flowfield structures were generally found to move

further downstream as the jet velocity increased at a constant velocity ratio.
Author
Ground Effect (Aerodynamics); High Speed; Low Speed; Stovl Aircraft; Aerodynamic Configurations

20040035569 NASA Glenn Research Center, Cleveland, OH, USA
An Experimental Investigation of Unsteady Thrust Augmentation Using a Speaker-Driven Jet
Paxson, Daniel E.; Wernet, Mark P.; John, Wentworth T.; February 2004; 17 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-708-90-05
Report No.(s): NASA/TM-2004-212909; AIAA Paper 2004-0092; E-14332; No Copyright; Avail: CASI; A03, Hardcopy

An experimental investigation is described in which a simple speaker-driven jet was used as a pulsed thrust source (driver) for an ejector configuration. The objectives of the investigation were twofold: first, to add to the experimental body of evidence showing that an unsteady thrust source, combined with a properly sized ejector generally yields higher thrust augmentation values than a similarly sized, steady driver of equivalent thrust. Second, to identify characteristics of the unsteady driver that may be useful for sizing ejectors, and predicting what thrust augmentation values may be achieved. The speaker-driven jet provided a convenient source for the investigation because it is entirely unsteady (having no mean component) and because relevant parameters such as frequency, time-averaged thrust, and diameter are easily variable. The experimental setup will be described, as will the various measurements made. These include both thrust and Digital Particle Imaging Velocimetry of the driver. It will be shown that thrust augmentation values as high as 1.8 were obtained, that the diameter of the best ejector scaled with the dimensions of the emitted vortex, and that the so-called Formation Number serves as a useful dimensionless number by which to characterize the jet and predict performance.
Author
Ejectors; Thrust Augmentation; Unsteady Aerodynamics; Pulsejet Engines

20040035576 Boeing Commercial Airplane Group, Seattle, WA, USA
Water Misting and Injection of Commercial Aircraft Engines to Reduce Airport NOx
Daggett, David L.; Hendricks, Robert C., Technical Monitor; March 2004; 93 pp.; In English
Contract(s)/Grant(s): NASA Order C-74711-A
Report No.(s): NASA/CR-2004-212957; C/EA-BQ130-Y04-002; E-14397; No Copyright; Avail: CASI; A05, Hardcopy

This report provides the first high level look at system design, airplane performance, maintenance, and cost implications of using water misting and water injection technology in aircraft engines for takeoff and climb-out NOx emissions reduction. With an engine compressor inlet water misting rate of 2.2 percent water-to-air ratio, a 47 percent NOx reduction was calculated. Combustor water injection could achieve greater reductions of about 85 percent, but with some performance penalties. For the water misting system on days above 59 F, a fuel efficiency benefit of about 3.5 percent would be experienced. Reductions of up to 436 F in turbine inlet temperature were also estimated, which could lead to increased hot section life. A 0.61 db noise reduction will occur. A nominal airplane weight penalty of less than 360 lb (no water) was estimated for a 305 passenger airplane. The airplane system cost is initially estimated at $40.92 per takeoff giving an attractive NOx emissions reduction cost/benefit ratio of about $1,663/ton.
Author
Aircraft Engines; Commercial Aircraft; Nitrogen Oxides; Water Injection; Exhaust Emission; Mist; Airports; Air Pollution

20040035577 NASA Glenn Research Center, Cleveland, OH, USA
The Modular Aero-Propulsion System Simulation (MAPSS) Users' Guide
Parker, Khary I.; Melcher, Kevin J.; March 2004; 30 pp.; In English
Contract(s)/Grant(s): WBS 22-704-30-01
Report No.(s): NASA/TM-2004-212968; E-14441; No Copyright; Avail: CASI; A03, Hardcopy

The Modular Aero-Propulsion System Simulation is a flexible turbofan engine simulation environment that provides the user a platform to develop advanced control algorithms. It is capable of testing the performance of control designs on a validated and verified generic engine model. In addition, it is able to generate state-space linear models of the engine model to aid in controller design. The engine model used in MAPSS is a generic high-pressure ratio, dual-spool, lowbypass, military-type, variable cycle turbofan engine with a digital controller. MAPSS is controlled by a graphical user interface (GUI)

and this guide explains how to use it to take advantage of the capabilities of MAPSS.
Author
Turbofan Engines; Digital Simulation; Graphical User Interface; Variable Cycle Engines; Control Systems Design; Mathematical Models; Aerodynamics; Propulsion System Performance; User Manuals (Computer Programs)

20040035609 Pratt and Whitney Aircraft, West Palm Beach, FL, USA
Product Module Rig Test
Holdeman, James D., Technical Monitor; Chiappetta, Louis, Jr.; Hautman, Donald J.; Ols, John T.; Padget, Frederick C., IV; Peschke, William O. T.; Shirley, John A.; Siskind, Kenneth S.; February 2004; 119 pp.; In English
Contract(s)/Grant(s): NAS3-27235; WBS 22-714-01-39
Report No.(s): NASA/CR-2004-212880; E-14294; MTD211AA; No Copyright; Avail: CASI; A06, Hardcopy

The low emissions potential of a Rich-Quench-Lean (RQL) combustor for use in the High Speed Civil Transport (HSCT) application was evaluated as part of Work Breakdown Structure (WBS) 1.0.2.7 of the NASA Critical Propulsion Components (CPC) Program under Contract NAS3-27235. Combustion testing was conducted in cell 1E of the Jet Burner Test Stand at United Technologies Research Center. Specifically, a Rich-Quench-Lean combustor, utilizing reduced scale quench technology implemented in a quench vane concept in a product-like configuration (Product Module Rig), demonstrated the capability of achieving an emissions index of nitrogen oxides (NOx EI) of 8.5 gm/Kg fuel at the supersonic flight condition (relative to the program goal of 5 gm/Kg fuel). Developmental parametric testing of various quench vane configurations in the more fundamental flametube, Single Module Rig Configuration, demonstrated NOx EI as low as 5.2. All configurations in both the Product Module Rig configuration and the Single Module Rig configuration demonstrated exceptional efficiencies, greater than 99.95 percent, relative to the program goal of 99.9 percent efficiency at supersonic cruise conditions. Sensitivity of emissions to quench orifice design parameters were determined during the parametric quench vane test series in support of the design of the Product Module Rig configuration. For the rectangular quench orifices investigated, an aspect ratio (length/width) of approximately 2 was found to be near optimum. An optimum for orifice spacing was found to exist at approximately 0.167 inches, resulting in 24 orifices per side of a quench vane, for the 0.435 inch quench zone channel height investigated in the Single Module Rig. Smaller quench zone channel heights appeared to be beneficial in reducing emissions. Measurements were also obtained in the Single Module Rig configuration on the sensitivity of emissions to the critical combustor parameters of fuel/air ratio, pressure drop, and residence time. Minimal sensitivity was observed for all of these parameters.
Author
Combustion Chambers; Exhaust Emission; Nitrogen Oxides; Aircraft Engines

20040035611 NASA Glenn Research Center, Cleveland, OH, USA
Systems Characterization of Combustor Instabilities With Controls Design Emphasis
Kopasakis, George; February 2004; 17 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-708-28-09
Report No.(s): NASA/TM-2004-212912; AIAA Paper 2004-0638; E-14345; No Copyright; Avail: CASI; A03, Hardcopy

This effort performed test data analysis in order to characterize the general behavior of combustor instabilities with emphasis on controls design. The analysis is performed on data obtained from two configurations of a laboratory combustor rig and from a developmental aero-engine combustor. The study has characterized several dynamic behaviors associated with combustor instabilities. These are: frequency and phase randomness, amplitude modulations, net random phase walks, random noise, exponential growth and intra-harmonic couplings. Finally, the very cause of combustor instabilities was explored and it could be attributed to a more general source-load type impedance interaction that includes the thermo-acoustic coupling. Performing these characterizations on different combustors allows for more accurate identification of the cause of these phenomena and their effect on instability.
Author
Combustion Chambers; Control Systems Design; Aircraft Engines; Data Processing; Acoustic Instability; Acoustic Coupling

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*.

20040031704 NASA Goddard Space Flight Center, Greenbelt, MD, USA
18-Degree-of-Freedom Controller Design for the ST7 Disturbance Reduction System
Markley, F. L.; Maghami, P. G.; Houghton, M. B.; Hsu, O. C.; February 14, 2003; 3 pp.; In English; AAS Astrodynamics Specialist Conference, 3-7 Aug. 2003, Big Sky, MT, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents the overall design and analysis process of the spacecraft controller being developed at NASA's Goddard Space Flight Center to close the loop between the GRS and the micro-newton colloidal thrusters. The essential dynamics of the ST7-DRS are captured in a simulation including eighteen rigid-body dynamic degrees of freedom: three translations and three rotations for the spacecraft and for each test mass. The ST7 DRS comprises three control systems: the attitude control system (ACS) to maintain a sun-pointing attitude; the drag free control (DFC) to center the spacecraft about the test masses; and the test mass suspension control. This paper summarizes the control design and analysis of the ST7-DRS 18-DOF model, and is an extension of previous analyses employing a 7-DOF planar model of ST-7.
Derived from text
Design Analysis; Attitude Control; Rigid Structures; Drag Reduction; Degrees of Freedom

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*.

20040031663 Lawrence Livermore National Lab., Livermore, CA
Electron Radiation Effects in Low-K Dielectric Materials
Jenei, Z.; Petkov, M. P.; Asoka-Kumar, P.; Miller, R. D.; Volksen, W.; Oct. 22, 2003; 12 pp.; In English
Report No.(s): DE2003-15005179; UCRL-CONF-155633; No Copyright; Avail: Department of Energy Information Bridge

Positron annihilation spectroscopy was used to study microstructural changes in low-k interlevel dielectrics under emulated electron irradiation of up to 1 Mrad(Si) dose, and the impact of the degradation of materials properties on device performance.
NTIS
Dielectrics; Radiation Effects; Electron Irradiation; Spectroscopy; Electron Radiation

20040033968 NASA Glenn Research Center, Cleveland, OH, USA
Real NASA Inspiration in a Virtual Space
Petersen, Ruth; Starr, Bob; Anderson, Susan; Learning and Leading with Technology; September 2003; Volume 31, No. 1, pp. 14-19; In English
Contract(s)/Grant(s): WBS 22-332-41-00-02; No Copyright; Avail: CASI; A02, Hardcopy

NASA exemplifies the spirit of exploration of new horizons - from flight in earth's skies to missions in space. As we know from our experience as teachers, one of the best ways to motivate students' interest in mathematics, science, technology, and engineering is to allow them to explore the universe through NASA's rich history of air and space exploration and current missions. But how? It's not really practical for large numbers of students to talk to NASA astronauts, researchers, scientists, and engineers in person. NASA offers tools that make it possible for hundreds of students to visit with NASA through videoconferencing. These visits provide a real-world connection to scientists and their research and support the NASA mission statement: To inspire the next generation of explorers ... as only NASA can.
Author
NASA Programs; Education; Students; Video Conferencing

20040034272 Lawrence Livermore National Lab., Livermore, CA
Structured Surface Grid Generation on Boundary Represented Geometry
Chou, J. J.; Jan. 18, 2002; 16 pp.; In English
Report No.(s): DE2003-15005134; No Copyright; Avail: Department of Energy Information Bridge

Generation of surface meshes is the first step in many grid generation processes. For the generation of block-structured meshes, structured surface meshes have to be generated first. This paper investigates the problem of generating a structured surface mesh across multiple surface patches on an object with the boundary representation and relates the problem to other commonly encountered issues in CAD/CAM. It describes a method for solving the problem. This method is based on initial surface construction, point projection and a mixed model-space and parameter-space based elliptic smoothing.
NTIS
Grid Generation (Mathematics); Computer Aided Design; Aerospace Engineering; Computer Aided Manufacturing

20040034807 NASA Glenn Research Center, Cleveland, OH, USA
Multiphase Flow in Power and Propulsion Workshop Fluid Stability and Dynamics Workshop: Overview
McQuillen, John; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 155-166; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The short term purpose of the workshop described by this viewgraph presentation is to present a research plan and a 'roadmap' developed for strategic research for the Office of Biological and Physical Research. The long term purpose of the workshop is to conduct necessary ground-based and space-flight low gravity experiments, complemented by analyses, resulting in a documented framework for parameter prediction of needed by designers. The presentation reviews several previous workshops which were similar, and describes the differences in this workshop. The presentation also includes a prioritizing scheme for microgravity issues, which includes four priority ratings.
CASI
Fluid Dynamics; Microgravity; Multiphase Flow

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20040033945 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Chandra X-Ray Observatory: An Overview
Weisskopf, Martin C.; [2004]; 1 pp.; In English; Topics in X-Ray Astronomy, 23-25 Feb. 2004, Tubingen, Germany; No Copyright; Avail: Other Sources; Abstract Only

The Chandra X-Ray Observatory has been operating successfully for more than 4 years. This 'Great Observatory'' has made unique and important contributions to the field of high-energy astrophysics. We will discuss present some of the most interesting observations including a discussion, for the first time, of the first source ever observed with Chandra - Leon X- 1.
Author
Astrophysics; Observatories

20040034803 NASA Glenn Research Center, Cleveland, OH, USA
Discussion of Priorities
Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 131-154; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Microgravity Science Division identifies four priority ratings for microgravity research and technology issues: 1) Critical; 2) Severely Limiting; 3) Enhancements; 4) Communication. Reduced gravity instabilities are critical, while severely limiting issues include phase separation, phase change, and flow through components. Enhancements are listed for passive phase separation and phase change. This viewgraph presentation also classifies microgravity issues as spaceflight,

ground-based, or other for the time periods 2003-2008, 2009-2015, and beyond.
CASI
Microgravity; Priorities; Research and Development; Space Flight

20040034808 NASA Glenn Research Center, Cleveland, OH, USA
Proposed Space Flight Experiment Hardware
Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 19-26; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The primary thrust for this plan is to develop design tools and fundamental understanding that are timely and consistent with the goal of the various exploration initiatives. The plan will utilize ISS facilities, such as the Fluids Integrated Rack (FIR) and the Microgravity Science Glovebox (MSG). A preliminary flow schematic of Two-Phase Flow Facility (T(phi)FFy) which would utilize FIR is shown in Figure 3. MSG can be utilized to use the Boiling eXperiment Facility (BXF) and Contact Line Dynamics Experiment (CLiDE) Facility. The T(phi)FFy system would have multiple test sections whereby different configurations of heat exchangers could be used to study boiling and condensation phenomena. The test sections would be instrumented for pressure drop, void fraction, heat fluxes, temperatures, high-speed imaging and other diagnostics. Besides a high-speed data acquisition system with a large data storage capability, telemetry could be used to update control and test parameters and download limited amounts of data. In addition, there would be multiple accumulators that could be used to investigate system stability and fluid management issues. The system could accommodate adiabatic tests through either the space station nitrogen supply or have an experiment-specific compressor to pressurize a sufficient amount of air or other non-condensable gas for reuse as the supply bottle is depleted.
Derived from text
Spaceborne Experiments; Microgravity; Two Phase Flow; Data Acquisition; Fluid Management; Heat Exchangers; Heat Flux

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

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

20040031678 Swedish Defence Research Establishment, Stockholm, Sweden
Space Activities at the Swedish Defence Research Agency
Lindstroem, S.; May 2003; In Swedish
Report No.(s): PB2004-101822; FOI-R-0867-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report is a summary of an inventory of space activities at the Swedish Defense Research Agency (FOI). The objective of this review is to show FOI's employers in what areas FOI has knowledge and capabilities within the concept of space. Another reason is to inform co-workers at FOI about the present projects to avoid duplication of work and hopefully also to strengthen the cooperation within the area of space research at FOI. The questionnaire concerning the present space activities (1995-2003) that was sent to all departments at FOI addressed anybody who has worked or are working with space related issues as space physics, satellite data, the satellite structure, telemetry or command, the ground station and so on. The survey showed that present space related activities cover the development of propulsion systems and propellant, research about laser ignition systems, laser communication, accident investigation of the launch rocket Ariane-5, studies for the Swedish Armed Forces related to the use of satellite systems in the Network Based Defense, analysis of interference in navigation systems and study of formation flying satellites.
NTIS
Inventories; Atmospheric Physics; Network Analysis; Propulsion System Configurations; Propulsion System Performance

20040031822 NASA Dryden Flight Research Center, Edwards, CA, USA
Launch Condition Deviations of Reusable Launch Vehicle Simulations in Exo-Atmospheric Zoom Climbs
Urschel, Peter H.; Cox, Timothy H.; September 2003; 39 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 11-14 Aug. 2003, Austin, TX, USA
Contract(s)/Grant(s): 710-85-14-SE-47
Report No.(s): NASA/TM-2003-212023; H-2533; No Copyright; Avail: CASI; A03, Hardcopy

The Defense Advanced Research Projects Agency has proposed a two-stage system to deliver a small payload to orbit.

The proposal calls for an airplane to perform an exo-atmospheric zoom climb maneuver, from which a second-stage rocket is launched carrying the payload into orbit. The NASA Dryden Flight Research Center has conducted an in-house generic simulation study to determine how accurately a human-piloted airplane can deliver a second-stage rocket to a desired exo-atmospheric launch condition. A high-performance, fighter-type, fixed-base, real-time, pilot-in-the-loop airplane simulation has been modified to perform exo-atmospheric zoom climb maneuvers. Four research pilots tracked a reference trajectory in the presence of winds, initial offsets, and degraded engine thrust to a second-stage launch condition. These launch conditions have been compared to the reference launch condition to characterize the expected deviation. At each launch condition, a speed change was applied to the second-stage rocket to insert the payload onto a transfer orbit to the desired operational orbit. The most sensitive of the test cases was the degraded thrust case, yielding second-stage launch energies that were too low to achieve the radius of the desired operational orbit. The handling qualities of the airplane, as a first-stage vehicle, have also been investigated.
Author
Aeromaneuvering; Climbing Flight; Reusable Launch Vehicles; Transfer Orbits; Payload Transfer

20040034738 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-111/Endeavour/ISS UF2 Pre-Launch Activities: Launch with Playbacks
June 05, 2002; In English; No Copyright; Avail: CASI; V04, Videotape-VHS; B04, Videotape-Beta

This video of the preflight preparations for and launch of Space Shuttle Endeavour on STS-111 begins with a view of Endeavour on the launch pad. Additional launch pad views leading up to liftoff are interspersed with footage from the Firing Room at Kennedy Space Center, the crew's prelaunch activities, and inspection of the crew members in the White Room before boarding Endeavour. The crew is introduced by a narrator during the preflight banquet and suiting up, and a later clip shows them departing to the launch site. The crew consists of Commander Kenneth Cockrell, Pilot Paul Lockhart, Mission Specialists Philippe Perrin and Franklin Chang-Diaz, and the Expedition 5 crew of the International Space Station (ISS) (Commander Valery Korzun and Flight Engineers Peggy Whitsun and Sergei Treschev). The nozzles on Endeavour's Space Shuttle Main Engine (SSME) are swiveled before liftoff, and the launch is shown past the separation of the solid rocket boosters. After a brief clip from the Mission Control Center at Johnson Space Center, the following launch replays are shown: Beach Tracker, VAB, Pad A, Tower 1, UCS-15, Grandstand, Cocoa Beach DOAMS, Playalinda DOAMS, UCS-23, and OTV-070.
CASI
Endeavour (Orbiter); Liftoff (Launching); Spacecrews; Preflight Operations

20040034798 NASA Glenn Research Center, Cleveland, OH, USA
Project Prometheus
Johnson, Steve; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 71-89; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Project Prometheus will enable a new paradigm in the scientific exploration of the Solar System. The proposed JIMO mission will start a new generation of missions characterized by more maneuverability, flexibility, power and lifetime. Project Prometheus organization is established at NASA Headquarters: 1.Organization established to carry out development of JIMO, nuclear power (radioisotope), and nuclear propulsion research. 2.Completed broad technology and national capacity assessments to inform decision making on planning and technology development. 3.Awarded five NRA s for nuclear propulsion research. 4.Radioisotope power systems in development, and Plutonium-238 being purchased from Russia. 5.Formulated science driven near-term and long-term plan for the safe utilization of nuclear propulsion based missions. 6.Completed preliminary studies (Pre-Phase A) of JIMO and other missions. 7.Initiated JIMO Phase A studies by Contractors and NASA.
Derived from text
Technology Assessment; Prometheus; NASA Space Programs; Nuclear Propulsion; Maneuverability; Decision Making

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*.

20040034106 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation and Application of Satellite-Based Latent Heating Profile Estimation Methods
Olson, William S.; Grecu, Mircea; Yang, Song; Tao, Wei-Kuo; [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

In recent years, methods for estimating atmospheric latent heating vertical structure from both passive and active microwave remote sensing have matured to the point where quantitative evaluation of these methods is the next logical step. Two approaches for heating algorithm evaluation are proposed: First, application of heating algorithms to synthetic data, based upon cloud-resolving model simulations, can be used to test the internal consistency of heating estimates in the absence of systematic errors in physical assumptions. Second, comparisons of satellite-retrieved vertical heating structures to independent ground-based estimates, such as rawinsonde-derived analyses of heating, provide an additional test. The two approaches are complementary, since systematic errors in heating indicated by the second approach may be confirmed by the first. A passive microwave and combined passive/active microwave heating retrieval algorithm are evaluated using the described approaches. In general, the passive microwave algorithm heating profile estimates are subject to biases due to the limited vertical heating structure information contained in the passive microwave observations. These biases may be partly overcome by including more environment-specific a priori information into the algorithm s database of candidate solution profiles. The combined passive/active microwave algorithm utilizes the much higher-resolution vertical structure information provided by spaceborne radar data to produce less biased estimates; however, the global spatio-temporal sampling by spaceborne radar is limited. In the present study, the passive/active microwave algorithm is used to construct a more physically-consistent and environment-specific set of candidate solution profiles for the passive microwave algorithm and to help evaluate errors in the passive algorithm s heating estimates. Although satellite estimates of latent heating are based upon instantaneous, footprint- scale data, suppression of random errors requires averaging to at least half-degree resolution. Analysis of mesoscale and larger space-time scale phenomena based upon passive and passive/active microwave heating estimates from TRMM, SSMI, and AMSR data will be presented at the conference.
Author
Atmospheric Heating; Remote Sensing; Microwaves

20040034777 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evaluation of the Space Shuttle Transatlantic Abort Landing Atmospheric Sounding System
Leahy, Frank B.; [2004]; 6 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes a study that was conducted to determine the quality of thermodynamic and wind data measured by the Space Shuttle Transatlantic Abort Landing (TAL) Atmospheric Sounding System (TASS). The system has Global Positioning System (GPS) tracking capability and provides profiles of atmospheric parameters such as temperature, relative humidity, and wind in support of potential emergency Space Shuttle landings at TAL sites. Ten comparison flights between the Low-Resolution Flight Element (LRFE) of the Automated Meteorological Profiling System (AMPS) and TASS were conducted at the Eastern Test Range (ETR) in early 2002. Initial results indicated that wind, temperature, and relative humidity compared well. However, incorrect GPS settings in the TASS software were resulting in altitude differences of about 60 to 70 m (approximately 200 to 230 ft) and air pressure differences of approximately 4 hectoPascals (hPa). TASS software updates to correct altitude data were completed in early 2003. Subsequent testing showed that altitude and air pressure differences were generally less than 5 m and 1 hPa, respectively.
Author
Atmospheric Sounding; Emergency Landing; Space Shuttles; Global Positioning System; Wind (Meteorology); Thermodynamics; Aborted Missions

20040035545 Idaho National Engineering and Environmental Lab., Idaho Falls, ID
Real-Time Risk and Fault Management in the Mission Evaluation Room for the International Space Station
Nelson, W. R.; Novack, S. D.; May 2003; 38 pp.; In English
Report No.(s): DE2003-819191; INEEL/EXT-03-00661; No Copyright; Avail: Department of Energy Information Bridge

Effective anomaly resolution in the Mission Evaluation Room (MER) of the International Space Station (ISS) requires consideration of risk in the process of identifying faults and developing corrective actions. Risk models such as fault trees from the ISS Probabilistic Risk Assessment (PRA) can be used to support anomaly resolution, but the functionality required goes significantly beyond what the PRA could provide. Methods and tools are needed that can systematically guide the identification of root causes for on-orbit anomalies, and to develop effective corrective actions that address the event and its consequences without undue risk to the crew or the mission. In addition, an overall information management framework is needed so that risk can be systematically incorporated in the process, and effectively communicated across all the disciplines and levels of management within the space station program. The commercial nuclear power industry developed such a decision making framework, known as the critical safety function approach, to guide emergency response following the accident at Three Mile Island in 1979. This report identifies new methods, tools, and decision processes that can be used to enhance anomaly resolution in the ISS Mission Evaluation Room. Current anomaly resolution processes were reviewed to identify requirements for effective real-time risk and fault management. Experience gained in other domains, especially the commercial nuclear power industry, was reviewed to identify applicable methods and tools. Recommendations were developed for next-generation tools to support MER anomaly resolution, and a plan for implementing the recommendations was formulated. The foundation of the proposed tool set will be a 'Mission Success Framework' designed to integrate and guide the anomaly resolution process, and to facilitate consistent communication across disciplines while focusing on the overriding importance of mission success.
NTIS
Space Missions; Information Management; Real Time Operation; Risk

20040035636 Columbia Accident Investigation Board, Arlington, VA, USA
Columbia Accident Investigation Board Report, Volume 2
Hess, Kenneth W.; Wallace, Steven B.; Ride, Sally K.; Reed, Lisa; Gomez, Reynaldo J., III; Aftosmis, Michael; Vicker, Darby; Meakin, Robert L.; Stuart, Phillip C.; Rogers, Stuart E., et al.; October 2003; 581 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI

On February 1, 2003, at 07:59 Central Standard Time, the Space Shuttle Columbia broke apart during entry killing all seven crewmembers of mission STS-107. As part of the ongoing investigation into the cause of the Columbia mishap, all aspects of training for mission STS-107 were examined. An analysis of STS-107 Orbiter and payload training requirements was conducted, as well as a complete review of all training records, schedules, instructor logbooks, and related documentation for the crew, flight controller and launch controller training. Interviews and discussions were held with STS-107 training and operational personnel at both Johnson and Kennedy Space Centers to investigate the training process, the effect of launch slips, the performance of the crew, flight controllers, and launch controllers, and the flight readiness of all for the STS-107 mission. The following report provides an overview of the Space Shuttle mission training process, summarizes the factual information about STS-107 mission training, describes the investigative process used in assessing this information, and presents an analysis of that training. This investigation determined that the crew and controller training for STS-107 was not a contributing factor in the loss of Columbia and the STS-107 crew.
Author
Accident Investigation; Columbia (Orbiter); Space Flight Training; Spacecrews

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*.

20040031734 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Flight Test Results from the Low Power Transceiver Communications and Navigation Demonstration on Shuttle (CANDOS)
Rush, John; Israel, David; Harlacher, Marc; Haas, Lin; September 23, 2003; 12 pp.; In English; AIAA Space 2003, 23 Sep. 2003, Long Beach, CA, USA
Report No.(s): AIAA Paper 2003-6337; No Copyright; Avail: CASI; A03, Hardcopy

The Low Power Transceiver (LPT) is an advanced signal processing platform that offers a configurable and reprogrammable capability for supporting communications, navigation and sensor functions for mission applications ranging from spacecraft TT&C and autonomous orbit determination to sophisticated networks that use crosslinks to support

communications and real-time relative navigation for formation flying. The LPT is the result of extensive collaborative research under NASNGSFC s Advanced Technology Program and ITT Industries internal research and development efforts. Its modular, multi-channel design currently enables transmitting and receiving communication signals on L- or S-band frequencies and processing GPS L-band signals for precision navigation. The LPT flew as a part of the GSFC Hitchhiker payload named Fast Reaction Experiments Enabling Science Technology And Research (FREESTAR) on-board Space Shuttle Columbia s final mission. The experiment demonstrated functionality in GPS-based navigation and orbit determination, NASA STDN Ground Network communications, space relay communications via the NASA TDRSS, on-orbit reconfiguration of the software radio, the use of the Internet Protocol (IP) for TT&C, and communication concepts for space based range safety. All data from the experiment was recovered and, as a result, all primary and secondary objectives of the experiment were successful. This paper presents the results of the LPTs maiden space flight as a part of STS- 107.
Author
Flight Tests; Transmitter Receivers; Navigation Instruments; Signal Processing; Platforms; Space Communication

20040034729 NASA Glenn Research Center, Cleveland, OH, USA
Failover Switching Tests Between Two RF Communications Links
Brooks, David; Frantz, Brian; Hoder, Doug; Wilkins, Ryan; November 13, 2003; 88 pp.; In English
Contract(s)/Grant(s): WBS 22-727-01-04
Report No.(s): NASA/TM-2004-212953; E-14392; No Copyright; Avail: CASI; A05, Hardcopy
This work presents a short report on the routing tests of the Ku band satcom and VHF line-of-sight communications systems on the Advanced Air Transportation Technologies (AATT) Aero/Mobile van. The first section is a description of the equipment used, followed by descriptions of the tests, the theoretical results, and finally, conclusions and the actual data.
Author
Line of Sight Communication; Mobile Communication Systems; Performance Tests; Satellite Communication; Phased Arrays; Aircraft Communication; Data Links

20040034746 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Orbital Debris Mitigation at GSFC
San, Josephine; [2003]; 10 pp.; In English; NASA Orbital Debris Colloquium #3, 4-5 Nov. 2003, Houston, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy
Contents include the following: SNOE and HST orbital debris analysis. Missions in development-design for demise effort. Applied engineering and technology directorate other on-going efforts.
CASI
Space Debris; Reentry Guidance; Descent Trajectories

20040034837 ITT Industries, Inc., Reston, VA, USA
Navigation Flight Test Results from the Low Power Transceiver Communications and Navigation Demonstration on Shuttle (CANDOS) Experiment
Haas, Lin; Massey, Christopher; Baraban, Dmitri; September 12, 2003; 7 pp.; In English; ION GPS/GNSS 2003 Meeting, 9-12 Sep. 2003, Portland, OR, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy
This paper presents the Global Positioning System (GPS) navigation results from the Communications and Navigation Demonstration on Shuttle (CANDOS) experiment flown on STS-107. This experiment was the initial flight of a Low Power Transceiver (LPT) that featured high capacity space- space and space-ground communications and GPS- based navigation capabilities. The LPT also hosted the GPS Enhanced Orbit Determination Experiment (GEODE) orbit determination software. All CANDOS test data were recovered during the mission using LPT communications links via the Tracking and Data Relay Satellite System (TDRSS). An overview of the LPT s navigation software and the GPS experiment timeline is presented, along with comparisons of test results to the NASA Johnson Space Center (JSC) real-time ground navigation vectors and Best Estimate of Trajectory (BET).
Author
Flight Tests; Space Navigation; Space Communication; Communication Networks

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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*.

20040031748 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RADECS Short Course Section 4 Radiation Hardness Assurance (RHA) for Space Systems
Poivey, Christian; [2003]; 68 pp.; In English; RADECS 2003, September 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A04, Hardcopy

Contents include the following: Introduction. Programmatic aspects of RHA. RHA componens: requirements and specifications; mission radiation environment; and parts selection and radiation tolerance. Analysis at the function/subsystem/system level: TID/DD; SEE. Conclusion.
CASI
Radiation Tolerance; Hardness; Assurance; Aerospace Systems

20040031771 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Disturbance Reduction Control Design for the ST7 Flight Validation Experiment
Maghami, P. G.; Hsu, O. C.; Markley, F. L.; Houghton, M. B.; [2003]; 14 pp.; In English; Flight Dynamics Symposium, 29-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Space Technology 7 experiment will perform an on-orbit system-level validation of two specific Disturbance Reduction System technologies: a gravitational reference sensor employing a free-floating test mass, and a set of micro-Newton colloidal thrusters. The ST7 Disturbance Reduction System is designed to maintain the spacecraft's position with respect to a free-floating test mass to less than 10 nm/Hz, over the frequency range of 1 to 30 mHz. This paper presents the design and analysis of the coupled, drag-free and attitude control systems that close the loop between the gravitational reference sensor and the micro-Newton thrusters, while incorporating star tracker data at low frequencies. A full 18 degree-of-freedom model, which incorporates rigid-body models of the spacecraft and two test masses, is used to evaluate the effects of actuation and measurement noise and disturbances on the performance of the drag-free system.
Author
Attitude Control; Drag Reduction; Space Technology Experiments; Frequency Ranges; Design Analysis

20040031812 NASA Marshall Space Flight Center, Huntsville, AL, USA
X-37 and Our Future in Space: Breaking Barriers to Achieve New Milestones in Space Settlement
Sexton, Jeff; [2003]; 26 pp.; In English; AIAA/Reusable Launch Vehicle Program Committee Meeting, 7 Jan. 2004, Reno, NV, USA; CD-ROM includes a video animation
Contract(s)/Grant(s): NAS8-02070; No Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The X-37 flight demonstrator will serve as a testbed and technology demonstrator for a variety of aerospace technologies needed to produce a successor to the Space Shuttle. Lithium-ion (Li-ion) batteries, thermal protection systems, and hot structures such as flaperons and ruddervators are systems onboard the X-37 which will be of particular use to this effort. This viewgraph presentation identifies stakeholders and participants in the X-37 flight demonstrator program and includes a section of notes which correspond to each of its slides.
CASI
X-37 Vehicle; Test Stands; Research and Development; Flight Test Vehicles

20040033911 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulating the Effect of Space Vehicle Environments on Directional Solidification of a Binary Alloy
Westra, D. G.; Heinrich, J. C.; Poirier, D. R.; [2003]; 3 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Space microgravity missions are designed to provide a microgravity environment for scientific experiments, but these missions cannot provide a perfect environment, due to vibrations caused by crew activity, on-board experiments, support systems (pumps, fans, etc.), periodic orbital maneuvers, and water dumps. Therefore, it is necessary to predict the impact of these vibrations on space experiments, prior to performing them. Simulations were conducted to study the effect of the vibrations on the directional solidification of a dendritic alloy. Finite element ca!cu!attie?ls were dme with a simd2titcr based

on a continuum model of dendritic solidification, using the Fractional Step Method (FSM). The FSM splits the solution of the momentum equation into two steps: the viscous intermediate step, which does not enforce continuity; and the inviscid projection step, which calculates the pressure and enforces continuity. The FSM provides significant computational benefits for predicting flows in a directionally solidified alloy, compared to other methods presently employed, because of the efficiency gains in the uncoupled solution of velocity and pressure. finite differences, arises when the interdendritic liquid reaches the eutectic temperature and concentration. When a node reaches eutectic temperature, it is assumed that the solidification of the eutectic liquid continues at constant temperature until all the eutectic is solidified. With this approach, solidification is not achieved continuously across an element; rather, the element is not considered solidified until the eutectic isotherm overtakes the top nodes. For microgravity simulations, where the convection is driven by shrinkage, it introduces large variations in the fluid velocity. When the eutectic isotherm reaches a node, all the eutectic must be solidified in a short period, causing an abrupt increase in velocity. To overcome this difficulty, we employed a scheme to numerically predict a more accurate value for the rate of change of fraction of liquid as the liquid in an element solidifies. The new method enables us to contrast results of simulations in which the alloy is subjected to no gravity or a steady-state acceleration versus simulations when the alloy is subjected to vibration disturbances; therefore, the effect of vibration disturbances can be assessed more accurately. To assess the impact of these vibration-perturbations, transient accelerometer data from a space shuttle mission are used as inputs for the simulation model. These on-orbit acceleration data were obtained from the Microgravity Science Division at Glenn Research Center (GRC- MSD) and are applied to the buoyancy term of the momentum equation in a simulation of a Pb-5.8 wt. % Sb alloy that solidifies in a thermal gradient of 4000 K/m and a translation velocity of 3 p d s . Figure 2 shows the vertical velocity of a node that begins in the all-liquid region and subsequently solidifies; the vibrations are applied at 5000 seconds in this simulation. An important difficulty, common to all solidification models based on finite elements or 2 The magnitudes of the velocity oscillations that are vibration-induced are very small and acceptable. The biggest concern is whether the concentration of the liquid near the dendrite tips is distorted because of the vibration-induced perturbations. Results for this case show no concentration oscillations present in the all-liquid region.
Author

Simulation; Space Transportation System Flights; Solidification; Binary Alloys

20040033944 NASA Marshall Space Flight Center, Huntsville, AL, USA

Nuclear Electric Vehicle Optimization Toolset (NEVOT): Integrated System Design Using Genetic Algorithms

Tinker, Michael L.; Steincamp, James W.; Stewart, Eric T.; Patton, Bruce W.; Pannell, William P.; Newby, Ronald L.; Coffman, Mark E.; Qualls, A. L.; Bancroft, S.; Molvik, Greg; [2003]; 8 pp.; In English; Space Technology and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): 090-50-EB; Copyright; Avail: CASI; A02, Hardcopy

The Nuclear Electric Vehicle Optimization Toolset (NEVOT) optimizes the design of all major Nuclear Electric Propulsion (NEP) vehicle subsystems for a defined mission within constraints and optimization parameters chosen by a user. The tool uses a Genetic Algorithm (GA) search technique to combine subsystem designs and evaluate the fitness of the integrated design to fulfill a mission. The fitness of an individual is used within the GA to determine its probability of survival through successive generations in which the designs with low fitness are eliminated and replaced with combinations or mutations of designs with higher fitness. The program can find optimal solutions for different sets of fitness metrics without modification and can create and evaluate vehicle designs that might never be conceived of through traditional design techniques. It is anticipated that the flexible optimization methodology will expand present knowledge of the design trade-offs inherent in designing nuclear powered space vehicles and lead to improved NEP designs.
Author

Nuclear Electric Propulsion; Optimization; Genetic Algorithms; Systems Engineering; Systems Integration

20040034035 NASA Marshall Space Flight Center, Huntsville, AL, USA, Boeing Information, Space and Defense Systems, USA

Blind Leak Detection for Closed Systems

Oelgoetz, Peter; Johnson, Ricky; Todd, Douglas; Russell, Samuel; Walker, James; [2003]; 1 pp.; In English; Boeing Technical Excellence Conference, 24 Feb. 2004, Saint Louis, MO, USA

Contract(s)/Grant(s): NAS8-01140; No Copyright; Avail: Other Sources; Abstract Only

The current inspection technique for locating interstitial leaking in the Space Shuttle Main Engine nozzles is the application of a liquid leak check solution in the openings where the interstitials space between the tubing and the structural jacket vent out the aft end of the nozzle, while its cooling tubes are pressurized to 25 psig with Helium. When a leak is found, it is classified, and if the leak is severe enough the suspect tube is cut open so that a boroscope can be inserted to find the leak

point. Since the boroscope can only cover a finite tube length and since it is impossible to identify which tube (to the right or left of the identified interstitial) is leaking, many extra and undesired repairs have been made to fix just one leak. In certain instances when the interstitials are interlinked by poor braze bonding, many interstitials will show indications of leaking from a single source. What is desired is a technique that can identify the leak source so that a single repair can be performed. Dr, Samuel Russell and James Walker, both with NASA/MSFC have developed a thermographic inspection system that addresses a single repair approach. They have teamed with Boeing/Rocketdyne to repackage the inspection processes to be suitable to address full scale Shuttle development and flight hardware and implement the process at NASA centers. The methods and results presented address the thermographic identification of interstitial leaks in the Space Shuttle Main Engine nozzles. A highly sensitive digital infrared camera (capable of detecting a delta temperature difference of 0.025 C) is used to record the cooling effects associated with a leak source, such as a crack or pinhole, hidden within the nozzle wall by observing the inner hot wall surface as the nozzle is pressurized, These images are enhanced by digitally subtracting a thermal reference image taken before pressurization. The method provides a non-intrusive way of locating the tube that is leaking and the exact leak source position to within a very small axial distance. Many of the factors that influence the inspectability of the nozzle are addressed; including pressure rate, peak pressure, gas type, ambient temperature and surface preparation. Other applications for this thermographic inspection system are the Reinforced-Carbon-Carbon (RCC) leading edge of the Space Shuttle orbiter and braze joint integrity.
Author
Leakage; Detection; Space Shuttle Main Engine; Closed Ecological Systems

20040034039 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Attitude Control System for the Wilkinson Microwave Anisotropy Probe
Markley, F. Landis; Andrews, Stephen F.; ODonnell, James R., Jr.; Ward, David K.; January 02, 2003; 33 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The Wilkinson Microwave Anisotropy Probe mission produces a map of the cosmic microwave background radiation over the entire celestial sphere by executing a fast spin and a slow precession of its spin axis about the Sun line to obtain a highly interconnected set of measurements. The spacecraft attitude is sensed and controlled using an inertial reference unit, two star trackers, a digital sun sensor, twelve coarse sun sensors, three reaction wheel assemblies, and a propulsion system. Sufficient attitude knowledge is provided to yield instrument pointing to a standard deviation (l sigma) of 1.3 arc-minutes per axis. In addition, the spacecraft acquires and holds the sunline at initial acquisition and in the event of a failure, and slews to the proper orbit adjust orientations and to the proper off-sunline attitude to start the compound spin. This paper presents an overview of the design of the attitude control system to carry out this mission and presents some early flight experience.
Author
Attitude Control; Microwave Anisotropy Probe; Space Missions; Control Systems Design; Spacecraft Design; Spacecraft Instruments

20040034242 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Pseudo Linear Attitude Determination of Spinning Spacecraft
Harman, Richard R.; Bar-Itzhack, Itzhack Y.; [2004]; 4 pp.; In English; AIAA Guidance, Navigation and Control Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents the overall mathematical model and results from pseudo linear recursive estimators of attitude and rate for a spinning spacecraft. The measurements considered are vector measurements obtained by sun-sensors, fixed head star trackers, horizon sensors, and three axis magnetometers. Two filters are proposed for estimating the attitude as well as the angular rate vector. One filter, called the q-Filter, yields the attitude estimate as a quaternion estimate, and the other filter, called the D-Filter, yields the estimated direction cosine matrix. Because the spacecraft is gyro-less, Euler's equation of angular motion of rigid bodies is used to enable the estimation of the angular velocity. A simpler Markov model is suggested as a replacement for Euler's equation in the case where the vector measurements are obtained at high rates relative to the spacecraft angular rate.
Author
Attitude (Inclination); Angular Velocity; Mathematical Models; Gyroscopes; Magnetometers

20040034804 NASA, Washington, DC, USA
Human Support Technology Research to Enable Exploration
Joshi, Jitendra; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 91-121; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Advanced life support. System integration, modeling, and analysis. Progressive capabilities. Water processing. Air revitalization systems. Why advanced CO2 removal technology? Solid waste resource recovery systems: lyophilization. ISRU technologies for Mars life support. Atmospheric resources of Mars. N2 consumable/ make-up for Mars life. Integrated test beds. Monitoring and controlling the environment. Ground-based commercial technology. Optimizing size vs capability. Water recovery systems. Flight verification topics.
CASI
Air Conditioning Equipment; Carbon Dioxide Removal; Life Support Systems; Solid Wastes; Water Reclamation

20040035554 Cranfield Univ., Bedford, UK
MUSTANG 2001: Summary of the Group Design Project MSc in Astronautics and Space Engineering 2001/02, Cranfield University
Hobbs, Stephen; Bowling, Tom; Roberts, Peter; September 2003; 146 pp.; In English
Report No.(s): COA-0206; Copyright; Avail: Other Sources
MUSTANG (Multi-University Space Technology Advanced Nanosatellite Group) was the group design project for students of the MSc in Astronautics and Space Engineering for the Academic Year 2001/02 at Cranfield University. The project also involved students of Southampton University and Astrium (UK) Ltd. and was supported by BNSC. The project involved the initial design of a nanosatellite to be used as a technology demonstrator for microsystem technology (MST) in space. The project builds on previous work (in 1999/2000 and 2000/01) and is both a critical reevaluation of the previous work and a development of new design work in specific areas (e.g. electrical subsystem, mechanisms, data handling). By the end of the project, the design has developed to a stage where detailed sub-system design and prototyping / manufacture are the next steps. The goal of launch readiness by 2003/04 is possible, but only achievable with significant extra resources.
Author
Nanosatellites; University Program; Satellite Design

20040035567 NASA Glenn Research Center, Cleveland, OH, USA
On Orbit Daytime Solar Heating Effects: A Comparison of Ground Chamber Arcing Results
Galofaro, J.; Vayner, B.; Ferguson, D.; February 2004; 14 pp.; In English; Eighth Spacecraft Charging Technology Conference, 20-24 Oct. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): WBS 22-319-20-D1
Report No.(s): NASA/TM-2004-212890; E-14308; No Copyright; Avail: CASI; A03, Hardcopy
The purpose of the current experiment is to make direct comparisons between the arcing results obtained from the diffusion pumped vertical chamber and our newly renovated Teney vacuum chamber which is equipped with a cryogenic pump. Recall that the prior reported results obtained for the Vertical chamber were nominal at best, showing only a slight reduction in the arc rate after 5 heating cycles at the lower bias potentials and virtually no changes at high potential biases. It was concluded that the vertical chamber was unable to remove enough water vapor from the chamber to adequately test the arcing criterion. Because the cryo-pumped Teney chamber has a ten times better pumping speed, (40,000 liters per sec compared to 4,000 liters per sec for the diffusion pumped vertical chamber), a decision was made to retest that experiment in both the Teney and Vertical vacuum chambers. A comparison of the various data is presented with encouraging results.
Author
Solar Heating; Arc Heating; Solar Arrays; Vacuum Chambers; Daytime; Low Earth Orbits

20040035652 NASA Glenn Research Center, Cleveland, OH, USA
Workshop on Critical Issues in Microgravity Fluids, Transport, and Reaction Processes in Advanced Human Support Technology
Chiaramonte, Francis P.; Joshi, Jitendra A.; February 2004; 62 pp.; In English; Workshop on Critical Issues in Microgravity Fluids, Transport, and Reaction Processes in Advanced Human Support Technology, 11-13 Aug. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): WBS 22-101-53-01
Report No.(s): NASA/TM-2004-212940; E-14380; No Copyright; Avail: CASI; A04, Hardcopy
This workshop was designed to bring the experts from the Advanced Human Support Technologies communities together to identify the most pressing and fruitful areas of research where success hinges on collaborative research between the two communities. Thus an effort was made to bring together experts in both advanced human support technologies and microgravity fluids, transport and reaction processes. Expertise was drawn from academia, national laboratories, and the federal government. The intent was to bring about a thorough exchange of ideas and develop recommendations to address the

significant open design and operation issues for human support systems that are affected by fluid physics, transport and reaction processes. This report provides a summary of key discussions, findings, and recommendations.
Author
Microgravity; Multiphase Flow; Life Support Systems; Transport Theory; Fluid Flow; Thermodynamics

20040035661 NASA Marshall Space Flight Center, Huntsville, AL, USA
Foam on Tile Impact Modeling for the Space Shuttle Program
Stellingwerf, R. F.; Robinson, J. H.; Richardson, S.; Evans, S. W.; Stallworth, R.; Hovater, M.; [2003]; 2 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

Following the breakup of the Space Shuttle Columbia during reentry a NASA-wide investigation team was formed to examine the probable damage inflicted on Orbiter Thermal Protection System (TPS) elements by impact of External Tank insulating foam projectiles. Our team was to apply rigorous, physics-based analysis techniques to help determine parameters of interest for an experimental test program, utilize validated codes to investigate the full range of impact scenarios, and use analysis derived models to predict aero-thermal-structural responses to entry conditions. We were to operate on a non-interference basis with the j Team, and were to supply significant findings to that team and to the Orbiter Vehicle Engineering Working Group, being responsive to any solicitations for support from these entities. The authors formed a working sub-group within the larger team to apply the Smooth Particle Hydrodynamics code SPHC to the damage estimation problem. Numerical models of the LI-900 TPS tiles and of the BX-250 foam were constructed and used as inputs into the code. Material properties needed to properly model the tiles and foam were obtained from other working sub-groups who performed tests on these items for this purpose. Two- and three- dimensional models of the tiles were constructed, including the glass outer layer, the densified lower layer of LI-900 insulation, the Nomex felt Strain Isolation Pad (SIP) mounting layer, and the underlying aluminum 2024 vehicle skin. A model for the BX-250 foam including porous compression, elastic rebound, and surface erosion was developed. Code results for the tile damage and foam behavior were extensively validated through comparison with the Southwest Research Institute (SwRI) foam-on-tile impact experiments carried out in 1999. These tests involved small projectiles striking individual tiles and small tile arrays. Following code and model validation we simulated impacts of larger ET foam projectiles on the TPS tile systems used on the wings of the orbiter. Tiles used on the Wing Acreage, the Main Landing Gear Door, and the Carrier Panels near the front edge of the wing were modeled. Foam impacts shot for the CAB investigation were modeled, as well as impacts at larger angles, including rapid rotation of the projectile, and with varying foam properties. General results suggest that foam impacts on tiles at about 500 mph could cause appreciable damage if the impact angle is greater than about 20 degrees. Some variations of the foam properties, such as increased brittleness or increased density could increase damage in some cases. Rapid (17 rps) rotation failed to increase the damage for the two cases considered. This does not rule out other cases in which the rotational energy might lead to an increase in tile damage, but suggests that in most cases rotation will not be an important factor. Similar models will be applied for other impacting materials, other velocities, and other geometries as part of the Return to Flight process.
Author
Foams; Impact Tests; Mathematical Models; Thermal Protection; Space Shuttle Orbiters; Tiles; NASA Programs

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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*.

20040031747 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Validation of On-board Cloud Cover Assessment Using EO-1
Mandl, Dan; Miller, Jerry; Griffin, Michael; Burke, Hsiao-hua; June 9, 2003; 8 pp.; In English; ESTO Science Technology Conference, 24-26 Jun. 2003, USA; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this NASA Earth Science Technology Office funded effort was to flight validate an on-board cloud detection algorithm and to determine the performance that can be achieved with a Mongoose V flight computer. This validation was performed on the EO-1 satellite, which is operational, by uploading new flight code to perform the cloud detection. The algorithm was developed by MIT/Lincoln Lab and is based on the use of the Hyperion hyperspectral instrument using selected

spectral bands from 0.4 to 2.5 microns. The Technology Readiness Level (TRL) of this technology at the beginning of the task was level 5 and was TRL 6 upon completion. In the final validation, an 8 second (0.75 Gbytes) Hyperion image was processed on-board and assessed for percentage cloud cover within 30 minutes. It was expected to take many hours and perhaps a day considering that the Mongoose V is only a 6-8 MIP machine in performance. To accomplish this test, the image taken had to have level 0 and level 1 processing performed on-board before the cloud algorithm was applied. For almost all of the ground test cases and all of the flight cases, the cloud assessment was within 5% of the correct value and in most cases within 1-2%. Author

Airborne/Spaceborne Computers; Flight Control; Cloud Cover; Spectral Bands

20040031762 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Real-Time Attitude Independent Three Axis Magnetometer Calibration

Crassidis, John L.; Lai, Kok-Lam; Harman, Richard R.; [2003]; 16 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA

Contract(s)/Grant(s): NAG5-12179; No Copyright; Avail: CASI; A03, Hardcopy

In this paper new real-time approaches for three-axis magnetometer sensor calibration are derived. These approaches rely on a conversion of the magnetometer-body and geomagnetic-reference vectors into an attitude independent observation by using scalar checking. The goal of the full calibration problem involves the determination of the magnetometer bias vector, scale factors and non-orthogonality corrections. Although the actual solution to this full calibration problem involves the minimization of a quartic loss function, the problem can be converted into a quadratic loss function by a centering approximation. This leads to a simple batch linear least squares solution. In this paper we develop alternative real-time algorithms based on both the extended Kalman filter and Unscented filter. With these real-time algorithms, a full magnetometer calibration can now be performed on-orbit during typical spacecraft mission-mode operations. Simulation results indicate that both algorithms provide accurate integer resolution in real time, but the Unscented filter is more robust to large initial condition errors than the extended Kalman filter. The algorithms are also tested using actual data from the Transition Region and Coronal Explorer (TRACE).

Author

Magnetometers; Calibrating; Real Time Operation; Scalars; Attitude (Inclination); Algorithms; Geomagnetism

20040031781 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Carrier Plus: A sensor payload for Living With a Star Space Environment Testbed (LWS/SET)

Marshall, Cheryl J.; Moss, Steven; Howard, Regan; LaBel, Kenneth A.; Grycewicz, Tom; Barth, Janet L.; Brewer, Dana; [2003]; 7 pp.; In English; International Society for Optical Engineering; Copyright; Avail: CASI; A02, Hardcopy

The Defense Threat Reduction Agency (DTR4) and National Aeronautics and Space Administration (NASA) Goddard Space Flight Center are collaborating to develop the Carrier Plus sensor experiment platform as a capability of the Space Environments Testbed (SET). The Space Environment Testbed (SET) provides flight opportunities for technology experiments as part of NASA's Living With a Star (LWS) program. The Carrier Plus will provide new capability to characterize sensor technologies such as state-of-the-art visible focal plane arrays (FPAs) in a natural space radiation environment. The technical objectives include on-orbit validation of recently developed FPA technologies and performance prediction methodologies, as well as characterization of the FPA radiation response to total ionizing dose damage, displacement damage and transients. It is expected that the sensor experiment will carry 4-6 FPAs and associated radiation correlative environment monitors (CEMs) for a 2006-2007 launch. Sensor technology candidates may include n- and p-charge coupled devices (CCDs), active pixel sensors (APS), and hybrid CMOS arrays. The presentation will describe the Carrier Plus goals and objectives, as well as provide details about the architecture and design. More information on the LWS program can be found at http://lws.gsfc.nasa.gov/. Business announcements for LWS/SET and program briefings are posted at http://lws-set.gsfc.nasa.gov

Author

Aerospace Environments; Prediction Analysis Techniques; Extraterrestrial Radiation; Focal Plane Devices; Performance Prediction; Payloads

20040032489 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Reconfigurable Computing As an Enabling Technology for Single-Photon-Counting Laser Altimetry

Powell, Wesley; Hicks, Edward; Pinchinat, Maxime; Dabney, Philip; McGarry, Jan; Murray, Paul; November 05, 2003; 12 pp.; In English; 2004 IEEE Aeroconference; No Copyright; Avail: CASI; A03, Hardcopy

Single-photon-counting laser altimetry is a new measurement technique offering significant advantages in vertical

resolution, reducing instrument size, mass, and power, and reducing laser complexity as compared to analog or threshold detection laser altimetry techniques. However, these improvements come at the cost of a dramatically increased requirement for onboard real-time data processing. Reconfigurable computing has been shown to offer considerable performance advantages in performing this processing. These advantages have been demonstrated on the Multi-KiloHertz Micro-Laser Altimeter (MMLA), an aircraft based single-photon-counting laser altimeter developed by NASA Goddard Space Flight Center with several potential spaceflight applications. This paper describes how reconfigurable computing technology was employed to perform MMLA data processing in real-time under realistic operating constraints, along with the results observed. This paper also expands on these prior results to identify concepts for using reconfigurable computing to enable spaceflight single-photon-counting laser altimeter instruments.
Author
Laser Altimeters; Photons; Counting; Altimetry; Onboard Data Processing

20040034054 Northrop Grumman Corp., Lanham, MD USA
Autonomous Telemetry Collection for Single-Processor Small Satellites
Speer, Dave; June 2003; 11 pp.; In English; 17th Annual AIAA/USU Conference on Small Satellites, 11-14 Aug. 2003, Logan, UT, USA
Contract(s)/Grant(s): NAS5-99124
Report No.(s): SSC03-XI-6; No Copyright; Avail: CASI; A03, Hardcopy

For the Space Technology 5 mission, which is being developed under NASA's New Millennium Program, a single spacecraft processor will be required to do on-board real-time computations and operations associated with attitude control, up-link and down-link communications, science data processing, solid-state recorder management, power switching and battery charge management, experiment data collection, health and status data collection, etc. Much of the health and status information is in analog form, and each of the analog signals must be routed to the input of an analog-to-digital converter, converted to digital form, and then stored in memory. If the micro-operations of the analog data collection process are implemented in software, the processor may use up a lot of time either waiting for the analog signal to settle, waiting for the analog-to-digital conversion to complete, or servicing a large number of high frequency interrupts. In order to off-load a very busy processor, the collection and digitization of all analog spacecraft health and status data will be done autonomously by a field-programmable gate array that can configure the analog signal chain, control the analog-to-digital converter, and store the converted data in memory.
Author
Small Scientific Satellites; Autonomy; Telemetry; Airborne/Spaceborne Computers

20040034068 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Nonlinear Observers for Gyro Calibration
Thienel, Julie; Sanner, Robert M.; [2003]; 1 pp.; In English; AAS Guidance and Control Conference, February 2004, Breckenridge, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

High precision estimation and control algorithms, to achieve unprecedented levels of pointing accuracy, will be required to support future formation flying missions such as interferometry missions. Achieving high pointing accuracy requires precise knowledge of the spacecraft rotation rate. Typically, the rotation rate is measured by a gyro. The measured rates can be corrupted by errors in alignment and scale factor, gyro biases, and noise. In this work, we present nonlinear observers for gyro calibration. Nonlinear observers are superior to extended or pseudo-linear Kalman filter type approaches for large errors and global stability. Three nonlinear gyro calibration observers are developed. The first observer estimates a constant gyro bias. The second observer estimates scale factor errors. The third observer estimates the gyro alignment for three orthogonal gyros. The convergence properties of all three observers are discussed. Additionally, all three observers are coupled with a nonlinear control algorithm. The stability of each of the resulting closed loop systems is analyzed. The observers are then combined, and the gyro calibration parameters are estimated simultaneously. The stability of the combined observers is addressed, as well as the stability of the resulting closed loop systems. Simulated test results are presented for each scenario. Finally, the nonlinear observers are compared to a pseudo-linear Kalman filter.
Author
Gyroscopes; Calibrating; Nonlinearity; Formation Flying

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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*.

20040033933 NASA Glenn Research Center, Cleveland, OH, USA
Experimental Investigations From the Operation of a 2 kW Brayton Power Conversion Unit and a Xenon Ion Thruster
Mason, Lee; Birchenough, Arthur; Pinero, Luis; February 2004; 14 pp.; In English; Space Technology and Applications International Forum (STAIF 2004), 8-12 Feb.2004, Albuquerque, NM, USA
Contract(s)/Grant(s): WBS 22-973-80-10
Report No.(s): NASA/TM-2004-212960; E-14419; No Copyright; Avail: CASI; A03, Hardcopy

A 2 kW Brayton Power Conversion Unit (PCU) and a xenon ion thruster were integrated with a Power Management and Distribution (PMAD) system as part of a Nuclear Electric Propulsion (NEP) Testbed at NASA's Glenn Research Center. Brayton converters and ion thrusters are potential candidates for use on future high power NEP missions such as the proposed Jupiter Icy Moons Orbiter (JIMO). The use of existing lower power test hardware provided a cost-effective means to investigate the critical electrical interface between the power conversion system and ion propulsion system. The testing successfully demonstrated compatible electrical operations between the converter and the thruster, including end-to-end electric power throughput, high efficiency AC to DC conversion, and thruster recycle fault protection. The details of this demonstration are reported herein.
Author
Brayton Cycle; Ion Engines; Nuclear Electric Propulsion; Xenon; Electric Power

20040034018 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA's Integrated Development of Solar Sail Propulsion Project
Garbe, Gregory; Montgomery, Edward E., IV; Heaton, Andrew F.; VanSant, John T.; Campbell, Bruce A.; January 05, 2004; 5 pp.; In English; AIAA/AAS Space Flight Dynamics Meeting, 10 Feb. 2004, Honolulu, HI, USA
Report No.(s): AAS-04-103; No Copyright; Avail: CASI; A01, Hardcopy

Solar sails have been studied for a variety of missions and have the potential to provide cost effective, propellantless propulsion that enables longer on-station operation, increased scientific payload mass fraction, and access to previously inaccessible orbits (e. g., non-Keplerian, high solar latitudes, etc.). Research being conducted by the In-Space Propulsion (ISP) Technologies Projects is at the forefront of NASA's efforts to mature propulsion technologies that will enable or enhance a variety of space science missions. Solar sail propulsion systems will be required to meet the challenge of monitoring and predicting space weather by the Office of Space Science's (OSS) Living with a Star (LWS) program. Near-to-mid-term mission needs include monitoring of solar activity and observations at high solar latitudes. Work currently funded by the ISP s Solar Sail Propulsion (SSP) project is based on the quantitative demonstration of scalability of present solar sail subsystem designs and concepts to future mission requirements through ground testing of hardware, computational modeling and analytical simulations. This paper will give an overview of the Solar Sail Propulsion project's major development tasks of fabricating and testing two different subscale (400 square meter sail) solar sail system architectures. It will then be shown how either of these subscale prototypes can evolve into a flight validation system and briefly discuss the mission parameter. The paper will conclude with a discussion on how a flight validation will exercise the quantitative tools needed to demonstrate the scale to the size needed for the Solar Polar Imager and L1-Diamond SEC roadmap missions.
Author
Solar Sails; Spacecraft Propulsion; Aerospace Sciences; NASA Space Programs; Space Missions; Systems Integration; Fabrication

20040034036 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Review of Past Insights by Robert Forward and Current Advanced Propulsion Activities
Robertson, Tony; Norley, G. D.; [2003]; 1 pp.; In English; Space Technology and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

A review of various technologies discussed by Dr. Robert Forward is done as a tribute to Dr. Forward, and is based on selections from his writings. These speculations and predictions by Dr. Forward are used as a basis for discussing expected

propulsion technology work over the next twenty years. Among the technologies to be discussed are antimatter propulsion, space elevators and tethers, and laser propulsion.
Author
Technology Utilization; Spacecraft Propulsion

20040034099 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal and Chemical Characterization of Composite Materials
Stanley, D. C.; Huff, T. L.; December 1, 2003; 1 pp.; In English
Report No.(s): NASA/TM-2003-212934; M-1099; No Copyright; Avail: Other Sources; Abstract Only

The purpose of this research effort was to: (1) provide a concise and well-defined property profile of current and developing composite materials using thermal and chemical characterization techniques and (2) optimize analytical testing requirements of materials. This effort applied a diverse array of methodologies to ascertain composite material properties. Often, a single method of technique will provide useful, but nonetheless incomplete, information on material composition and/or behavior. To more completely understand and predict material properties, a broad-based analytical approach is required. By developing a database of information comprised of both thermal and chemical properties, material behavior under varying conditions may be better understood. THis is even more important in the aerospace community, where new composite materials and those in the development stage have little reference data. For example, Fourier transform infrared (FTIR) spectroscopy spectral databases available for identification of vapor phase spectra, such as those generated during experiments, generally refer to well-defined chemical compounds. Because this method renders a unique thermal decomposition spectral pattern, even larger, more diverse databases, such as those found in solid and liquid phase FTIR spectroscopy libraries, cannot be used. By combining this and other available methodologies, a database specifically for new materials and materials being developed at Marshall Space Flight Center can be generated . In addition, characterizing materials using this approach will be extremely useful in the verification of materials and identification of anomalies in NASA-wide investigations.
Author
Composite Materials; Fourier Transformation; Infrared Spectroscopy; Chemical Composition; Thermal Decomposition; Thermodynamic Properties

20040034188 NASA Marshall Space Flight Center, Huntsville, AL, USA
Changes in Polymeric Tether Properties Due to Atomic Oxygen
Finckenor, Miria M.; Vaughn, Jason A.; Watts, Edward W.; [2003]; 2 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-9 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): 700-11-00; No Copyright; Avail: Other Sources; Abstract Only

The Propulsive Small Expendable Deployer System (ProSEDS) mission is designed to provide an on-orbit demonstration of the electrodynamic propulsion capabilities of tethers in space. The ProSEDS experiment will be a secondary payload on a Delta II unmanned expendable booster. A 5-km conductive tether is attached to the Delta II second stage and collects current fiom the low Earth orbit (LEO) plasma to facilitate de-orbit of the spent stage. The conductive tether is attached to a 10-km non-conductive tether, which is then attached to an endmass containing several scientific instruments. Atomic oxygen (AO) erodes most organic materials. As the orbit of the Delta II second stage decas, the AO flux (atoms/sq cm sec) increases. A nominal AO fluence of 1 x l0(exp 21) atoms/sq cm was agreed upon by the investigators as an adequate level for evaluating the performance of the tether materials. A test series was performed to determine the effect of atomic oxygen (AO) on the mechanical integrity and possible strength loss of ProSEDS tether materials. The tether materials in this study were Dyneema, an ultra-high molecular weight polyethylene material used as the non-conducting portion of the ProSEDS tether, and the Kevlar core strength fiber used in the conductive tether. Samples of Dyneema and Kevlar were exposed to various levels of atomic oxygen up to 1.07 x 10(exp 21) atoms/sq cm in the Marshall Space Flight Center Atomic Oxygen Beam Facility (AOBF). Changes in mass were noted after AO exposure. The tethers were then tensile-tested until failure. AO affected both the Dyneema and Kevlar tether material strength. Dyneema exposed to 1.07 x 10(exp 21) atoms/sq cm of atomic oxygen failed due to normal handling when removed fiom the AOBF and was not tensile-tested. Another test series was performed to determine the effect of AO on the electrical properties of the ProSEDS conductive tether. The conductive tether consists of seven individually coated strands of 28 AWG 1350-0 aluminum wire. The conductive coating, developed by Triton Systems, Inc., is a mix of polyanaline and COR, a clear AO-resistant polymer.
Author
Tethering; Polymers; Oxygen Atoms; Propulsion; Mechanical Properties

20040034267 Lawrence Livermore National Lab., Livermore, CA

PEPCON Disaster - Causative Factors and Potential Preventive and Mitigative Measures

Lambert, H. E.; Alvares, N. J.; Jul. 25, 2003; 18 pp.; In English

Report No.(s): DE2003-15005088; UCRL-JC-154704; No Copyright; Avail: Department of Energy Information Bridge

On May 4, 1988, the PEPCON plant experienced three major and several smaller explosions that caused over $70 million in property damage and caused two deaths. The PEPCON plant produced Ammonium Perchlorate (AP), a major ingredient for rocket fuel. The PEPCON plant and the nearby Kidd Marshmallow plant were totally destroyed by the detonations. The initiating event for the explosions was a fire that originated in the Batch Dryer Building and spread to adjacent storage. Several factors combined to cause the AP in the major storage fields to detonate, the most important being lack of adequate separation between storage units. Welding and flame cutting procedure with poor fire watch protocol was the prime candidate for fire ignition. There were no automatic fire suppression systems at the plant. Buildings including the Batch Dryer Building were made of combustible building material (fiberglass). There was poor housekeeping and no control of AP dust generation. AP was stored in combustible polyethylene drums, aluminum tote bins, 30-gallon steel storage drums and fiber reinforced tote bags. There were high-density storage practices. In addition, a contributing factor to the rapid fire-spread was that the wind that day was blowing directly from the batch dryer building to the storage areas. This paper claims that if codes, standards, and well-known hazard identification safety techniques were implemented at PEPCON, then the disaster would have been averted. A limited scope probabilistic risk assessment was conducted to establish the effectiveness of various preventive and mitigative features that could have been deployed to avert the disaster. The major hazard at the PEPCON site was fire and explosion involving the processing, production and storage of AP, which was then and is currently stored as a class 4 oxidizer.

NTIS

Explosives; Fiber Composites; Ammonium Perchlorates; Disasters

20040034747

In-Space Propulsion Options for Mars Sample Return Missions

Donahue, Benjamin; Cupples, Michael; Green, Shaun; Coverstone, Victoria; Woo, Byoungsam; [2004]; 59 pp.; In English; Space Technologies and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): NASA Order H-35186-D; Copyright; Avail: CASI; A04, Hardcopy

Contents include the following: Review of analysis goal. Analysis introduction: summary approach and goal assumptions. System analysis: propulsion technologies investigated. Analysis results: mission and performance analysis. Cost analysis. Comparison of propulsion technologies. Conclusion.

CASI

Cost Analysis; Propulsion

20040035568 NASA Glenn Research Center, Cleveland, OH, USA

Utility of Thin-Film Solar Cells on Flexible Substrates for Space Power

Dickman, J. E.; Hepp, A. F.; Morel, D. L.; Ferekides, C. S.; Tuttle, J. R.; Hoffman, D. J.; Dhere, N. G.; March 2004; 15 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA

Contract(s)/Grant(s): WBS 22-755-60-01

Report No.(s): NASA/TM-2004-212554; AIAA Paper 2003-5922; E-14120; No Copyright; Avail: CASI; A03, Hardcopy

The thin-film solar cell program at NASA GRC is developing solar cell technologies for space applications which address two critical metrics: specific power (power per unit mass) and launch stowed volume. To be competitive for many space applications, an array using thin film solar cells must significantly increase specific power while reducing stowed volume when compared to the present baseline technology utilizing crystalline solar cells. The NASA GRC program is developing two approaches. Since the vast majority of the mass of a thin film solar cell is in the substrate, a thin film solar cell on a very lightweight flexible substrate (polymer or metal films) is being developed as the first approach. The second approach is the development of multijunction thin film solar cells. Total cell efficiency can be increased by stacking multiple cells having bandgaps tuned to convert the spectrum passing through the upper cells to the lower cells. Once developed, the two approaches will be merged to yield a multijunction, thin film solar cell on a very lightweight, flexible substrate. The ultimate utility of such solar cells in space require the development of monolithic interconnections, lightweight array structures, and ultra-lightweight support and deployment techniques.

Author

Solar Cells; Substrates; Thin Films; Technology Utilization; Spacecraft Propulsion; Fabrication

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*.

20040034023

Protein Crystals and their Growth

Chernov, A. A.; January 2004; 1 pp.; In English

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Recent results on binding between protein molecules in crystal lattice, crystal-solution surface energy, elastic properties and strength and spontaneous crystal cracking are reviewed and discussed in the first half of this paper (Sea 2-4). In the second par&, some basic approaches to solubility of proteins are followed by overview on crystal nucleation and growth (Sec 5). It is argued that variability of mixing in batch crystallization may be a source for scattering of crystal number ultimately appearing in the batch. Frequency at which new molecules join crystal lattice is measured by kinetic coefficient and related to the observable crystal growth rate. Numerical criteria to discriminate diffusion and kinetic limited growth are discussed on this basis in Sec 7. In Sec 8, creation of defects is discussed with the emphasis on the role of impurities and convection on macromolecular crystal I;erfection.

Author

Proteins; Crystal Growth; Crystal Lattices; Elastic Properties; Convection

20040034192 Johns Hopkins Univ., Laurel, MD, USA

Detailed Modeling and Analysis of the CPFM Dataset

Swartz, William H.; Lloyd, Steven A.; DeMajistre, Robert; February 23, 2004; 12 pp.; In English

Contract(s)/Grant(s): NAG5-11297; No Copyright; Avail: CASI; A03, Hardcopy

A quantitative understanding of photolysis rate coefficients (or 'j-values') is essential to determining the photochemical reaction rates that define ozone loss and other crucial processes in the atmosphere. j-Values can be calculated with radiative transfer models, derived from actinic flux observations, or inferred from trace gas measurements. The principal objective of this study is to cross-validate j-values from the Composition and Photodissociative Flux Measurement (CPFM) instrument during the Photochemistry of Ozone Loss in the Arctic Region In Summer (POLARIS) and SAGE I11 Ozone Loss and Validation Experiment (SOLVE) field campaigns with model calculations and other measurements and to use this detailed analysis to improve our ability to determine j-values. Another objective is to analyze the spectral flux from the CPFM (not just the j-values) and, using a multi-wavelength/multi-species spectral fitting technique, determine atmospheric composition.

Author

Photochemical Reactions; Photodissociation; Computation; Ozone; Losses

20040034227 Lawrence Livermore National Lab., Livermore, CA

Dislocation Dynamics: Simulation of Plastic Flow of bcc Metals

Lassila, D. H.; Feb. 20, 2001; 84 pp.; In English

Report No.(s): DE2003-15005437; UCRL-ID-142533; No Copyright; Avail: Department of Energy Information Bridge

This report is comprised of 6 individual sections. The first is an executive summary of the project and describes the overall project goal, which is to establish an experimentally validated 3D dislocation dynamics simulation. This first section also gives some information of LLNL's multi-scale modeling efforts associated with the plasticity of bcc metals, and the role of this LDRD project in the multiscale modeling program. The last five sections of this report are journal articles that were produced during the course of the FY-2000 efforts.

NTIS

Metals; Plastic Flow; Body Centered Cubic Lattices; Computerized Simulation; Dislocations (Materials)

20040034278 Lawrence Livermore National Lab., Livermore, CA

Mechanistic Constitutive Models for Rubber Elasticity and Viscoelasticity

Puso, M.; Jan. 21, 2003; 134 pp.; In English

Report No.(s): DE2003-15004918; UCRL-ID-151578; No Copyright; Avail: Department of Energy Information Bridge

Physically based models which describe the finite strain behavior of vulcanized rubber are developed. Constitutive laws for elasticity and viscoelasticity are derived by integrating over orientation space the forces due to each individual polymer

chain. A novel scheme is presented which effectively approximates these integrals in terms of strain and strain invariants. In addition, the details involving the implementation of such models into a quasi-static large strain finite element formulation are provided. In order to account for the finite extensibility of a molecular chain, Langevin statistics is used to model the chain response. The classical statistical model of rubber assumes that polymer chains interact only at the chemical crosslinks. It is known that such model when fitted for uniaxial tension data cannot fit compression or equibiaxial data. A model which incorporates the entanglement interactions of surrounding chains, in addition to the finite extensibility of the chains, is shown to give better predictions than the classical model. The technique used for approximating the orientation space integral was applied to both the classical and entanglement models. A viscoelasticity model based on the force equilibration process as described by Doi and Edwards is developed. An assumed form for the transient force in the chain is postulated. The resulting stress tensor is composed of an elastic and a viscoelastic portion with the elastic stress given by the proposed entanglement model. In order to improve the simulation of experimental data, it was found necessary to include the effect of unattached or dangling polymer chains in the viscoelasticity model. The viscoelastic effect of such chains is the manifestation of a disengagement process. This disengagement model for unattached polymer chains motivated an empirical model which was very successful in simulating the experimental results considered.
NTIS
Mathematical Models; Data Compression; Finite Element Method; Molecular Chains; Langevin Formula

20040034282 Lawrence Livermore National Lab., Livermore, CA, Aerojet Solid Propulsion Co., Sacramento, CA, Sacramento, CA, USA
Heats of Formation of Energetic Oxetane Monomers and Polymers
Schmidt, R. D.; Manser, G. E.; Mar. 2001; 14 pp.; In English
Report No.(s): DE2003-15005280; UCRL-JC-141600; No Copyright; Avail: Department of Energy Information Bridge
Energetic oxetane polymers have shown promise as performance-enhancing ingredients in gun and missile propellants. In order to correctly predict the performance of energetic materials containing these polymers, it is important to have accurate, experimentally determined values for the polymer heats of formation (triangleHf). In support of a theoretical study on gun propellant performance, heats of combustion were experimentally determined for a series of oxetane polymers and monomers (see below) using combustion calorimetry, and from these, triangleHf values were calculated. Polymers included BAMO/AMMO, BAMO/NMMO (polyol and TPE), and BNMO/NMMO mixtures. In order to calculate the triangleHf of the polymers from heat of combustion data, a number of assumptions were made regarding the polymer structure and molecular weight. A comparison of the triangleHf values for the monomers and polymers were made, and these values were compared to heats of formation measured elsewhere.
NTIS
Monomers; Polymers; Oxetane Polymers; Heat Measurement

20040034296 Lawrence Livermore National Lab., Livermore, CA
Chemical Degradation of Siloxane Stress Cushions (M97 and S5370) by Thermal, Mechanical and Spectroscopic Investigations
Maxwell, R. S.; Gee, R.; Balazs, B.; Apr. 10, 2002; 12 pp.; In English
Report No.(s): DE2003-15005400; UCRL-JC-148371; No Copyright; Avail: Department of Energy Information Bridge
We are currently investigating the long term aging of weapon organics in an effort to develop predictive capabilities for hctional service life. As part of this effort, we have been studying multimechanism aging of M97 and S5370 stress cushions. Ionizing radiation, thermal degradation, and desiccation all affect the crosslink density and motional dynamics and thus the engineering performance of these materials. Our approach has been to develop molecular level understanding of the effects of such aging mechanisms on polymer properties by a combined approach utilizing solvent swelling, thermal, DMA, molecular modeling, and solid state NMR. This presentation will offer a survey of our current work, concentrating on the application of solid state NMR for correlating structure and polymer dynamics. An overview of the relationships between crosslink density, NMR relaxation times, polymer chain dynamics, and storage modulus measurements will be presented and the advantages of NMR will be discussed.
NTIS
Degradation; Weapons; Service Life; Nuclear Magnetic Resonance; Thermal Degradation

20040034765 Lawrence Livermore National Lab., Livermore, CA
H2O Outgassing in and its Effects on M9787 Silicone
Dinh, L. N.; Schildbach, M. A.; McLean, W.; Balazs, B.; LeMay, J. D.; Sep. 2001; 40 pp.; In English
Report No.(s): DE2003-15005328; UCRL-ID-145882; No Copyright; Avail: Department of Energy Information Bridge

Temperature programmed desorption (TPD) was performed on M9787 silicone, Cab-O-Sil-M-7D (fumed) and Hi-Sil-233 (precipitated) silica particles that had been annealed to 460 K for 24 hours then exposed to different moisture levels. Our results suggest that moisture desorption and adsorption in M9787 can be approximated by the interaction of its silica contents (Cab-O-Sil-M-7D and Hi-Sil-233) with moisture. Our experimental data also reveal that, in general, as heat treated silica particles are exposed to moisture, chemisorbed states, then physisorbed states are gradually filled up in that order.
NTIS
Silicones; Degassing; Silicon Dioxide

20040034818 Lawrence Livermore National Lab., Livermore, CA
Experimental Studies of Laser-Induced Breakdown in Transparent Dielectrics
Carr, C. W.; Sep. 23, 2003; 140 pp.; In English
Report No.(s): DE2003-15005376; UCRL-LR-155392; No Copyright; Avail: Department of Energy Information Bridge

The mechanisms by which transparent dielectrics damage when exposed to high power laser radiation has been of scientific and technological interest since the invention of the laser. In this work, a set of three experiments are presented which provide insight into the damage initiation mechanisms and the processes involved in laser-induced damage. Using an OPO (optical parametric oscillator) laser, we have measured the damage thresholds of deuterated potassium dihydrogen phosphate (DKDP) from the near ultraviolet into the visible. Distinct steps, whose width is of order K(sub b)T, are observed in the damage threshold at photon energies associated with the number of photons (3(yields)2 or 4(yields)3) needed to promote a ground state electron across the energy gap. The wavelength dependence of the damage threshold suggests that a primary mechanism for damage initiation in DKDP is a multi-photon process in which the order is reduced through excited defect state absorption. In-situ fluorescence microscopy, in conjunction with theoretical calculations by Liu et al., has been used to establish that hydrogen displacement defects are potentially responsible for the reduction in the multi-photon cross-section. During the damage process, the material absorbs energy from the laser pulse and produces an ionized region that gives rise to broadband emission. By performing a time-resolved investigation of this emission, we demonstrate both that it is blackbody in nature, and we provide the first direct measurement of the localized temperature during and following laser damage initiation for various optical materials. For excitation using nanosecond laser pulses, the plasma, when confined in the bulk, is in thermal equilibrium with the lattice. These results allow for a detailed characterization of temperature, pressure, and electron densities occurring during laser-induced damage.
NTIS
Dielectrics; Breakdown; Laser Beams

20040034820 Lawrence Livermore National Lab., Livermore, CA
Chemistry and Processing of Nanostructured Materials
Fox, G. A.; Baumann, T. F.; Hope-Weeks, L. J.; Vance, A. L.; Jan. 2002; 18 pp.; In English
Report No.(s): DE2003-15005302; UCRL-ID-146820; No Copyright; Avail: Department of Energy Information Bridge

Nanostructured materials can be formed through the sol-gel polymerization of inorganic or organic monomer systems. For example, a two step polymerization of tetramethoxysilane (TMOS) was developed such that silica aerogels with densities as low as 3 kg/m(sup 3) ((approx.) two times the density of air) could be achieved. Organic aerogels based upon resorcinol-formaldehyde and melamine-formaldehyde can also be prepared using the sol-gel process. Materials of this type have received significant attention at LLNL due to their ultrafine cell sizes, continuous porosity, high surface area and low mass density. For both types of aerogels, sol-gel polymerization depends upon the transformation of these monomers into nanometer-sized clusters followed by cross-linking into a 3-dimensional gel network.
NTIS
Explosives; Sol-Gel Processes; Synthesis (Chemistry); Polymerization

24
COMPOSITE MATERIALS

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

20040031691 Forest Products Lab., Madison, WI
Evaluating Wood-Based Composites for Incipient Fungal Decay with the Immunodiagnostic Wood Decay Test
Clausen, C. A.; Haughton, L.; Murphy, C.; 2003; 14 pp.
Report No.(s): PB2004-103190; FPL-GTR-142; No Copyright; Avail: CASI; A03, Hardcopy

Early and accurate detection of the extent of fungal deterioration during forensic inspection of the building envelope would eliminate excessive or unnecessary replacement of wood-based building materials. Areas of water infiltration in wood-framed building envelopes in the Pacific Northwest were evaluated visually and sampled for moisture content. Wood samples were cultured in the laboratory and tested for the presence of decay fungi by the immunodiagnostic wood decay (IWD) test. In oriented strandboard sheathing, a correlation was seen between low moisture content, arrested fungal growth, advanced visual deterioration, and negative IWD results in a building envelope in which advanced fungal decay was discovered 3 years prior to the evaluation. Evaluation of exterior siding showed a correlation of high moisture content and of swelling and softening of the product with positive IWD results.
NTIS
Wooden Structures; Composite Materials; Fungi; Decay

20040033966 NASA Glenn Research Center, Cleveland, OH, USA
C/SiC Life Prediction for Propulsion Applications
Levine, Stanley R.; Verrilli, Michael J.; Opula, Elizabeth J.; Halbig, Michael C.; Calomino, Anthony M.; Thomas, David J.; October 21, 2002; 33 pp.; In English; JANNAF 39th Combustion Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 794-20-65; No Copyright; Avail: CASI; A03, Hardcopy

Accurate life prediction is critical to successful use of ceramic matrix composites (CMC). The tools to accomplish this are immature and not oriented toward the behavior of carbon fiber reinforced silicon carbide (C/SiC), the primary system of interest for many reusable and single mission launch vehicle propulsion and airframe applications. This paper describes an approach and progress made to satisfy the need to develop an integrated life prediction system that addresses mechanical durability and environmental degradation of C/SiC. Issues such as oxidation, steam and hydrogen effects on material behavior are discussed. Preliminary tests indicate that stream will aggressively remove SiC seal coat and matrix in line with past experience. The kinetics of water vapor reaction with carbon fibers is negligible at 600 C, but comparable to air attack at 1200 C. The mitigating effect of steam observed in fiber oxidation studies has also been observed in stress rupture tests. Detailed microscopy of oxidized specimens is being carried out to develop the oxidation model. Carbon oxidation kinetics are reaction controlled at intermediate temperatures and diffusion controlled at high temperatures (approx. 1000 C). Activation energies for T-300 and interface pyrolytic carbon were determined as key inputs to the oxidation model. Crack opening as a function of temperature and stress was calculated. Mechanical property tests to develop and verify the probabilistic life model are very encouraging except for residual strength prediction. Gage width is a key variable governing edge oxidation of seal coated specimens. Future efforts will include architectural effects, enhanced coatings, biaxial tests, and LCF. Modeling will need to account for combined effects.
Author
Ceramic Matrix Composites; Silicon Carbides; Life (Durability); Carbon Fibers

20040033969 Army Vehicle Technology Center, Cleveland, OH, USA
Silicon Carbide Fiber-Reinforced Silicon Nitride Composites
Bhatt, Ramakrishna T.; [2003]; 52 pp.; In English
Contract(s)/Grant(s): 22-714-30-09; No Copyright; Avail: CASI; A04, Hardcopy

The fabrication and thermo-mechanical properties of SiC monofilament- and SiC fiber tow-reinforced reaction-bonded silicon nitride matrix composites (SiC/RBSN) and fully dense SiC monofilament-reinforced silicon nitride matrix composites (SiC/Si3N4) have been reviewed. The SiC/RBSN composites display high strength and toughness, and low thermal conductivity in the as-fabricated condition, but are susceptible to internal oxidation and mechanical property degradation in the intermediate temperature range from 400 to 1100 C. The internal oxidation problem can be avoided by applying functionally graded oxidation resistant coatings on external surfaces of the composite. On the other hand, the fully dense SiC/SiC3N4 composites fabricated by using SiC monofilaments and pressure assisted sintering methods display moderate strength and limited strain capability beyond matrix cracking stress. Advantages, disadvantages, and potential applications of SiC fiber-reinforced silicon nitride matrix composites fabricated using various fiber types and processing methods are discussed.
Author
Silicon Carbides; Silicon Nitrides; Fiber Composites

20040033992 NASA Glenn Research Center, Cleveland, OH, USA

Ultra-High Temperature Ceramic Composites for Leading Edges

Levine, Stanley R.; Opila, Elizabeth J.; Lorincz, Jonathan A.; Robinson, Raymond C.; Singh, Mrityunjay; Petko, Jeanne; Ellerby, Donald T.; Gasch, Matthew J.; [2003]; 37 pp.; In English; JANNAF 39th Combustion/27th Airbreathing Propulsion/21st Propulsion Systems Hazards/3rd Modeling and Simulation Joint Subcommittee Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 22-794-40-45; No Copyright; Avail: CASI; A03, Hardcopy

Ultra-high temperature ceramics (UHTC) have performed unreliably due to material flaws and attachment design. These deficiencies are brought to the fore by the low fracture toughness and thermal shock resistance of UHTC. If these deficiencies are overcome, we are still faced with poor oxidation resistance as a limitation on UHTC applicability to reusable launch vehicles. We have been addressing the deficiencies of UHTC for the past two years via a small task at GRC that is in the Airframe part of the Next Generation Launch Technology Program. Our focus is on composite constructions and functional grading to address the mechanical issues and on composition modification to address the oxidation issue. The progress on approaches to improving oxidation resistance by alloying and functional grading will be reported. In particular, initial tests of tantalum additions have shown potential for major improvement. Results for additional tests at higher temperatures will be presented. These oxidation improvements are being incorporated in the composites approaches. Two fabrication approaches are being persued to produce carbon fiber reinforced UHTC composites: prepregging and rigid perform infiltration. Fabrication procedures, microstructures, and initial mechanical property and oxidation results for composites will be reported. Author

Ceramic Matrix Composites; Leading Edges; Refractory Materials

20040034111 Georgia Inst. of Tech., Atlanta, GA, USA

Nanotube Reinforcement of Adhesively Bonded Joints

Johnson, W. S.; Saltysiak, Bethany; September 23, 2003; 10 pp.; In English

Contract(s)/Grant(s): NAG1-2312; GT Proj. E-18-636; No Copyright; Avail: CASI; A02, Hardcopy

Over the past five years there has been much excitement about the development of nanotubes and nanofibers and the potential that these materials may offer in enhancing electrical and mechanical properties of systems. The purpose of this paper is to present research into improving the mechanical performance of polymers by using nanofibers as a reinforcement to make high performance composite materials. This paper will present theoretical predictions of the composite modulus and then present the actual performance of the composite. Fabrication details will be given along with photos of the microstructure. The matrix material is polymethylmethacrylate (PMMA) and the nanofibers are vapor-grown carbon nanofibers produced by Pyrograph Products, Inc.

Author

Fabrication; Matrix Materials; Mechanical Properties; Electrical Properties; Carbon Nanotubes

20040034207 NASA Langley Research Center, Hampton, VA, USA

Preparation and Characterization of Space Durable Polymer Nanocomposite Films from Functionalized Carbon Nanotubes

Delozier, D. M.; Connell, J. W.; Smith, J. G.; Watson, K. A.; [2003]; 13 pp.; In English; Nanocomposites 2003, 10-12 Nov. 2003, San Francisco, CA, USA

Contract(s)/Grant(s): 23-755-06-08; No Copyright; Avail: CASI; A03, Hardcopy

Low color, flexible, space durable polyimide films with inherent, robust electrical conductivity have been under investigation as part of a continuing materials development activity for future NASA space missions involving Gossamer structures. Electrical conductivity is needed in these films to dissipate electrostatic charge build-up that occurs due to the orbital environment. One method of imparting conductivity is through the use of single walled carbon nanotubes (SWNTs). However, the incompatibility and insolubility of the SWNTs severely hampers their dispersion in polymeric matrices. In an attempt to improve their dispersability, SWNTs were functionalized by the reaction with an alkyl hydrazone. After this functionalization, the SWNTs were soluble in select solvents and dispersed more readily in the polymer matrix. The functionalized SWNTs were characterized by Raman spectroscopy and thermogravimetric analysis (TGA). The functionalized nanotubes were dispersed in the bulk of the films using a solution technique. The functionalized nanotubes were also applied to the surface of polyimide films using a spray coating technique. The resultant polyimide nanocomposite films were evaluated for nanotube dispersion, electrical conductivity, mechanical, and optical properties and compared with previously prepared

polyimide-SWNT samples to assess the effects of SWNT functionalization.
Author
Polymer Matrix Composites; Polyimides; Aerospace Environments; Carbon Nanotubes; Electrostatic Charge; Nanocomposites

20040034224 Lawrence Livermore National Lab., Livermore, CA
Experimental and Modeling Studies of Water-Silica-PDMS Interactions in M97-Based Stress Cushions
Maxwell, R.; Dinh, L.; Gee, R.; Balazs, B.; Apr. 18, 2002; 12 pp.; In English
Report No.(s): DE2003-15005360; UCRL-JC-148029; No Copyright; Avail: Department of Energy Information Bridge
In filled PDMS based composites, such as M97XX stress cushions, significant mechanical reinforcement of the polymer component is obtained from hydrogen bonding between the silica filler surface hydroxyls and the siloxane polymer backbone. It is expected that these interactions are influenced by the amount and structure of interfacial water. We have chosen to investigate in detail the effect of chemisorbed and physisorbed water on the interfacial structure and dynamics in silica-filled PDMS-based composites. Toward this end, we have combined classical molecular dynamics simulations and experimental studies employing nanoindentation, temperature programmed desorption (TPD), Dynamic Mechanical Analysis (DMA), and Nuclear Magnetic Resonance (NMR) analyses. Our TPD results suggest that moisture desorption and adsorption in M9787 can be approximated by the interaction of its silica constituents (Cab-0-Sil-M-7D and Hi-Sil-233) with moisture. Our experimental data also reveal that, in general, as heat-treated silica particles are exposed to moisture, chemisorbed states, then physisorbed states are gradually filled up in that order.
NTIS
Cushions; Silicon Dioxide; Water; Mechanical Properties; Polymers; Molecular Dynamics; Composite Materials

20040035564 Lawrence Livermore National Lab., Livermore, CA
Characterization of the Polymer-Filler Interface in Gamma-Irradiated Silica-Reinforced Polysiloxane Composites
Chien, A. T.; Balazs, B.; LeMay, J.; Apr. 03, 2000; 12 pp.; In English
Report No.(s): DE2003-15005421; UCRL-JC-136064; No Copyright; Avail: Department of Energy Information Bridge
We present the first measurements of the absolute albedos of hohlraums made from gold or from high-Z mixtures. The measurements are performed over the range of radiation temperatures (70-100 eV) expected during the foot of an indirect-drive temporally- shaped ignition laser pulse, where accurate knowledge of the wall albedo (i.e. soft x-ray wall re-emission) is most critical for determining capsule radiation symmetry. We find that the gold albedo agrees well with calculations using the super transition array opacity model, potentially providing additional margin for ICF ignition.
NTIS
Polysiloxanes; Silicon Dioxide; Pulsed Lasers

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20040031653 Lawrence Livermore National Lab., Livermore, CA
Physical Basis for Materials Synthesis Using Biomineralization
De Yoreo, J.; Orme, C.; Dove, P.; Teng, H.; May 16, 2000; 12 pp.; In English
Report No.(s): DE2003-15005096; UCRL-ID-139313; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Mineralogy; Calcification; Carbonates

20040031665 Swedish Defence Research Establishment, Linkoeping
Analysis of the Temperature Difference between Air and Background: Statistics and Modelling
Hansson, M.; Mar. 2003; In Swedish
Report No.(s): PB2004-101816; FOI-R-0853-SE; No Copyright; Avail: National Technical Information Service (NTIS)
Many gases prove to have characteristic properties which give the possibility of gas detection with spectrometer methods in the infrared region. The method utilizes the temperature difference between the air and the natural sources in the background

e.g. ground, vegetation and sky. This report contains statistics concerning the temperature difference between air and different types of background. The temperature difference is calculated from radiance data from FOI's database. The results show that with 50% probability the temperature difference is 1-2 degrees C or larger from measurements with a background of grass, meadow or forest. By comparing the statistics of the temperature difference and performance parameters of existing spectrometer systems for gas detection the adequacy of these systems can be evaluated. Furthermore, an empirical and a semi-empirical model for prediction of temperature difference are described. Predictions with the semi-empirical model generally show good correspondence between calculated and measured temperature difference for the considered cases. The best result is achieved for a flat, homogeneous background e.g. asphalt. Predictions with the empirical texture model are less successful in producing correspondence with the data. Deviations between the models and measured data are quantified and compared.
NTIS
Temperature Gradients; Gas Detectors; Infrared Radiation; Probability Theory

20040031679 Swedish Defence Research Establishment, Tumba
Optimisation and Characterisation of Compositions with Low Sensitivity Based on FOX-7 and Energetic Binders. Large-Scale GAP Test of Pure FOX-7
Adolfsson, R.; Bodin, L.; Eldsaeter, C.; Pettersson, A.; Roman, N.; Dec. 2002; In Swedish
Report No.(s): PB2004-101826; FOI-R-0668-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Composition B has been used for over 50 years in a large number of applications. It is well known and has good performance. It is easily processed and is made from relatively low-price raw materials. Unfortunately, it suffers from a lot of problems. It may shrink during manufacturing, which results in cracks and voids. It is sensitive to impact and reacts violently during cook-off. These drawbacks have resulted in a need to find low-vulnerability replacements to Composition B, 1, 1-diamino 2; 2-dinitroethylene (FOX-7) is a good candidate when low vulnerability is of concern. FOI has previously developed a PBX composition based on 70% of FOX-7 and 30% of an energetic binder, which includes polyGLYN and butyl-NENA. Small-scale slow cook-off and detonations tests showed that this composition was insensitive. Unfortunately, this composition was very stiff. This report describes the development of a new energetic binder, based on polyGLYN and GAP. This new binder has improved elasticity and low-temperature properties. It has also been discussed if FOX-7 alone or as an additive, could be useful as a propellant. This report presents results from a study where the burn rate of a FOX-7 based solid propellant has been measured. A gap test of pure FOX-7 has also been done. The purpose of this test is to evaluate the impact sensitivity of the pure compound and this result will serve as a reference value in tests of future FOX-7 based compositions.
NTIS
Sensitivity; Binders (Materials); Elastic Properties; Impact Resistance; Optimization

20040034052 NASA Langley Research Center, Hampton, VA, USA
High Temperature Transfer Molding Resins: Status of PETI-298 and PETI-330
Connell, John W.; Smith, Joseph G., Jr.; Hergenrother, Paul M.; Criss, Jim M.; [2003]; 15 pp.; In English; SAMPE Technical Conference, 28 Sep. - 2 Oct. 2003, Dayton, OH, USA
Contract(s)/Grant(s): RTA 713-10-67-01; No Copyright; Avail: CASI; A03, Hardcopy

Two phenylethynyl terminated oligomers designated PETI-298 and PETI-330 were developed at the NASA Langley Research Center and have emerged as leading candidates for composite applications requiring high temperature performance (i.e. greater than or equal to 288 C for 1000 hours) combined with the ability to be readily processed into composites without the use of an autoclave or complex/lengthy cure or post-cure cycle. These high performance/high temperature composites are potentially useful on advanced aerospace vehicles in structural applications and as aircraft engine components such as inlet frames and compressor vanes. The number designation (i.e. 298, 330) refers to the glass transition temperature in degrees Celsius as determined on neat resin cured for 1 hour at 371 C. The resins are processable by non-autoclave techniques such as resin transfer molding (RTM), vacuum assisted RTM (VARTM) and resin infusion (RI). Both resins exhibit low complex melt viscosities (0.1-10 poise) at 280 C and are stable for greater than or equal to 2 hours at this temperature. Typically, the resins are melted, de-gassed and infused or injected at 280 C and subsequently cured at 371 C for 1-2 hours. Virtually no volatiles are evolved during the cure process. The resin synthesis is straightforward and has been scaled-up to 25 kg batches. The chemistry of PETI-298 and PETI-330 and the RTM AS-4 and T-650 carbon fabric laminate properties, and those of BMI-5270 for comparison, are presented.
Author
High Temperature; Resin Transfer Molding; Phenyls; Oligomers; Polyimides; Laminates

20040034766 Lawrence Livermore National Lab., Livermore, CA
Reaction Kinetics of LiD with Water Vapor
Balooch, M.; Dinh, L. N.; Calef, D. F.; Apr. 2001; 30 pp.; In English
Report No.(s): DE2003-15005289; UCRL-JC-143491; No Copyright; Avail: Department of Energy Information Bridge

The interaction of LiD with water vapor in the partial pressure range of 10 to the minus 7th power Torr to 20 Torr has been investigated. The reaction probability of water with pure LiD cleaved in an ultra high vacuum environment was obtained using the modulated molecular beam technique. This probability was 0.1 1 and independent of LiD surface temperature suggesting a negligible activation energy for the reaction in agreement with quantum chemical calculations. The value gradually reduced, however, to .007 as the surface concentration of oxygen containing product (LiOH), which was monitored in-situ by Auger electron spectroscopy on the reaction zone, approached full coverage. As the hydroxide film grew beyond a monolayer, the phase lag of hydrogen product increased fiorn zero to 20 degrees and the reaction probability reduced further until it approached our detection limit (approximately 10 to the minus 4th power).
NTIS
Reaction Kinetics; Water Vapor; Activation Energy; Electron Spectroscopy; Hydroxides

20040034834 Lawrence Livermore National Lab., Livermore, CA
Electronic Excitations and Chemistry in Nitromethane and HMX
Reed, E. J.; Manaa, M. R.; Joannopoulos, J. D.; Fried, L. E.; Jun. 19, 2001; 12 pp.; In English
Report No.(s): DE2003-15005492; UCRL-JC-144302; No Copyright; Avail: Department of Energy Information Bridge

The nature of electronic excitations in crystalline solid nitromethane under conditions of shock loading and static compression are examined. Density functional theory calculations are used to determine the crystal bandgap under hydrostatic stress, uniaxial strain, and shear strain. Bandgap lowering under uniaxial strain due to molecular defects and vacancies is considered. In all cases, the bandgap is not lowered enough to produce a significant population of excited states in the crystal. Preliminary simulations on the formation of detonation product molecules from HMX are discussed.
NTIS
Explosives; Nitromethane; Hmx; Hydrostatics; Energy Gaps (Solid State)

20040035559 Lawrence Livermore National Lab., Livermore, CA
Electrochemical Testing of Gas Tungsten Arc Welded and Reduced Pressure Electron Beam Welded Alloy 22
Day, S. D.; Wong, F. M. G.; Gordon, S. R.; Wong, L. L.; Rebak, R. B.; Sep. 07, 2003; 34 pp.; In English
Report No.(s): DE2003-15005410; UCRL-JC-155503; No Copyright; Avail: Department of Energy Information Bridge

Alloy 22 (N06022) is the material selected for the fabrication of the outer shell of the nuclear waste containers for the Yucca Mountain high-level nuclear waste repository site. A key technical issue in the Yucca Mountain waste package program has been the integrity of container weld joints. The currently selected welding process for fabricating and sealing the containers is the traditional gas tungsten arc welding (GTAW) or TIG method. An appealing faster alternative technique is reduced pressure electron beam (RPEB) welding. Standard electrochemical tests were carried on GTAW and RPEB welds as well as on base metal to determine their relative corrosion behavior in SCW at 90 deg C (alkaline), 1 M HC1 at 60 degrees C (acidic) and 1 M NaCl at 90 degrees C (neutral) solutions. Results show that for all practical purposes, the three tested materials had the electrochemical behavior in the three tested solutions.
NTIS
Electrochemical Corrosion; Gas Tungsten Arc Welding; Electron Beam Welding

20040035641 Lawrence Livermore National Lab., Livermore, CA
Environmental Considerations in the Studies of Corrosion Resistant Alloys for High-Level Radioactive Waste Containment
Iievbare, G. O.; Lian, T.; Farmer, J. C.; Jan. 15, 2002; 24 pp.; In English
Report No.(s): DE2003-15005478; UCRL-JC-146831; No Copyright; Avail: Department of Energy Information Bridge

The corrosion resistance of Alloy 22 (UNS No.: N06022) was studied in simulated ground water different pH values and ionic contents at various temperatures. Potentiodynamic polarization techniques were used to study the electrochemical behavior and measure the critical potentials in the various systems. Alloy 22 was found to be resistant to localized corrosion in the simulated ground waters tested.
NTIS
Containment; Corrosion Resistance; Radioactive Wastes; Alloys; Electrochemistry

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METALS AND METALLIC MATERIALS

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

20040031611 Lawrence Livermore National Lab., Livermore, CA
High Straing Rate-High Strain Response of an Ultrahigh Carbon Steel Containing 1.3% C and 3% SI
Lesuer, D. R.; Syn, C. K.; Sherby, O. M.; Kum, D. W.; Feb. 19, 2003; 12 pp.; In English
Report No.(s): DE2003-15004874; UCRL-JC-151883; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Carbon Steels; Strain Rate

20040031613 Lawrence Livermore National Lab., Livermore, CA
Stress-Strain Rate Relations in Ultra High Carbon Steels Deformed in the Ferrite Range of Temperature
Syn, C. K.; Leusuer, D. R.; Sherby, O. D.; Taleff, E. M.; Feb. 20, 2003; 12 pp.; In English
Report No.(s): DE2003-15004875; UCRL-JC-151884; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Ferrites; Carbon Steels; Stress-Strain Relationships

20040031625 Lawrence Livermore National Lab., Livermore, CA
High-Performance laser Peening for Effective Mitigation of Stress Corrosion Cracking
Hackel, L.; Chen, H. L.; Wong, F.; Hill, M.; Oct. 02, 2002; 32 pp.; In English
Report No.(s): DE2003-15004903; UCRL-ID-150449; No Copyright; Avail: Department of Energy Information Bridge
Stress corrosion cracking (SCC) in the Yucca Mountain waste package closure welds is believed to be the greatest threat to long-term containment. Use of stress mitigation to eliminate tensile stresses resulting from welding can prevent SCC. A laser technology with sufficient average power to achieve high throughput has been developed and commercially deployed with high peak power and sufficiently high average power to be an effective laser peening system. An appropriately applied version of this process could be applied to eliminate SCC in the waste package closure welds.
NTIS
Stress Corrosion Cracking; Stainless Steels; Welded Joints; Tensile Stress; Cans

20040034040
Characterization of Plastic flow and Resulting Micro-Textures in a Friction Stir Weld
Schneider, J. A.; Nunes, A. C., Jr.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: Other Sources; Abstract Only
The mechanically affected zone of a friction stir weld (FSW) cross section exhibits two distinct microstructural regions, possibly the residues of two distinct currents of metal in the FSW flow process. In this study the respective textures of these microstructural regions are investigated using orientation image mapping (OIM).
Author
Plastic Flow; Friction Stir Welding; Microstructure

20040034073 QSS Group, Inc., Cleveland, OH, USA
Powder-Derived High-Conductivity Coatings for Copper Alloys
Thomas-Ogbuji, Linus U.; October 30, 2003; 31 pp.; In English; Materials Science and Technology 2003, November 2003, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-98008; 22-713-82-21; No Copyright; Avail: CASI; A03, Hardcopy
Makers of high-thermal-flux engines prefer copper alloys as combustion chamber liners, owing to a need to maximize heat dissipation. Since engine environments are strongly oxidizing in nature and copper alloys generally have inadequate resistance to oxidation, the liners need coatings for thermal and environmental protection; however, coatings must be chosen with great care in order to avoid significant impairment of thermal conductivity. Powder-derived chromia- and alumina- forming alloys are being studied under NASA's programs for advanced reusable launch vehicles to succeed the space shuttle fleet. NiCrAlY and Cu-Cr compositions optimized for high thermal conductivity have been tested for static and cyclic oxidation, and for susceptibility to blanching - a mode of degradation arising from oxidation-reduction cycling. The results indicate that the

decision to coat the liners or not, and which coating/composition to use, depends strongly on the specific oxidative degradation mode that prevails under service conditions.
Author
Thermal Control Coatings; Copper Alloys; Chromium Alloys; Aluminum Alloys; Combustion Chambers; Linings

20040034074 QSS Group, Inc., Cleveland, OH, USA
A Simplified Test for Blanching Susceptibility of Copper Alloys
Thomas-Ogbuji, Linus U.; Humphrey, Donald; Setlock, John; October 30, 2003; 19 pp.; In English; Materials Science and Technology 2003, November 2003, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-98008; 22-708-31-20; No Copyright; Avail: CASI; A03, Hardcopy

GRCop-84 (Cu-8Cr-4Nb) is a dispersion-strengthened alloy developed for space-launch rocket engine applications, as a liner for the combustion chamber and nozzle ramp. Its main advantage over rival alloys, particularly NARloy-Z (Cu-Ag-Zr), the current liner alloy, is in high temperature mechanical properties. Further validation required that the two alloys be compared with respect to service performance and durability. This has been done, under conditions resembling those expected in reusable launch engine applications. GRCop-84 was found to have a superior resistance to static and cyclic oxidation up to approx. 700 C. In order to improve its performance above 700 C, Cu-Cr coatings have also been developed and evaluated. The major oxidative issue with Cu alloys is blanching, a mode of degradation induced by oxidation-reduction fluctuations in hydrogen-fueled engines. That fluctuation cannot be addressed with conventional static or cyclic oxidation testing. Hence, a further evaluation of the alloy substrates and Cu-Cr coating material necessitated our devising a test protocol that involves oxidaton-reduction cycles. This paper describes the test protocols used and the results obtained.
Author
Degradation; Copper Alloys; Oxidation; Protective Coatings; Chromium Alloys

20040034288 Lawrence Livermore National Lab., Livermore, CA
Surface Topographic Analyses Two-Year Coupons of Alloy 22 from Long-Term Corrosion Testing
Bedrosian, P. J.; Dec. 1999; 50 pp.; In English
Report No.(s): DE2003-15005284; UCRL-ID-142350; No Copyright; Avail: Department of Energy Information Bridge

We have applied atomic force microscopy (AFM) to analyze the surface topographies associated with representatives of each of the classes of aqueous-baths from which coupons of Alloy 22 were exposed for two years in Long-Term Corrosion Testing. The data support the conclusion that the AFM offers little, if any qualitative information on the corrosion of coupons which are currently undergoing Long-Term Testing.
NTIS
Atomic Force Microscopy; Corrosion

20040034732 Lawrence Livermore National Lab., Livermore, CA
Grain Size and Pressure Effects on Spall Strength in Copper
Schwartz, A. J.; Cazamias, J. U.; Fiske, P. S.; Minich, R. W.; Jun. 2001; 10 pp.; In English
Report No.(s): DE2003-15005281; UCRL-JC-141817; No Copyright; Avail: Department of Energy Information Bridge

We are executing a systematic study to quantify the effects of specific microstructural features on the spall behavior of 99.999% copper. Single crystals with (100) orientation, polycrystals with three grain sizes, and internally oxidized single crystals are shocked with Cu flyers at velocities from 300 to 2000 m/s using a 35-mm single/two-stage light gas gun. VISAR measurements of the free surface velocity are used to characterize the spall pullback signal and details of the ringing. The high purity single crystals exhibit the highest spall strength followed by the large, medium and small grain size polycrystalline samples. Cu - 0.15 wt.% Si single crystals have been internally oxidized to produce a fine dispersion of 350 nm silica particles. These samples exhibit the lowest spall strength, a factor of two and greater below the high purity single crystals.
NTIS
Copper; Silicon Dioxide; Single Crystals

20040034752 Lawrence Livermore National Lab., Livermore, CA
Modeling Large Strain, High Rate Deformation in Metals
Lesuer, D. R.; Kay, G. J.; LeBlanc, M. M.; 2001; 18 pp.; In English
Report No.(s): DE2003-15005327; UCRL-JC-134118; No Copyright; Avail: Department of Energy Information Bridge

The large strain deformation response of 6061-T6 and Ti-6Al-4V has been evaluated over a range in strain rates from

10(sup -4) s(sup -1) to over 10(sup 4) s(sup -1). The results have been used to critically evaluate the strength and damage components of the Johnson-Cook (JC) material model. A new model that addresses the shortcomings of the JC model was then developed and evaluated. The model is derived from the rate equations that represent deformation mechanisms active during moderate and high rate loading. Another model that accounts for the influence of void formation on yield and flow behavior of a ductile metal (the Gurson model) was also evaluated. The characteristics and predictive capabilities of these models are reviewed.
NTIS
Metals; Deformation; Strain Rate

20040034835 Lawrence Livermore National Lab., Livermore, CA
Effects of Helium on Radiation Damage Processes in Iron
Morishita, K.; Wirth, B. D.; Diaz, T.; Jun. 02, 2001; 10 pp.; In English
Report No.(s): DE2003-15005493; UCRL-JC-144458; No Copyright; Avail: Department of Energy Information Bridge
The introduction of helium into metals by direct helium implantation or by nuclear reactions during neutron irradiation can produce significant changes in metal microstructure and properties. In the fusion energy environment, high rates of insoluble helium are generated concurrently with radiation damage. Therefore, understanding helium behavior in metals remains one of the most important subjects in the field of research and development of nuclear fusion reactor materials.
NTIS
Helium; Iron; Radiation Effects

20040035594 Aluminum Co. of America, New Kensington, PA, USA
Effects of Intermittent Versus Continuous Heating upon the Tensile Properties of 2024-T4, 6061-T6 and 7075-T6 Alloys
Stickley, G. W.; Anerson, H. L.; August 1956; 8 pp.; In English
Report No.(s): NACA-TM-1419; No Copyright; Avail: CASI; A02, Hardcopy
In some applications, aluminum alloys are subjected to intermittent heating at elevated temperature. It is generally considered that the effects of such intermittent heating are cumulative, and therefore are the same as if the heating had been continuous for the same total length of time. The object of these tests was to determine the effects of intermittent and continuous heating at 300 and 400 F, for total periods of 100 and 200 hr, upon the tensile properties of 2024-T4 and 6061-T6 alloy rolled-and-drawn rod and 7075-T6 alloy extrusions, at room temperature and at the temperature of heating.
Derived from text
Aluminum Alloys; Heating; Tensile Properties

20040035595 NASA Glenn Research Center, Cleveland, OH, USA
The Effect of Tungsten Additions on Disk Alloy CH98
Gayda, John; Gabb, Timothy P.; August 2003; 16 pp.; In English
Contract(s)/Grant(s): WU 538-12-40
Report No.(s): NASA/TM-2003-212474; E-14012; No Copyright; Avail: CASI; A03, Hardcopy
Gas turbine engines for future subsonic transports will probably have higher pressure ratios which will require nickelbase superalloy disks with 1300 to 1400 F temperature capability. Several advanced disk alloys are being developed to fill this need. One of these, CH98, is a promising candidate for gas turbine engines and is being studied in NASA s Advanced Subsonic Technology (AST) program. For large disks, residual stresses generated during quenching from solution heat treatments are often reduced by a stabilization heat treatment, in which the disk is heated in the range of 1500 to 1600 F for several hours followed by a static air cool and age. The reduction in residual stress levels lessens distortion during machining of disks. Previous work on CH98 has indicated that stabilization treatments will decrease creep capability, however, tungsten additions appear to improve the creep capability of stabilized and aged CH98. In this study, a systematic variation of tungsten additions to CH98 was investigated. Specifically, the 1300 F tensile, creep, and fatigue crack growth properties of stabilized CH 98 were assessed with varying levels of tungsten additions.
Author
Tungsten Alloys; Heat Resistant Alloys; Gas Turbine Engines; Residual Stress; Crack Propagation; Fatigue (Materials)

20040035597 NASA Marshall Space Flight Center, Huntsville, AL, USA
Commercialization of NASA's High Strength Cast Aluminum Alloy for High Temperature Applications
Lee, Jonathan A.; [2003]; 12 pp.; In English; 28th Annual Conference on Composites, Materials and Structures, 26-30 Jan. 2004, Cocoa Beach, FL, USA
Contract(s)/Grant(s): 090-26-RD; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, the commercialization of a new high strength cast aluminum alloy, invented by NASA-Marshall Space Flight Center, for high temperature applications will be presented. Originally developed to meet U.S. automotive legislation requiring low- exhaust emission, the novel NASA aluminum alloy offers dramatic improvement in tensile and fatigue strengths at elevated temperatures (450 F-750 F), which can lead to reducing part weight and cost as well as improving performance for automotive engine applications. It is an ideal low cost material for cast components such as pistons, cylinder heads, cylinder liners, connecting rods, turbo chargers, impellers, actuators, brake calipers and rotors. NASA alloy also offers greater wear resistance, dimensional stability, and lower thermal expansion compared to conventional aluminum alloys, and the new alloy can be produced economically from sand, permanent mold and investment casting. Since 2001, this technology was licensed to several companies for automotive and marine internal combustion engines applications.
Author
Commercialization; Aluminum Alloys; Cast Alloys; NASA Programs; Mechanical Properties; Heat Resistant Alloys

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NONMETALLIC MATERIALS

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

20040031670 Swedish Defence Research Establishment, Linkoeping
Hybrid Jauman Absorber for the mm-Wavebands
Ousbaeck, J. O.; Larsson, F.; Jan. 2003; In Swedish
Report No.(s): PB2004-101821; FOI-R-0812-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The report presents a work to realize a formerly presented radar absorber namely a load carrying hybrid Jauman absorber optimized for the Ka- and W-bands. The absorber consists of a thin resistive sheet enclosed by two dielectric layers. As resistive sheet a conductive polymer treated fabric has been used and as dielectric layers glass fiber reinforced plastics. Perturbation analysis has been performed under the assumption that the resistive sheet has negligible thickness in order to get tolerances of design parameters. Two absorbing panels manufactured under strict control worked in the Ka- but did not work in the W-band, probably depending on the fact that the resistive sheet in this case cannot be considered as having negligible thickness. Deeper perturbation analysis including both thickness and dielectric constant of the resistive sheet has been performed in order to get knowledge about the influence of them. The hybrid Jauman absorber that was manufactured after that the analysis was done had a resistive sheet with a thickness half that of the two previous panels. Even this absorber worked only in the Ka-band. It seems that the dielectric characterization of the resistive sheet is not correct. However during the time FOI has worked with this matter a successful result has been reported on a panel with the same resistive sheet the authors first used. This result may be questionable from the thorough analysis performed at FOI. The conductivity of the resistive sheet decreases with the time due to aging. The effect of aging is described as a function of selected environmental parameters.
NTIS
Radar Absorbers; Extremely High Frequencies; Dielectrics; Design Analysis

20040031735 NASA Glenn Research Center, Cleveland, OH, USA
High Temperature Propulsion System Structural Seals for Future Space Launch Vehicles
Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; DeMange, Jeffrey J.; January 2004; 24 pp.; In English; 39th Combustion Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA
Contract(s)/Grant(s): WBS 22-794-20-65
Report No.(s): NASA/TM-2004-212907; E-14304; No Copyright; Avail: CASI; A03, Hardcopy

Durable, flexible sliding seals are required in advanced hypersonic engines to seal the perimeters of movable engine ramps for efficient, safe operation in high heat flux environments at temperatures of 2000 to 2500 F. Current seal designs do not meet the demanding requirements for future engines, so NASA s Glenn Research Center is developing advanced seals and preloading devices to overcome these shortfalls. An advanced ceramic wafer seal design and two types of seal preloading devices were evaluated in a series of compression, scrub, and flow tests. Silicon nitride wafer seals survived 2000 in. 1000 cycles) of scrubbing at 1600 F against an Inconel 625 rub surface with no chips or signs of damage. Flow rates measured for the wafers before and after scrubbing were almost identical and were up to 32 times lower than those recorded for the best braided rope seal flow blockers. Canted coil springs and silicon nitride compression springs showed promise conceptually as potential seal preloading devices to help maintain seal resiliency. A finite element model of the canted coil spring revealed that

it should be possible to produce a spring out of high temperature materials for applications at 2000+ F.
Author
Sealers; Silicon Nitrides

20040031784 NASA Langley Research Center, Hampton, VA, USA
Carbon Nanotube/Conductive Additive/Space Durable Polymer Nanocomposite Films for Electrostatic Charge Dissipation
Smith, Joseph G., Jr.; Watson, Kent A.; Delozier, Donavon M.; Connell, John W.; May 21, 2003; 12 pp.; In English; 35th SAMPE International Technical Conference, 28 Sep. - 2 Oct. 2003, Dayton OH, USA
Contract(s)/Grant(s): 766-06-00-08; No Copyright; Avail: CASI; A03, Hardcopy

Thin film membranes of space environmentally stable polymeric materials possessing low color/solar absorptivity (alpha) are of interest for potential applications on Gossamer spacecraft. In addition to these properties, sufficient electrical conductivity is required in order to dissipate electrostatic charge (ESC) build-up brought about by the charged orbital environment. One approach to achieve sufficient electrical conductivity for ESC mitigation is the incorporation of single wall carbon nanotubes (SWNTs). However, when the SWNTs are dispersed throughout the polymer matrix, the nanocomposite films tend to be significantly darker than the pristine material resulting in a higher alpha. The incorporation of conductive additives in combination with a decreased loading level of SWNTs is one approach for improving alpha while retaining conductivity. Taken individually, the low loading level of conductive additives and SWNTs is insufficient in achieving the percolation level necessary for electrical conductivity. When added simultaneously to the film, conductivity is achieved through a synergistic effect. The chemistry, physical, and mechanical properties of the nanocomposite films will be presented.
Author
Carbon Nanotubes; Nanocomposites; Thin Films; Dissipation; Mechanical Properties; Electrostatics; Polyimides; Electrostatic Charge

20040031797 Georgia Inst. of Tech., Atlanta, GA, USA
Synthesis of Hafnium-Based Ceramic Materials for Ultra-High Temperature Aerospace Applications
Johnson, Sylvia; Feldman, Jay; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG2-1571; No Copyright; Avail: CASI; A01, Hardcopy

This project involved the synthesis of hafnium (Hf)-based ceramic powders and Hf-based precursor solutions that were suitable for preparation of Hf-based ceramics. The Hf-based ceramic materials of interest in this project were hafnium carbide (with nominal composition HE) and hafnium dioxide (HfO2). The materials were prepared at Georgia Institute of Technology and then supplied to research collaborators Dr. Sylvia Johnson and Dr. Jay Feldman) at NASA Ames Research Center.
Author
Synthesis (Chemistry); Hafnium Oxides; Ceramics; Hafnium

20040033932 NASA Glenn Research Center, Cleveland, OH, USA
Conversion Coatings for Aluminum Alloys by Chemical Vapor Deposition Mechanisms
Reye, John T.; McFadden, Lisa S.; Gatica, Jorge E.; Morales, Wilfredo; January 2004; 15 pp.; In English
Contract(s)/Grant(s): NCC3-876; WBS 22-714-09-16
Report No.(s): NASA/TM-2004-212905; E-14328; No Copyright; Avail: CASI; A03, Hardcopy

With the rise of environmental awareness and the renewed importance of environmentally friendly processes, the USA Environmental Protection Agency has targeted surface pre-treatment processes based on chromates. Indeed, this process has been subject to regulations under the Clean Water Act as well as other environmental initiatives, and there is today a marked movement to phase the process out in the near future. Therefore, there is a clear need for new advances in coating technology that could provide practical options for replacing present industrial practices. Depending on the final application, such coatings might be required to be resistant to corrosion, act as chemically resistant coatings, or both. This research examined a chemical vapor deposition (CVD) mechanism to deposit uniform conversion coatings onto aluminum alloy substrates. Robust protocols based on solutions of aryl phosphate ester and multi-oxide conversion coating (submicron) films were successfully grown onto the aluminum alloy samples. These films were characterized by X-ray Photoelectron Spectroscopy (XPS). Preliminary results indicate the potential of this technology to replace aqueous-based chromate processes.
Author
Aluminum Alloys; Vapor Deposition; Protective Coatings; Chromates; Substrates

20040034816 Lawrence Livermore National Lab., Livermore, CA
Thermal and Chemical Analyses of Silicone Polymers for Component Engineering Lifetime Assessments
Balazs, B.; Maxwell, R. S.; May 2002; 12 pp.; In English
Report No.(s): DE2003-15005291; UCRL-JC-143691; No Copyright; Avail: Department of Energy Information Bridge

Accurate predictions of a polymer component's functional lifetime at best are tenuous when one has only relatively short term chemical or mechanical property data to extrapolate. We have analyzed a series of silica-filled siloxanes to determine the chemical and microstructural signatures of aging, and we are incorporating these data into rational methodologies for assessing a component's lifetime measured against as-designed engineering properties. We are monitoring changes in mechanical properties, crystallization kinetics, cross-link density changes, and motional dynamics with a variety of analysis methods: Modulated DSC, Dynamic Mechanical Analysis, and Solid-state Nuclear Magnetic Resonance.
NTIS
Thermal Analysis; Chemical Analysis; Silicones; Polymers

20040034822 Lawrence Livermore National Lab., Livermore, CA
MicroMechanical Characterization Tools for Highly-Filled Polymers
Groves, S.; DeTeresa, S.; Cunningham, B.; Ciarlo, D.; Allen, D.; Feb. 16, 2000; 20 pp.; In English
Report No.(s): DE2003-15005378; UCRL-ID-137693; No Copyright; Avail: Department of Energy Information Bridge

We are attempting to characterize and model the micromechanical response of highly-filled polymers. In this class of materials, the continuous plastic binder used to bond the highly-filled material dominates the observed viscoelastic response. As a result, realistic lifetime analysis of these materials will require a thorough understanding of the contribution of the plastic binder. Laboratory applications of these materials include plastic bonded explosives, propellants, a variety of specialized filled organic materials for stockpile systems, and highly filled epoxy dielectric materials for the National Ignition Facility. We have explored numerous techniques to characterize the local microstructure of plastic bonded explosives. However, insufficient funding was obtained to bring these technologies to maturity, nevertheless our present tool set is significantly better than 2 years ago. We have also made some progress in developing an appropriate micromechanical constitutive modeling framework, based on a finite element method incorporating a cohesive zone model to represent the binder contribution within a Voronoi tesselation mesh structure for the PBX grains. A second modeling approach was used to incorporate analytical micromechanics (generalized self-consistent schemes). However, preliminary theoretical analysis strongly suggested that this approach would be invalid for such extremely high-filled systems like PBX.
NTIS
Polymers; Microstructure; Characterization

20040034846 Iowa State Univ. of Science and Technology, Ames, IA
Nuclear Spin Lattice Relaxation and Conductivity Studies of the non-Arrhenius Conductivity Behavior in Lithium Fast Ion Conducting Sulfide Glasses
Meyer, B. M.; 2003; 208 pp.; In English
Report No.(s): DE2003-815760; No Copyright; Avail: Department of Energy Information Bridge

As time progresses, the world is using up more of the planet's natural resources. Without technological advances, the day will eventually arrive when these natural resources will no longer be sufficient to supply all of the energy needs. As a result, society is seeing a push for the development of alternative fuel sources such as wind power, solar power, fuel cells, and etc. These pursuits are even occurring in the state of Iowa with increasing social pressure to incorporate larger percentages of ethanol in gasoline. Consumers are increasingly demanding that energy sources to be more powerful, more durable, and, ultimately, more cost efficient. Fast Ionic Conducting (FIC) glasses are a material that offers great potential for the development of new batteries and/or fuel cells to help inspire the energy density of battery power supplies.
NTIS
Lithium; Sulfides; Earth Resources

20040035542 Pennsylvania State Univ., University Park. Energy Inst, University Park, PA, USA
Development of Activated Carbons from Coal Combustion By-Products. Annual Technical Progress Report, June 2001
Schobert, H. H.; Maroto-Valer, M. M.; Lu, Z.; Sep. 2001; 30 pp.; In English
Report No.(s): DE2003-818153; No Copyright; Avail: Department of Energy Information Bridge

The implementation of increasingly stringent Clean Air Act Regulations by the coal utility industry has resulted in an increase in the concentration of unburned carbon in coal combustion fly ash. In 1999, around 6 million tons of unburned

carbon were disposed in the US, due to the present lack of efficient routes for its utilization. However, unburned carbon is a potential precursor for the production of adsorbent carbons, since it has gone through a devolatilization process while in the combustor, and therefore, only requires to be activated. Accordingly, this report evaluates and compares several routes for the production of activated carbons from unburned carbon, including physical activation with steam or CO(sub 2), and chemical activation using KOH pretreatment.
NTIS
By-Products; Coal; Carbon; Combustion

20040035543 Pennsylvania State Univ., University Park. Energy Inst, University Park, PA, USA
Development of Activated Carbons from Coal Combustion By-Products. Annual Technical Progress Report, June 2002
Schobert, H. H.; Maroto-Valer, M. M.; Lu, Z.; Sep. 2002; 42 pp.; In English
Report No.(s): DE2003-818168; No Copyright; Avail: Department of Energy Information Bridge
The increasing role of coal as a source of energy in the 21st century will demand environmental and cost-effective strategies for the use of coal combustion by-products (CCBPs), mainly unburned carbon in fly ash. Unburned carbon is nowadays regarded as a waste product and its fate is mainly disposal, due to the present lack of efficient routes for its utilization. However, unburned carbon is a potential precursor for the production of adsorbent carbons, since it has gone through a devolatilization process while in the combustor, and therefore, only requires to be activated. Accordingly, this report evaluates and compares several routes for the production of activated carbons from unburned carbon in fly ash, including physical and chemical activation methods.
NTIS
Fly Ash; Coal; By-Products; Combustion; Activated Carbon

20040035619 Lawrence Livermore National Lab., Livermore, CA
Developing a Process for Commercial Silica Production from Salton Sea Brines
Bourcier, W.; McCutcheon, M.; Leif, R.; Bruton, C.; Sist, F.; Sep. 2000; 18 pp.; In English
Report No.(s): DE2003-15005961; UCRL-JC-140590; No Copyright; Avail: Department of Energy Information Bridge
The goal of this joint LLNL-CalEnergy project is to develop a method for precipitating marketable silica from spent Salton Sea Geothermal Field (SSGF) brines. Many markets for silica exist. We have initially targeted production of silica as a rubber additive. Silica reinforced rubber gives tires less rolling resistance, greater tear strength, and better adhesion to steel belts. Previous silica precipitates produced by CalEnergy from Salton Sea brines were not suitable as rubber additives. They did not to disperse well in the rubber precursors and produced inferior rubber. CalEnergy currently minimizes silica scaling in some of their production facilities by acidifying the brine pH. The rate of silica precipitation slows down as the pH is lowered, so that energy extraction and brine reinfection are possible without unacceptable amounts of scaling even with more than 700 ppm SiO(sub 2) in solution. We are adding a step in which a small amount of base is added to the acidified brine to precipitate silica before reinfection. By carefully controlling the type, rate, and amount of base addition, we can optimize the properties of the precipitate to approach those of an ideal rubber additive.
NTIS
Salton Sea (Ca); Silicon Dioxide; Additives; Elastomers; Brines

20040035621 Lawrence Livermore National Lab., Livermore, CA
NIF Anti-Reflective Coating Solutions: Preparation, Procedures and Specifications
Suratwala, T. I.; Carman, L.; Thomas, I.; Jul. 2003; 42 pp.; In English
Report No.(s): DE2003-15005259; UCRL-ID-154626; No Copyright; Avail: Department of Energy Information Bridge
The following document contains a detailed description of the preparation procedures for the antireflective coating solutions used for NIF optics. This memo includes preparation procedures for the coating solutions (sections 2.0-4.0), specifications and vendor information of the raw materials used and on all equipment used (section 5.0), and QA specifications (section 6.0) and procedures (section 7.0) to determine quality and repeatability of all the coating solutions. There are different five coating solutions that will be used to coat NIF optics. These solutions are listed below: Colloidal silica (3%) in ethanol; Colloidal silica (2%) in sec-butanol; Colloidal silica (9%) in sec-butanol (deammoniated); HMDS treated silica (10%) in decane; GR650 (3.3%) in ethanol/sec-butanol.
NTIS
Coating; Optics

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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*.

20040033949 NASA Johnson Space Center, Houston, TX, USA
Guide for Hydrogen Hazards Analysis on Components and Systems
Beeson, Harold; Woods, Stephen; October 2003; 48 pp.; In English
Report No.(s): NASA/TM-2003-212059; S-913; TP-WSTF-937; No Copyright; Avail: CASI; A03, Hardcopy

The physical and combustion properties of hydrogen give rise to hazards that must be considered when designing and operating a hydrogen system. One of the major concerns in the use of hydrogen is that of fire or detonation because of hydrogen's wide flammability range, low ignition energy, and flame speed. Other concerns include the contact and interaction of hydrogen with materials, such as the hydrogen embrittlement of materials and the formation of hydrogen hydrides. The low temperature of liquid and slush hydrogen bring other concerns related to material compatibility and pressure control; this is especially important when dissimilar, adjoining materials are involved. The potential hazards arising from these properties and design features necessitate a proper hydrogen hazards analysis before introducing a material, component, or system into hydrogen service. The objective of this guide is to describe the NASA Johnson Space Center White Sands Test Facility hydrogen hazards analysis method that should be performed before hydrogen is used in components and/or systems. The method is consistent with standard practices for analyzing hazards. It is recommended that this analysis be made before implementing a hydrogen component qualification procedure. A hydrogen hazards analysis is a useful tool for hydrogen-system designers, system and safety engineers, and facility managers. A hydrogen hazards analysis can identify problem areas before hydrogen is introduced into a system-preventing damage to hardware, delay or loss of mission or objective, and possible injury or loss of life.
Author
Hydrogen; Fires; Flammability; Hazards; Combustion; Hydrides; Hydrogen Embrittlement; Detonation

20040035632 Defence Science and Technology Organisation, Edinburgh, Australia
Reduced Sensitivity RDX, Part 1, Literature Review and DSTO Evaluation
Lochert, Ian J.; Franson, Mark D.; Hamshere, Brian L.; July 2003; 25 pp.; In English
Report No.(s): DSTO-TR-1447-Pt-1; DODA-AR-012-798-Pt-1; Copyright; Avail: Other Sources

In recent years it has been discovered that a form of the high explosive RDX exists which is identical to conventional RDX grades, with the exception that it is significantly less sensitive to shock stimuli in cast-cured polymer bonded explosives. This RDX, known as Reduced Sensitivity RDX, has the potential to provide major benefits in the field of Insensitive Munitions, particularly in sympathetic detonation scenarios. It has been shown that the Grade A RDX produced in Australia by ADI Ltd is a Reduced Sensitivity RDX.
Author
Explosives; Rdx

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20040034795 Rensselaer Polytechnic Inst., Troy, NY, USA
Comments on the Draft for NASA's Workshop on 'Two-Phase Flow, Fluid Stability and Dynamics'
Lahey, R. T., Jr.; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 127-128; In English; See also 20040034793; No Copyright; Avail: CASI; A01, Hardcopy

Technological (i.e., modeling and computational hardware) progress during the last two decades has shown us that we currently do have the capability to develop reliable 3-D multiphase predictive methods for space-based multiphase applications. This will require the acquisition of a suitable data base, and the development of flow-regime-specific closure laws

for 3-D multiphase CFD codes, however, this can be done, and , if so, NASA should have a reliable way to perform design optimization and to systems scale-up. It is important to note that this physicallybased approach to scale-up should be much more reliable and shouldn t take any longer to develop than the empirically-based approach.
Author
Flow Stability; Computational Fluid Dynamics; Prediction Analysis Techniques; Computer Programs

20040034797 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Microgravity Research, An Agency-Wide Asset: Using NASA-Generated Knowledge to Solve its Own Problems
Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 184-199; In English; See also 20040034793; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The National Center for Microgravity Research (NCMR) is a vital and successful operation, effectively supporting NASA's program in many ways beyond technical monitoring. NCMR is supplying leadership for certain new initiatives important to NASA's future. NASA might regard NCMR as kind of a small laboratory of innovative research management, and should support it generously.
Derived from text
Microgravity; NASA Programs; Research and Development; Technology Utilization

20040034805 Michigan Univ., Ann Arbor, MI, USA
Optimized Capillary Liquid Artery/Evaporator in Microgravity
Kaviany, Massoud; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 123-125; In English; See also 20040034793; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Many space-based (microgravity) systems rely on passive (capillary) liquid supply to evaporators. The evaporators can be divided into completely separated liquid and vapor phase evaporators (as in heat pipes, liquid acquisition, and AMTEC arteries), or liquid-submerged evaporators (as in porous-coating enhanced pool boiling). In both of these, a porous medium provides the capillarity suction for the liquid flow, but there are various liquid chocking limits. The proposed optimal capillary liquid artery and evaporation in microgravity and its experimental examinations, may be suitable for the planed NASA multiphase flow experimental facility. This problem is identified as one of the critical issues in the early draft of the Workshop strategic planning.
Author
Microgravity; Vapor Phases; Liquid Phases; Capillary Flow

20040034806 TRW, Inc., USA
Significant Open Design and Operational Issues For Thermal Management Systems
Lee, David W.; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 129; In English; See also 20040034793; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Flight qualification of multiple evaporator capillary pumped loops (CPL). Key technical issues involve bubble generation at startup and the development of a low thermal shock reservoir design. Enclosed are 2 references that highlight our recent CPL development efforts at Northrop Grumman Space Technology (NGST, formerly TRW). Reference 1 is our final report for our Advanced Lightweight Thermal Management Systems contract with AFRL. Reference 2 is a point paper written for the DoD Space Experiments Review Board (SERB) that describes the need for proceeding with our flight experiment, the EOS Chemistry Capillary Pumped Loop Qualification (CCQ), which would flight qualify a multiple evaporator CPL. These references provide background information as well as describe issues associated with multiple evaporator CPLs. (Note: prior to the Columbia accident, the SERB assigned CCQ a high priority for manifest on the shuttle).
Author
Management Systems; Spaceborne Experiments; Capillary Pumped Loops; Temperature Control; Aerospace Engineering

20040035593 NASA Marshall Space Flight Center, Huntsville, AL, USA
Bubble Formation and Transport during Microgravity Materials Processing: Model Experiments on the Space Station
Grugel, R. N.; Anilkumar, A. V.; Lee, C. P.; [2003]; 1 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; Copyright; Avail: Other Sources; Abstract Only

Flow Visualization experiments on the controlled melting and solidification of succinonitrile were conducted in the glovebox facility of the International Space Station (ISS). The experimental samples were prepared on ground by filling glass tubes, 1 cm ID and approximately 30 cm in length, with pure succinonitrile (SCN) under 450 millibar of nitrogen. Porosity in the samples arose from natural shrinkage, and in some cases by direct insertion of nitrogen bubbles, during solidification of the liquid SCN. The samples were processed in the Pore Formation and Mobility Investigation (PFMI) apparatus that is placed in the glovebox facility (GBX) aboard the ISS. Experimental processing parameters of temperature gradient and translation speed, as well as camera settings, were remotely monitored and manipulated from the ground Telescience Center (TSC) at the Marshall Space Flight Center. During the experiments, the sample is first subjected to a unidirectional melt back, generally at 10 microns per second, with a constant temperature gradient ahead of the melting interface. The temperatures in the sample are monitored by six in situ thermocouples. Real time visualization of the controlled directional melt back shows bubbles of different sizes initiating at the melt interface and, upon dislodging from the melting solid, migrating at different speeds into the temperature field ahead of them, before coming to rest. The thermocapillary flow field set up in the melt, ahead of the interface, is dramatic in the context of the large bubbles, and plays a major role in dislodging the bubble. A preliminary analysis of the observed bubble formation and mobility during melt back and its implication to future microgravity experiments is presented and discussed.
Author
Bubbles; International Space Station; Microgravity; Flow Visualization; Spaceborne Experiments; Flow Distribution

20040035655 NASA Marshall Space Flight Center, Huntsville, AL, USA
Robust Control for The G-Limit Microgravity Vibration Isolation System
Whorton, Mark S.; [2004]; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Many microgravity science experiments need an active isolation system to provide a sufficiently quiescent acceleration environment. The g-LIMIT vibration isolation system will provide isolation for Microgravity Science Glovebox experiments in the International Space Station. While standard control system technologies have been demonstrated for these applications, modern control methods have the potential for meeting performance requirements while providing robust stability in the presence of parametric uncertainties that are characteristic of microgravity vibration isolation systems. While H2 and H infinity methods are well established, neither provides the levels of attenuation performance and robust stability in a compensator with low order. Mixed H2/mu controllers provide a means for maximizing robust stability for a given level of mean-square nominal performance while directly optimizing for controller order constraints. This paper demonstrates the benefit of mixed norm design from the perspective of robustness to parametric uncertainties and controller order for microgravity vibration isolation. A nominal performance metric analogous to the mu measure for robust stability assessment is also introduced in order to define an acceptable trade space from which different control methodologies can be compared.
Author
Microgravity; Robustness (Mathematics); Vibration Isolators; International Space Station; Control Systems Design

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*.

20040031639 Physics and Electronics Lab. TNO, The Hague, Netherlands
Integrated Topside Design
Dunnebier, B.; August 2003; 146 pp.; In English
Contract(s)/Grant(s): V049; TNO Proj. 015.29413
Report No.(s): TD-2003-0030; FEL-03-A045; Copyright; Avail: Other Sources

Operational and technological developments have lead to increasing complexities in the design of Navy ships. The demands on: 1) Sensor performance (including aspects of Electromagnetic Interference (EMI) and Compatibility (EMC); 2) Vulnerability; and 3) signatures are more and more increasing. Furthermore, these demands have to be met concurrently. To this end, an orientation phase was performed, which led to this Integrated Topside Design (ITD) (KM4, V049) 'doelfinancierings' program. It aims at the development of an integrated design method and tools for the design of future navy ships. In the program experts of many technological areas participate to create the building blocks for an ITD design method

and the necessary tooling to perform a more optimal design of future ships. This report describes the activities in the program in 2002. The topics were selected based on the work in previous years.
Author
Ships; Design

20040031648 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Evaluation of the Function- and Failure Analysis
Boers, M. N.; deKlerk, W. P. C.; July 2003; 35 pp.; In Dutch
Contract(s)/Grant(s): A00/KL/440; TNO Proj. 014.14012
Report No.(s): TD-2002-0156; PML-2002-A82; Copyright; Avail: Other Sources

During the project 'Periodiek Onderzoek Energetische Materialen en Artikelen (POEMA) the function and failure analysis, as designed in the project 'Levensduur Voorspelling van Munitie en explosieve Stoffen' (LVMS), was used to advise on the periodic inspection. One of the aims of the POEMA project was to evaluate the method used for the function and failure analysis. The analysis is applied in order to determine the critical components of some munition articles. It appeared that the way of presentation and the calculation of the risks need improvement. The results of a limited study of literature and the evaluation of the results of the analyses were used to design a new format to present the results and a new method to determine the risks making the function and failure analysis results more definite.
Author
Failure Analysis; Explosives; Risk

32
COMMUNICATIONS AND RADAR

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

20040031685 Swedish National Testing and Research Inst., Boras, Sweden
Machine Control via Internet: An Overview
Stranden, L.; Hedberg, J.; Sivencrona, H.; 2003; 48 pp.; In Swedish
Report No.(s): PB2004-102717; SP-RAPP-2002:31; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this report was to give an introduction to specific aspects when including Internet in machine control systems. The report deals with safety critical applications i.e. to avoid harm to persons and equipment and to avoid major economical damage. The work is specifically aimed towards SMEs (Small and Medium sized Enterprises) that need support and do not have the resources for making an analysis on their own.
NTIS
Safety; Internets; Computers; Automatic Control

20040031687 Helsinki Univ. of Technology, Espoo
URSI/EEE XXVII Convention on Radio Science. Digest of Technical Papers
Tretyakov, S.; Saeily, J.; Oct. 2002; 218 pp.
Report No.(s): PB2004-102780; S-257; Copyright; Avail: National Technical Information Service (NTIS)

The scientific and technological areas in which the International Union of Radio Science is active today are extremely wide, extending from light-year scales of radio astronomy to nanoscales of modern microelectronics. This year, the emphasis of our early meeting is on Mobile Communication Systems, Millimeter and Submillimeter Waves, Electromagnetic Theory, Remote Sensing, and Radio Astronomy. In addition to regular sessions devoted to these topics, we have special sessions on Defense and Security Electronics and Emerging Metamaterials for Radio and Microwave Applications.
NTIS
Telecommunication; Submillimeter Waves; Mobile Communication Systems; Millimeter Waves

20040031693 National Defence Research Establishment, Linkoeping, Sweden
Research at FOI within Intersystem Interference 1995-2002, Final Report
Stenumgaard, P.; Dec. 2002; In Swedish
Report No.(s): PB2004-101827; FOI-R-0682-SE; No Copyright; Avail: National Technical Information Service (NTIS)

To establish a resource within intersystem interference for the Swedish Defense, a research project within this topic was initiated 1995. The focus for this research has been on analyses methods for the performance degradation on digital communication due to intersystem interference from both co-located military systems and COTS-systems (Commercial off the shelf) equipment. During this project, close cooperation has been done with the Sensor & Telecommunications Division at the Swedish Defense Materials Administration. The scientists within the project have worked as consultants for the Swedish industry. Furthermore, these scientists have been active in the education FOI is doing for the Swedish Defense College. Research cooperation has also been done with Professor Jens Zander at the Royal Institute of Technology, Stockholm, and Professor Arne Svensson at Chalmers University of Technology, Gothenburg. The results from the project have been internationally noticed for instance by the European standardization agency CISPR. The results have influenced the development of international standards for limiting electromagnetic radiation from electronic equipment. The evolution against network centric warfare will result in a large amount of civilian information technology equipment in the vicinity of vital communication systems. This requires further research to prevent damages in the command & control systems.
NTIS
Electromagnetic Interference; Command and Control; Electromagnetic Radiation; Pulse Communication

20040031694 Swedish Defence Research Establishment, Linkoeping
System Concept with Conformal Array Antennas
Alm, A.; Grahn, P.; Nelander, A.; Stroemberg, D.; Sume, A.; Sep. 2003; In Swedish
Report No.(s): PB2004-101829; FOI-R-0934-SE; No Copyright; Avail: National Technical Information Service (NTIS)

We describe a system concept for a multifunction system in a naval scenario with a radar surveillance and electronic intelligence, and simultaneously electronic warfare, fire control and communication. The antenna system is common for all functions and it is based on a conformal faceted array antenna. This is a very flexible system that can be adapted to the scenario and the user requirements including network defense users.
NTIS
Antenna Arrays; Radar; Antenna Design

20040031701 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2002-0441-2920, Yosemite National Park, El Portal, California
Cardarelli, J.; Methner, M.; Dec. 2003; 22 pp.
Report No.(s): PB2004-103514; HETA-2002-0441-2920; No Copyright; Avail: CASI; A03, Hardcopy

On September 9, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) at the Yosemite National Park, El Portal, California. The park Safety Office requested an evaluation of potential radio frequency (RF) exposures from a cell-phone antenna base station. On October 22, 2002, NIOSH investigators conducted a site visit at Ranger Camp Tuolumne Meadows and completed a source characterization of the RF fields emitting from the base station. This evaluation assessed occupational exposure to magnetic fields (60 Hz) and electric fields in the frequency range from 100 kilohertz (kHz) to 5 gigahertz (GHz) among workers during a typical daily work regimen. All of the measurements taken with the Holaday HI-4433 STE probe (electric field) and EMDEX-II ELF instrument (magnetic field) were below their respective limits-of-detection. The only measurable results were obtained with the Holiday HI-6005 probe (electric field); all of these measurements were below the exposure limits applied to the general public. Further, none of the measurements exceeded 0.1 percent of the applicable limit which indicates that the emissions from this base station pose no threat to employees or the general population who visit or pass through the area or to workers at the Tuolumne Meadows Camp Site.
NTIS
Magnetic Fields; Radio Waves; Radio Antennas; Health; Hazards; Exposure; Occupational Diseases

20040031755 Physics and Electronics Lab. TNO, The Hague, Netherlands
BMC4I and Interoperability, Status Report 2002
Beijer, M.; Smallegange, J. A. P.; Treurniet, W.; May 2003; 50 pp.; In English
Contract(s)/Grant(s): A01/D/658; TNO Proj. 015.31162
Report No.(s): TD-2002-0229; FEL-02-A327; Copyright; Avail: Other Sources

In order to substantially contribute to the NATO Feasibility Study on Active Layered TBMD the BMC4I and Interoperability aspects have been explored. Firstly, a functional analysis of the joint Dutch role is described. Secondly, the

NATO Code of Best Practice for C2 Assessment is applied to BMC4I for Active Layered TBMD. Finally, a desk-top study of the employability of Link-16 is documented.
Author
Command and Control; Military Operations; Armed Forces (Foreign); Interoperability

20040031764 Physics and Electronics Lab. TNO, The Hague, Netherlands
A First Comparison of CEC and Tactical Data Links
vanDam, B. J.; Kester, L. J. H. M.; Segers, J. C. M.; Theil, A.; April 2002; 42 pp.; In English
Contract(s)/Grant(s): TNO Proj. 015.31170
Report No.(s): TD-2002-0209; FEL-02-A243; Copyright; Avail: Other Sources

The major partners of the RNlN US Navy and UK Navy have in acquisition the Co-operative Engagement Capability. The Co-operative Engagement Capability provides the fleet an integrated real time air picture. To be a well matched partner for those navy's there is a need for the RNlN to consider the Co-operative Engagement Capability. Because the RNlN might at some time in future require the acquisition of CEC, quantative estimates of the improvement offered by CEC with respect to the use of tactical data links are required.
Author
Armed Forces (Foreign); Navy; Interoperability; Data Links

20040031768 Physics and Electronics Lab. TNO, The Hague, Netherlands
Advice ACCS WOC/SQOC - OMIS-KLu
deNiet, M.; Vertegaal, W. C.; deHaas, R. C. T.; June 2003; 72 pp.; In Dutch
Contract(s)/Grant(s): DMKLU-30/127/1/6900/01; TNO Proj. 015.31953
Report No.(s): TD-2003-0047; FEL-03-A053; Copyright; Avail: Other Sources

This report describes the results of an advice on the introduction in the Royal Netherland Air Force (RNLAF) of the WOC/SQOC component of the Air Command and Control System (ACCS). ACCS is the future automated command and control (C2) system for the operational and tactical C2 process of offensive, defensive, and supporting air operations. The Operational Management Information System (OMIS-KLu) is a development within the RNLAF that is aimed at the operational processes at operational units. The RNLAF had a need for an advice on the relation between ACCS WOC/SQOC and OMIS-KLu.
Author
Command and Control; Management Information Systems; Military Operations

20040033947
Energy Efficient Wireless Sensor Networks Using Fuzzy Logic
Liang, Qilian; Dec. 9, 2003; 30 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0466
Report No.(s): AD-A419061; No Copyright; Avail: CASI; A03, Hardcopy

During the period 8/1/2003-11/30/2003, we have made lots of progress on energy efficiency of wireless sensor networks. We investigated the optimal number of clusters for a given number of sensors. Based on this theoretical result, we proposed a Fuzzy Energy Aware Topology Updated with REconfiguration for sensor-networks (FEATURES) scheme. This scheme provides a methodology on how to partition a sensor network to the desired number of clusters using fuzzy c-means, how to elect a clusterhead using fuzzy logic system via combining different descriptors of a sensor: distance of a node to the cluster centroid, its remaining battery capacity, and its degree of mobility. We also proposed an Access-Based Low Energy Hierarchy (ABLEH) to clustering protocols more adaptive to the dynamic nature of sensor networks. Besides, we studied energy efficient protocol design for large-scale wireless sensor network. Four papers were produced during these six months, and are attached to this report.
DTIC
Energy Consumption; Sensors; Electric Batteries

20040033955 Nippon Telegraph and Telephone Public Corp., Japan
NTT Technical Review, Volume 1, No. 9
Wada, Masato, Editor; Fukuda, Kenichi, Editor; Hunter, Richard, Editor; Shibata, Tsu, Editor; Sawaki, Minako, Editor; Sadakata, Toru, Editor; Ida, Minoru, Editor; Iwata, Hideyuki, Editor; Murata, Koichi, Editor; Takaka, Shin-Ichi, Editor, et al.; December 2003; ISSN 1348-3447; 75 pp.; In English; See also 20040033956 - 20040033964; Copyright; Avail: Other Sources

The following reports from NTT TEchnical Review are presented: Photonic Technology as the Basis of the Information-sharing Society; IP-VPN Service Platform Development for the Personal Market; Overview of RFID Technologies for Ubiquitous Services; Asset Tracking System Using Long-life Active RFID Tags; Location Determination Method for Wireless Systems Based on Learning Vector Quantization; Infrared Signboard; Temporal Path Vector Routing Algorithm: TPV; Development of a Road Disaster Monitoring System Using Optical Fiber Sensing Technology; and Standardization Activities in the Content Reference Forum.
CASI
Photonics; Wireless Communication; Tracking (Position); Fiber Optics; Communication Networks

20040033956 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
IP-VPN Service Platform Development for the Personal Market
Murayama, Junichi; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 6-11; In English; See also 20040033955; Copyright; Avail: Other Sources

The Secure Communication Project at NTT Information Sharing Platform Laboratories is devoted to developing a next-generation IP-VPN (Internet protocol virtual private network) service platform. To find out how IP-VPN technology is evolving in the broadband era and what type of business it enables, we talked with senior research engineer Junichi Murayama, a member of the Secure Communication Project.
Author
Computer Information Security; Internets; Protocol (Computers)

20040033957 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Overview of RFID Technologies for Ubiquitous Services
Shimizu, Masashi; Kobayashi, Mamoru; Umehira, Masahiro; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 12-18; In English; See also 20040033955; Copyright; Avail: Other Sources

The terms 'ubiquitous', 'Auto-ID,' and 'wireless tag' have recently become very popular and they frequently appear in the daily newspapers. Despite their popular use, it is very difficult to express their real functions because the definitions of these terms are not clear. This paper explains promising services that are currently proposed, technical problems common to these services, and the direction in which research should head in the future.
Author
Radio Frequencies; Marking; Identifying; Wireless Communication

20040033958 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Location Determination Method for Wireless Systems Based on Learning Vector Quantization
Ogawa, Tomoaki; Yoshino, Shuichi; Shimizu, Masashi; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 27-36; In English; See also 20040033955; Copyright; Avail: Other Sources

In future ubiquitous services, object location determination will be a key technology. We describe a location determination method based on signal intensity using signals sent from base stations located at known positions to a terminal located at an unknown position. Instead of using numerical coordinates to define the object's location, it determines the object's location using a name that describes its locality. This method is based on learning vector quantization (LVQ) algorithms. We tested it using a 802.11 wireless LAN (local area network) and RFTD (radio frequency identification) tag systems. The results show that it provides more accurate location data than the conventional least-squares method in areas far from the base stations.
Author
Algorithms; Local Area Networks; Position (Location); Vector Quantization; Signal Measurement

20040033959 Nippon Telegraph and Telephone Public Corp., Musashino, Japan
Temporal Path Vector Routing Algorithm: TPV
Murakami, Ken-Ichiro; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 42-47; In English; See also 20040033955; Copyright; Avail: Other Sources

This paper describes a routing algorithm called Temporal Path Vector (TPV), for improving the convergence properties of conventional path vector routing protocols. By employing time stamps in routing information, TPV detects obsolete information and purges it. Thus, it suppresses route bouncing and accelerates the routing convergence. Compared with a

conventional routing protocol, Border Gateway Protocol (BGP), TPV takes less than one tenth as many steps to converge.
Author
Algorithms; Protocol (Computers); Routes; Communication Networks

20040033961 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
Photonic Technology as the Basis of the Information-sharing Society
Komatsu, Kazuhiko; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 3; In English; See also 20040033955; Copyright; Avail: Other Sources

This brief paper discusses the necessity of research and development in photonic technology to meet the demands of future communication networks and mobile devices and the role that the NTT Photonics Laboratories will play in meeting these goals.
CASI
Communication Networks; Photonics; Data Transmission; Wireless Communication

20040033962 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Infrared Signboard
Yoshino, Shuichi; Shimizu, Masashi; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 37-41; In English; See also 20040033955; Copyright; Avail: Other Sources

The infrared signboard system lets consumers receive digital information (such as URLs and email addresses) from a signboard at a distance. It uses infrared communication technology originally developed for remote control devices to achieve a reasonable communication range and low equipment cost.
Author
Wireless Communication; Signal Transmission; Infrared Instruments; Mobile Communication Systems

20040033964 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Asset Tracking System Using Long-life Active RFID Tags
Hayashi, Hitoshi; Tsubaki, Toshimitsu; Ogawa, Tomoaki; Shimizu, Masashi; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 19-26; In English; See also 20040033955; Copyright; Avail: Other Sources

We have developed an asset tracking system using long-life active RFID (radio frequency identification) tags that reports the position of an asset when required. To determine the location of a tag attached to an asset indoors, such as in stores, warehouses, and offices, we use a high-precision location system that is not greatly affected by environmental factors. Experimental results show that the root-mean-square error between the estimated and actual tag positions measured at 77 points is 2.9 m, indicating that this locating system is applicable not only to asset tracking but also to other ubiquitous services that utilize the position of an item or a person indoors.
Author
Radio Frequencies; Identifying; Marking; Materials Handling

20040035548
Electronic Compliance and Approval Project (ECAP) Annual Technical Progress Report, October 2002
Morgan, H.; Varela, R. A.; LaHood, D.; Cisco, S.; Benavides, M. A.; Nov. 2002; 30 pp.; In English
Report No.(s): DE2003-819027; No Copyright; Avail: Department of Energy Information Bridge

The Texas Railroad Commission (RRC), working in partnership with the USA Department of Energy and the oil and gas industry it regulates, is implementing a strategy for improving efficiency in regulations and significantly reducing administrative operating costs through the Electronic Compliance and Approval Process (ECAP). The project will streamline regulatory compliance and reporting by providing the ability to electronically submit, process, and query oil and gas applications and reports through the Internet-based ECAP system. Implementation of an ECAP drilling permit pilot project began September 1999 after funding resources were secured-a $700,000 grant from the U.S. Department of Energy and an appropriation of $1.4 million from the Texas Legislature. The pilot project involves creating the ability to file, review, and approve a well's drilling permit application through a completely electronic process. The pilot project solution will ultimately provide the infrastructure, technology, and electronic modules to enable the filing of all compliance permits and performance reports through the internet from a desktop computer. The pilot project was conducted in three phases. The first phase, implemented May 2000, provided the infrastructure that allows the electronic filing and approval of simple drilling permit applications, associated fees, and attachments. The official 'roll-out' of ECAP and the first electronically filed drilling permit

application occurred on May 11, 2000 in Dallas in conjunction with an Internet Workshop sponsored by the Petroleum Technology Transfer Council. After the completion of Phase I, the ECAP team conducted an extensive review of progress to date and analyzed requirements and opportunities for future steps. The technical team identified core infrastructure modifications that would facilitate and better support future development and expansion of the ECAP system and work began on database structure modifications. The second phase of the pilot project was implemented in October 2002. Phase II was the complete rewrite of the ECAP core system and included internal workflow processing capabilities and the ability to process more complex new drill permits such as horizontal, directional, pooled acreage and non-concurrent production restrictions all with additional attachments and reports. Phase III, completed in August 2003, concluded the ECAP pilot project. It allowed the processing of all types of drilling permits and completed the integration with existing geographic information systems, mainframe and electronic document management systems as well as the state payment portal. This report contains detailed information documenting accomplishments and problems encountered during the ECAP pilot project and plans for future steps.
NTIS
Rail Transportation; Regulations; Central Processing Units; Technology Transfer

20040035694 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
NTT Technical Review, Volume 1, No. 8
Wada, Masato, Editor; Fukuda, Kenichi, Editor; Shibata, Tsugumichi, Editor; Sawaki, Minako, Editor; Sadakata, Toru, Editor; Ida, Minoru, Editor; Iwata, Hideyuki, Editor; Kobayashi, Junya, Editor, et al.; November 2003; ISSN 1348-3447; 108 pp.; In English; See also 20040035695 - 20040035706; Copyright; Avail: Other Sources

Contents include the following: Technical Improvements in Photonic Networks for Constructing Next-generation Networks. Traffic Engineering Techniques in Photonic Networks 43-Gbit/s-channel DWDM System Technologies for Photonic Transport Network. Device Technologies for Photonic Networks. Revolutionizing Mobile Communications through New Interface Technologies. Biological Information Interface Technology. Alter-Ego Interface Technology. Fulltime-wear Interface Technology. Platform Technology for Ubiquitous Services. Ubiquitous Interface Technologies. Reality Speech/Audio Communications Technologies. Trend of Standardizing xDSL Technologies in ITU-T.
CASI
Biotechnology; Mobile Communication Systems; Telecommunication

20040035695 Nippon Telegraph and Telephone Public Corp., Musashino, Japan
Traffic Engineering Techniques in Photonic Networks
Okamoto, Satoru; Yamanaka, Naoaki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 24-35; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

A photonic network offers a high-speed circuit with wavelength division multiplexing (WDM) transmission and wavelength routing. In current WDM transmission technology, the number of wavelengths that can be accommodated in one optical fiber is less than about one hundred due to physical restrictions. Since wavelength is a comparatively valuable resource, it should be used efficiently in the photonic network. To offer new network services, it is necessary to control optical paths dynamically. This paper describes optical path control techniques and newly proposed variable-capacity optical path techniques, which are both provided by signaling protocols based on generalized multiprotocol label switching (GMPLS).
Author
Photonics; Optical Communication; Communication Networks

20040035697 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
43-Gbit/s-channel-based DWDM System Technologies for Photonic Transport Network
Miyamoto, Yutaka; Tomizawa, Masahito; Tada, Yasuhiko; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 36-48; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

This paper describes recent technical progress and the evolution of dense wavelength division multiplexing (DWDM) system technologies based on 43-Gbit/s channels for the optical transport network (OTN). We describe the new digital frame format 'OTU3: Optical Channel Transport Unit 3', which was recently standardized in ITU-T as a novel network node interface of the OTN using 43-Gbit/s channels. The new standard enables the transparent accommodation of multi-tributary service signals such as SDH (synchronous digital hierarchy), ATM (asynchronous transfer mode), Ethernet, and Fiber Channel in large payloads, and enhances the WDM (wavelength division multiplexing) network management capability of the OTN with its overhead byte. It also introduces the forward error correction (FEC) code byte in its frame to ensure high-quality

transmission at over 1 Tbit/s based on 43-Gbit/s channels. New transmission technologies have established stable 43-Gbit/s-channel long-haul WDM transmission across the OTN. They include a novel bandwidth-efficient RZ (return-to-zero) modulation format and a novel error-control scheme using optical spectral redundancy as well as several hybrid optical amplification technologies.
Author
Wavelength Division Multiplexing; Photonics; Communication Networks; Optical Communication

20040035699 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Device Technologies for Photonic Networks
Yasaka, Hiroshi; Okuno, Masayuki; Sugahara, Hirohiko; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 49-59; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

High-speed and more functional optical and electrical devices are essential in constructing large-capacity and highly functional photonic networks. Here, we introduce technologies for optical signal control photonic devices and very high-speed electrical signal processing integrated circuits.
Author
Communication Equipment; Photonics; Communication Networks; Optical Communication

20040035704 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Reality Speech/Audio Communications Technologies
Yasuda, Yasuyo; Ohya, Tomoyuki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 95-100; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

The advent of mobile broadband communications provides a platform for super reality communication even in a mobile communications environment. This article introduces NTT DoCoMo's initiatives for developing a new approach to mobile communication by maximizing the quality of the transferred speech/audio and using 3-D audio technology.
Author
Broadband; Mobile Communication Systems; Audio Equipment; Speech; Virtual Reality; Technologies

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*.

20040031683 Swedish Defence Research Establishment, Stockholm, Sweden
Fiberlaserteknik foer Undervattenssensorer (Fiber Laser Technology for Underwater Sensors)
Kullander, F.; Nov. 2002; In English
Report No.(s): PB2004-101837; FOI-R-0726-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Fiber lasers sensors for hydroacoustic applications were studied during 2002. The optical performance of a serial array with four distributed feedback DFB fiberlasers along a single fiber was tested. AN interrogation/demodulation system for four channels based on wavelength division multiplexing and heterodyne demodulation was constructed and evaluated. FM demodulators with integrated photodetectors were constructed. Acoustic interfaces to enhance the sensitivity of the fiberlases were developed. In order to extend the acoustic amplification beyond what can be reached with homogeneous coatings, typically of plastic materials, mechanical interfaces were studied. It was found that mechanical constructions of limited size might provide sufficient gain (50 dB) to allow detection down to the sea state zero hydroacoustic level. The frequency noise of the fiberlasers, ultimately limiting the resolution of the sensors, was measured within a frequency band from 20 Hz to 20 kHz. The frequency noise in the serial array was found to be comparable to that of single fiber laser elements with a level approaching 10 Hz/(square root of)Hz at 1 kHz. The crosstalk between the fiberlasers was found to be low with a measured level of about -60 dB. Occasionally, the fiberlaser array could turn into an unstable state with amplified intensity noise centered in frequency around the relaxation oscillation resonance of the lasers. This state could be counteracted by turning the pumplaser drive current or its temperature.
NTIS
Hydrophones; Fiber Lasers; Sensitivity; Underwater Acoustics

20040031739 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Characteristics of Single-Event Upsets in a Fabric Switch (ADS151)

Buchner, Stephen; Carts, Martin A.; McMorrow, Dale; Kim, Hak; Marshall, Paul W.; LaBel, Kenneth A.; [2003]; 7 pp.; In English; European Conference on Radiation and its Effects on Components and Systems (RADECS), 15-19 Sep. 2003, Duin, Netherlands; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Abstract-Two types of single event effects - bit errors and single event functional interrupts - were observed during heavy-ion testing of the AD8151 crosspoint switch. Bit errors occurred in bursts with the average number of bits in a burst being dependent on both the ion LET and on the data rate. A pulsed laser was used to identify the locations on the chip where the bit errors and single event functional interrupts occurred. Bit errors originated in the switches, drivers, and output buffers. Single event functional interrupts occurred when the laser was focused on the second rank latch containing the data specifying the state of each switch in the 33x17 matrix.

Author

Switching Circuits; Fabrics; Single Event Upsets; Errors

20040031770 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Fabrication of Monolithic Sapphire Membranes for High Tc Bolometer Array Development

Pugel, D. E.; Lakew, B.; Aslam, S.; Wang, L.; June 10, 2003; 1 pp.; In English; Thermal Detectors Workshop 2003, 19-20 Jun. 2003, Adelphi, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper examines the effectiveness of Pt/Cr thin film masks for the architecture of monolithic membrane structures in r-plane sapphire. The development of a pinhole-free Pt/Cr composite mask that is resistant to hot H2SO4:H3PO4 etchant, will lead to the fabrication of smooth sapphire membranes whose surfaces are well-suited for the growth of low-noise high Tc films. In particular, the relationship of thermal annealing conditions on the Pt/Cr composite mask system to: (1) changes in the surface morphology and elemental concentration of the Pt/Cr thin film layers and (2) etch pit formation on the sapphire surface will be presented.

Author

Fabrication; Sapphire; Membrane Structures; High Temperature Superconductors; Bolometers; Arrays

20040031776 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Broad Beam and Ion Microprobe Studies of Single-Event Upsets in High Speed 0.18micron Silicon Germanium Heterojunction Bipolar Transistors and Circuits

Reed, Robert A.; Marshall, Paul W.; Pickel, Jim; Carts, Martin A.; Irwin, TIm; Niu, Guofu; Cressler, John; Krithivasan, Ramkumar; Fritz, Karl; Riggs, Pam, et al.; [2003]; 5 pp.; In English; 2003 IEEE Nuclear and Space Radiation Effects Conference, 21-25 Jul. 2003, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

SiGe based technology is widely recognized for its tremendous potential to impact the high speed microelectronic industry, and therefore the space industry, by monolithic incorporation of low power complementary logic with extremely high speed SiGe Heterojunction Bipolar Transistor (HBT) logic. A variety of studies have examined the ionizing dose, displacement damage and single event characteristics, and are reported. Accessibility to SiGe through an increasing number of manufacturers adds to the importance of understanding its intrinsic radiation characteristics, and in particular the single event effect (SEE) characteristics of the high bandwidth HBT based circuits. IBM is now manufacturing in its 3rd generation of their commercial SiGe processes, and access is currently available to the first two generations (known as and 6HP) through the MOSIS shared mask services with anticipated future release of the latest (7HP) process. The 5 HP process is described and is characterized by a emitter spacing of 0.5 micron and a cutoff frequency ff of 50 GHz, whereas the fully scaled 7HP HBT employs a 0.18 micron emitter and has an fT of 120 GHz. Previous investigations have the examined SEE response of 5 HP HBT circuits through both circuit testing and modeling. Charge collection modeling studies in the 5 H P process have also been conducted, but to date no measurements have been reported of charge collection in any SiGe HBT structures. Nor have circuit models for charge collection been developed in any version other than the 5 HP HBT structure. Our investigation reports the first indications of both charge collection and circuit response in IBM s 7HP-based SiGe process. We compare broad beam heavy ion SEU test results in a fully function Pseudo-Random Number (PRN) sequence generator up to frequencies of 12 Gbps versus effective LET, and also report proton test results in the same circuit. In addition, we examine the charge collection characteristics of individual 7HP HBT structures and map out the spatial sensitivities using the Sandia Focused Heavy Ion Microprobe Facility s Ion Beam Induced Charge Collection (IBICC) technique. Combining the two data sets offers insights into the charge collection mechanisms responsible for circuit level response and provides the first insights

into the SEE characteristics of this latest version of IBM s commercial SiGe process.
Author
Single Event Upsets; Microelectronics; Silicon Transistors; Ion Beams; Electronic Equipment Tests

20040033372 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Field Effect Flow Control in a Polymer T-Intersection Microfluidic Network
Sniadecki, Nathan J.; Chang, Richard; Beamesderfer, Mike; Lee, Cheng S.; DeVoe, Don L.; [2003]; 4 pp.; In English; 7th International Conference on Miniaturized Chemical and Biochemical Analysis Systems, Transducers Research Foundation 'MicroTAS 2003', 5-9 Oct. 2003, Squaw Valley, CA, USA
Contract(s)/Grant(s): DARPA-02SB1-0232; NIH-GM62738; NIH-EB000453; Copyright; Avail: CASI; A01, Hardcopy

We present a study of induced pressure pumping in a polymer microchannel due to differential electroosmotic flow @OF) rates via field-effect flow control (FEFC). The experimental results demonstrate that the induced pressure pumping is dependent on the distance of the FEFC gate from the cathodic gate. A proposed flow model based on a linearly-decaying zeta potential profile is found to successfully predict experimental trends.
Author
Field Effect Transistors; Microchannels; Pressure Pulses; Polymers

20040033967 NASA Glenn Research Center, Cleveland, OH, USA
Channel Temperature Estimates for Microwave AlGaN/GaN Power HEMTS on SiC and Sapphire
Freeman, Jon C.; December 1, 2003; 16 pp.; In English; TEEE MIT-S International Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA
Contract(s)/Grant(s): 22-319-80-P5; No Copyright; Avail: CASI; A03, Hardcopy

A simple technique to estimate the channel temperature of a generic AlGaN/GaN HEMTs on SiC or Sapphire, while incorporating temperature dependence of the thermal conductivity is presented. The procedure is validated b y comparing it's predictions with the experimentally measured temperatures in devices presented in three recently published articles.
Author
High Electron Mobility Transistors; Microwave Amplifiers; Computation

20040034090 NASA Goddard Space Flight Center, Greenbelt, MD, USA, AEA Technology, UK
Design, Build and Qualification of 28 Volt Lithium-Ion battery
Curzon, D.; Spurrett, R.; Rao, G.; [2003]; 30 pp.; In English; 2003 NASA Aerospace Battery Workshop, 18-20 Nov. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAS5-01109; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. GSFC performance specifications requirements. 2. AEA philosophy: battery configuration. 3. AEA battery design: SONY cell, cell screening, 20Ah and 60Ah. 4. Testing: 20Ah battery qualification (environmental); 60Ah battery LEO life cycle. 5. Conclusion.: summary and lessons learned.
Derived from text
Design Analysis; Fabrication; Qualifications; Electric Batteries; Lithium Batteries; Metal Ions

20040034091 TNO Environment, Energy and Process Innovation, Apeldoom, Netherlands
Development of the Energy System for the Future Dismounted Soldier
Raadschelders, J. W.; July 2003; 61 pp.; In Dutch
Contract(s)/Grant(s): A00/KL/122; TNO Proj. 32454
Report No.(s): R-2003/256; TD-2003-0176; Copyright; Avail: Other Sources

A new concept in power supplies for combat soldiers is described, termed the Soldier Modernisation Programme, V903. The energy supply to all electrical components developed is called the Dual Source Energy Grid. The power to the grid is supplied from batteries and most likely in the future, fuel cells.
Derived from text
Electricity; Military Operations

20040034132 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
Low-Power RF SOI-CMOS Technology for Distributed Sensor Networks
Dogan, Numan S.; August 30, 2003; 5 pp.; In English; CD-ROM contains full text document in PDF format
Contract(s)/Grant(s): NAG5-9419; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The objective of this work is to design and develop Low-Power RF SOI-CMOS Technology for Distributed Sensor Networks. We briefly report on the accomplishments in this work. We also list the impact of this work on graduate student research training/involvement.
Author
Cmos; Radio Frequencies; Sensors

20040034197 NASA Glenn Research Center, Cleveland, OH, USA
Optimal Battery Charging for Damage Mitigation
Lorenzo, Carl F.; Hartley, Tom T.; [2002]; 2 pp.; In English
Contract(s)/Grant(s): NCC3-820; No Copyright; Avail: CASI; A01, Hardcopy

This research proposes to use model-based control methods in the charging and discharging of batteries and fuel cells to provide improved performance and longer life. Data from previous studies of NiH2 batteries is used to facilitate the research. Based on this data, a low order hybrid battery model is developed. This model contains some fractional order components due to the approximation of many diffusion processes in the battery. This model is then useable as a real-time observer. Damage mechanisms are studied for NiH2 batteries, which leads to the development of an instantaneous damage model. Using this knowledge, a control system is designed to extend battery life. Fundamental to the success of this research is the development of an accurate and versatile dynamic model of the specific battery type. This is discussed in the next section. Damage modeling is then considered for the purpose of developing a control system that will extend battery lifetime. Advanced versions of a real-time observer and observer-based control, which include features such as model-parameter tracking, specific battery 'learning,' and damage mitigation, are discussed. The experience gained with the NiH2 batteries should be extendable to Li based batteries and fuel cells. Similar procedures can be followed. It is expected that application of control methods to fuel cells should provide some immediate durability improvements, while the life of Li based batteries can be extended. This research is highly interdisciplinary, as it combines the areas of electrochemistry, space power, control systems, dynamic modeling, fractional calculus, damage modeling, life-extending control, and power electronics.
Derived from text
Charging; Fuel Cells; Electrochemistry; Nickel Hydrogen Batteries

20040034289 Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique, Toulouse (France), Toulouse, France
Using Spectral Low Rank Preconditioners for Large Electromagnetic Calculations
Duff, I. S.; Giraud, L.; Langou, J.; Martin, E.; 2003; In English
Report No.(s): PB2004-102654; TR/PA-03/95; No Copyright; Avail: National Technical Information Service (NTIS)

For solving large dense complex linear systems that arise in electromagnetic calculations, we perform experiments using a general purpose spectral low rank update preconditioner in the context of the GMRES method preconditioned by an approximate inverse preconditioner. The goal of the spectral preconditioner is to improve the convergence properties by shifting by one the smallest eigenvalues of the original preconditioned system. Numerical experiments on parallel distributed memory computers are presented to illustrate the effciency of this technique on large and challenging real-life industrial problems.
NTIS
Electromagnetic Scattering; Complex Systems; Distributed Memory

20040034290 Foersvarets Forskningsanstalt, Linkoeping (Sweden), Linkoeping, Sweden
Broadband Reconfigurable Active Power Splitters/Combiners for Multifunction Systems
Alfredson, M.; Samuelsson, C.; Nilsson, T.; Ouacha, A.; Jan. 2003; In Swedish
Report No.(s): PB2004-101839; FOI-R-0762-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the work performed within a project named REKON. The purpose is to study one type of analog reconfigurable circuits. The circuits considered in REKON are reconfigurable broadband active power splitters and power combiners in MMIC (Monolithic Microwave Integrated Circuits) technology intended for multifunctioning antennas. A number of future military platforms will be composed of a combined system for radar, communication and electronic warfare

(EW). This can be called a multifunction array antenna system (MFA-system) with a common set of beam forming circuitry, transmit/receive modules and antenna aperture. A solution for a common reconfigurable beam forming network can be achieved by a combination of a number of the proposed reconfigurable power splitters/combiners. Reconfigurability is not only needed in the feed network of a beam former but also in the power amplifier stage close to the antenna aperture. A reconfigurable power amplifier then allows for the possibility of reducing the radar cross section (RCS) for parts of the antenna aperture that is switched off. This is achieved by reconfiguring the amplifier stage into an adaptive termination for the antenna element.
NTIS
Broadband; Microwave Circuits; Circuits; Radar Cross Sections; Switching; Analog Circuits

20040034823 Lawrence Livermore National Lab., Livermore, CA
BaBar Superconducting Coil: Design, Construction and Test
Bell, R. A.; Jan. 26, 2001; 12 pp.; In English
Report No.(s): DE2003-15005486; UCRL-JC-142287; No Copyright; Avail: Department of Energy Information Bridge
The BABAR Detector, located in the PEP-I1 B-Factory a t the Stanford Linear Accelerator Center, includes a large 1.5 Tesla superconducting solenoid, 2.8 m bore and length 3.7 m. The two layer solenoid is wound with an aluminum stabilized conductor which is graded axially to produce a plus or minus- 3% field uniformity in the tracking region. This paper summarizes the 3 year design, fabrication and testing program of the superconducting solenoid. The work was carried out by an international collaboration between INFN, LLNL and SLAC. The coil was constructed by Ansaldo Energia. Critical current measurements of the superconducting strand, cable and conductor, cool-down, operation with the thermo-siphon cooling, fast and slow discharges, and magnetic forces are discussed in detail.
NTIS
Superconducting Devices; Solenoids; Superconductivity

20040034844 Lawrence Livermore National Lab., Livermore, CA
Stretchable Micro-Electrode Array
Maghribi, M.; Hamilton, J.; Polka, D.; Rose, K.; Wilson, T.; Mar. 2002; 10 pp.; In English
Report No.(s): DE2003-15005307; UCRL-JC-147676; No Copyright; Avail: Department of Energy Information Bridge
This paper focuses on the design consideration, fabrication processes and preliminary testing of the stretchable micro-electrode array. We are developing an implantable, stretchable micro-electrode array using polymer-based microfabrication techniques. The device will serve as the interface between an electronic imaging system and the human eye, directly stimulating retinal neurons via thin film conducting traces and electroplated electrodes. The metal features are embedded within a thin ((approx.) 50 micron) substrate fabricated using poly (dimethylsiloxane) (PDMS), a biocompatible elastomeric material that has very low water permeability.
NTIS
Microelectronics; Electrodes; Medical Electronics; Enhanced Vision

20040035540
Design of an L-band Microwave Radiometer with Active Mitigation of Interference
Ellingson, S. W.; Johnson, J. T.; January 8, 2003; 1 pp.; In English; 2003 IEEE APS/URSI Symposium, 22-27 Jun. 2003, Columbus, OH, USA
Contract(s)/Grant(s): NAS5-02001; No Copyright; Avail: Other Sources; Abstract Only
Radio frequency interference (RFI) impairs L-band radiometry outside the protected 20 MHz frequency band around 1413 MHz. However, bandwidths of 100 MHz or more are desired for certain remote sensing applications as well as certain astronomy applications. Because much of the RFI in this band is from radars with pulse lengths on the order of microseconds, traditional radiometers (i.e., those which directly measure total power or power spectral density integrated over time scales of milliseconds or greater) are poorly-suited to this task. Simply reducing integration time and discarding contaminated outputs may not be a practical answer due to the wide variety of modulations and pulse lengths observed in L-band RFI signals, the dynamic and complex nature of the associated propagation channels, and the logistical effort associated with post-measurement data editing. This motivates the design and development of radiometers capable of coherent sampling and adaptive, real-time mitigation of interference. Such a radiometer will be described in this presentation. This design is capable of coherently-sampling up to 100 MHz bandwidth at L-band. RFI mitigation is implemented in FPGA components so that real-time suppression is achieved. The system currently uses a cascade of basic time- and frequency- domain detection and

blanking techniques; more advanced algorithms are un- der consideration. The modular FPGA-based architecture provides other benefits, such as the ability to implement extremely stable digital filters and the ability to reconfigure the system 'on the fly'. An overview of the basic design along with on-the-air results from an initial implementation will be provided in the presentation. Related L-band RFI surveys will be described to illustrate the relevance of this approach in a variety of operating conditions.
Author
Design Analysis; Microwave Radiometers; Field-Programmable Gate Arrays; Frequency Measurement; Radio Frequency Interference; Radiometers

20040035557 QSS Group, Inc., Seabrook, MD, USA
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digita1 Converter
Buchner, Stephen; Campbell, Arthur; Sternberg, Andrew; Massengill, Lloyd; McMorrow, Dale; Dyer, Clive; [2003]; 6 pp.; In English; European Conference on Radiation and its Effects on Components and Systems, 15-19 Sep. 2003, Noordwijk, Netherlands; Copyright; Avail: CASI; A02, Hardcopy

The SEU rate in a flash ADC (AD9058) on board a space experiment varied by more than an order of magnitude, depending on the input. A pulsed laser aided in elucidating the reasons, which were found to be the result of the unique design of the AD9058.
Author
Sensitivity; Single Event Upsets; Analog to Digital Converters; Microelectronics; Photonics

20040035582 Helsinki Univ. of Technology, Espoo (Finland), Espoo, Finland
Mixed-Mode Cellular Array Processor Realization for Analyzing Brain Electrical Activity in Epilepsy
Laiho, M.; 2003; 156 pp.; In English
Report No.(s): PB2004-102808; REPT-38; Copyright; Avail: National Technical Information Service (NTIS)

This thesis deals with the realization of hardware that is capable of computing algorithms that can be described using the theory of polynomial cellular neural/nonlinear networks (CNNs). The goal is to meet the requirements of an algorithm for predicting the onset of an epileptic seizure. The analysis associated with this application requires extensive computation of data that consists of segments of brain electrical activity. Different types of computer architectures are overviewed. Since the algorithm requires operations in which data is manipulated locally, special emphasis is put on assessing different parallel architectures. An array computer is potentially able to perform local computational tasks effectively and rapidly.
NTIS
Algorithms; Brain; Epilepsy; Neural Nets; Electric Power

20040035601 NASA Glenn Research Center, Cleveland, OH, USA
High Electron Mobility SiGe/Si Transistor Structures on Sapphire Substrates
Alterovitz, Samuel A.; Mueller, Carl H.; Croke, Edward T.; Ponchak, George E.; June 04, 2003; 6 pp.; In English; Materials Research Society Fall 2003 Conference, 1-5 Dec. 2003, Boston, MA, USA
Contract(s)/Grant(s): 22-090-20-C1; Copyright; Avail: CASI; A02, Hardcopy

SiGe/Si n-type modulation doped field effect structures and transistors (n-MODFETs) have been fabricated on r-plane sapphire substrates. The structures were deposited using molecular beam epitaxy, and antimony dopants were incorporated via a delta doping process. Secondary ion mass spectroscopy (SIMS) indicates that the peak antimony, concentration was approximately 4 x 10(exp19) per cubic cm. The electron mobility was over 1,200 and 13,000 sq cm/V-sec at room temperature and 0.25 K, respectively. At these two temperatures, the electron carrier densities were 1.6 and 1.33 x 10(exp 12) per sq cm, thus demonstrating that carrier confinement was excellent. Shubnikov-de Haas oscillations were observed at 0.25 K, thus confirming the two-dimensional nature of the carriers. Transistors, with gate lengths varying from 1 micron to 5 microns, were fabricated using these structures and dc characterization was performed at room temperature. The saturated drain current region extended over a wide source-to-drain voltage (V(sub DS)) range, with (V(sub DS)) knee voltages of approximately 0.5 V and increased leakage starting at voltages slightly higher than 4 V.
Author
Sos (Semiconductors); Modfets; High Electron Mobility Transistors

20040035606 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effects Of Environmental And Operational Stresses On RF MEMS Switch Technologies For Space Applications
Jah, Muzar; Simon, Eric; Sharma, Ashok; November 2003; 4 pp.; In English; IMAPS Conference, November 20-23, 2003, Boston, MA, USA; No Copyright; Avail: CASI; A01, Hardcopy

Micro Electro Mechanical Systems (MEMS) have been heralded for their ability to provide tremendous advantages in electronic systems through increased electrical performance, reduced power consumption, and higher levels of device integration with a reduction of board real estate. RF MEMS switch technology offers advantages such as low insertion loss (0.1- 0.5 dB), wide bandwidth (1 GHz-100 GHz), and compatibility with many different process technologies (quartz, high resistivity Si, GaAs) which can replace the use of traditional electronic switches, such as GaAs FETS and PIN Diodes, in microwave systems for low signal power (x < 500 mW) applications. Although the electrical characteristics of RF MEMS switches far surpass any existing technologies, the unknown reliability, due to the lack of information concerning failure modes and mechanisms inherent to MEMS devices, create an obstacle to insertion of MEMS technology into high reliability applications. All MEMS devices are sensitive to moisture and contaminants, issues easily resolved by hermetic or near-hermetic packaging. Two well-known failure modes of RF MEMS switches are charging in the dielectric layer of capacitive membrane switches and contact interface stiction of metal-metal switches. Determining the integrity of MEMS devices when subjected to the shock, vibration, temperature extremes, and radiation of the space environment is necessary to facilitate integration into space systems. This paper will explore the effects of different environmental stresses, operational life cycling, temperature, mechanical shock, and vibration on the first commercially available RF MEMS switches to identify relevant failure modes and mechanisms inherent to these device and packaging schemes for space applications. This paper will also describe RF MEMS Switch technology under development at NASA GSFC.
Author
Microelectromechanical Systems; Radio Frequencies; Environmental Tests; Switches

20040035635 Defence Science and Technology Organisation, Edinburgh, Australia
Local Oscillators in Electronic Warfare Applications
Nguyen, Linh V. T.; September 2003; 47 pp.; In English
Report No.(s): DSTO-TR-1490; DODA-AR-012-889; Copyright; Avail: Other Sources

Local oscillators (LOs) are required whenever heterodyning is utilized in receiver architectures to convert high-frequency signals to an intermediate-frequency (IF) spectrum for ease of processing. Utilisation of the heterodyning technique includes applications ranging from Electronic Warfare (EW) to radio astronomy. While EW involves the interception and exploitation of signals across the complete electromagnetic (EM) spectrum, the range of frequencies of interest in this report is from near DC and up to millimetre wave (-110 GHz). Radio astronomy shares similarities with EW in the detection of wideband EM signals ranging from radio and up to sub-millimetric frequencies. This technical report focuses on the requirements of LOs in EW receiver systems. In particular, LO technologies including frequency synthesisers, quartz, yttrium iron garnet (YIG) and Gunn-effect electronics will be discussed in order to derive a suitable benchmark, in terms of tunability, amplitude accuracy and stability, frequency accuracy and stability, and phase noise level, for the development of photonic LOs.
Author
Oscillators; Electromagnetic Spectra; Electronic Warfare; Intermediate Frequencies; Noise Intensity; Signal Detection

20040035644 Lawrence Livermore National Lab., Livermore, CA
Electronic Structure of Germanium Nanocrystal Films Probed with Synchrotron Radiation
Bostedt, C.; May 01, 2002; 152 pp.; In English
Report No.(s): DE2003-15005483; UCRL-LR-148228; No Copyright; Avail: Department of Energy Information Bridge

The fundamental structure - property relationship of semiconductor quantum dots has been investigated. For deposited germanium nanocrystals strong quantum confinement effects have been determined with synchrotron radiation based x-ray absorption and photoemission techniques. The nanocrystals are condensed out of the gas phase with a narrow size distribution and subsequently deposited in situ onto various substrates. The particles are crystalline in the cubic phase with a structurally disordered surface shell and the resulting film morphology depends strongly on the substrate material and condition. The disordered surface region has an impact on the overall electronic structure of the particles. In a size-dependent study, the conduction and valence band edge of germanium nanocrystals have been measured for the first time and compared to the bulk crystal. The band edges move to higher energies as the particle size is decreased, consistent with quantum confinement theory. To obtain a more accurate analysis of confinement effects in the empty states, a novel analysis method utilizing an effective particle size for the x-ray absorption experiment, which allows a deconvolution of absorption edge broadening effects, has been introduced. Comparison of the present study to earlier studies on silicon reveals that germanium exhibits stronger quantum confinement effects than silicon. Below a critical particle size of 2:3 plus or minus 0:7 nm, the band gap of germanium becomes larger than that of silicon - even if it is the opposite for bulk materials.
NTIS
Electronic Structure; Germanium; Nanocrystals; Semiconductors (Materials); Synchrotron Radiation

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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*.

20040031600 Lawrence Livermore National Lab., Livermore, CA
Lattice Boltzmann Simulation of Particle Laden Flows in Microfluidic Systems
Clague, D. S.; Weisgraber, T.; Wheeler, E.; Krulevitch, P.; Hon, G.; Jul. 21, 2003; 38 pp.; In English
Report No.(s): DE2003-15004866; UCRL-ID-137061; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Fluidics; Boltzmann Distribution; Particles; Computerized Simulation

20040031626 Stanford Univ., Stanford, CA, USA
Large-Eddy Simulation of Conductive Flows at Low Magnetic Reynolds Number
Knaepen, B.; Moin, P.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 297-306; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

In this paper we study the LES method with dynamic procedure in the context of conductive flows subject to an applied external magnetic field at low magnetic Reynolds number R(sub m). These kind of flows are encountered in many industrial applications. For example, in the steel industry, applied magnetic fields can be used to damp turbulence in the casting process. In nuclear fusion devices (Tokamaks), liquid-lithium flows are used as coolant blankets and interact with the surrounding magnetic field that drives and confines the fusion plasma. Also, in experimental facilities investigating the dynamo effect, the flow consists of liquid-sodium for which the Prandtl number and, as a consequence, the magnetic Reynolds number is low. Our attention is focused here on the case of homogeneous (initially isotropic) decaying turbulence. The numerical simulations performed mimic the thought experiment described in Moffatt in which an initially homogeneous isotropic conductive flow is suddenly subjected to an applied magnetic field and freely decays without any forcing. Note that this flow was first studied numerically by Schumann. It is well known that in that case, extra damping of turbulence occurs due to the Joule effect and that the flow tends to become progressively independent of the coordinate along the direction of the magnetic field. Our comparison of filtered direct numerical simulation (DNS) predictions and LES predictions show that the dynamic Smagorinsky model enables one to capture successfully the flow with LES, and that it automatically incorporates the effect of the magnetic field on the turbulence. Our paper is organized as follows. In the next section we summarize the LES approach in the case of MHD turbulence at low R(sub m) and recall the definition of the dynamic Smagorinsky model. In Sec. 3 we describe the parameters of the numerical experiments performed and the code used. Section 4 is devoted to the comparison of filtered DNS results and LES results. Conclusions are presented in Sec. 5.
Author (revised)
Large Eddy Simulation; Magnetohydrodynamic Turbulence; Low Reynolds Number; Homogeneous Turbulence; Isotropic Turbulence

20040031634 Prins Maurits Lab. TNO, Rijswijk, Netherlands
CFD Modelling of Transient Flow in the FM12 Gasmask
Kievit, O.; vanGulijk, C.; April 2003; 33 pp.; In Dutch
Contract(s)/Grant(s): A01/KL/447; TNO Proj. 014.12767
Report No.(s): TD-2002-0210; PML-2003-A36; Copyright; Avail: Other Sources

Air flow inside a gas mask was modeled using Computational FLuid Dynamics software. The model yields insight and the possibilityto extrapolate outside teh constraints of the operational window. The present report describes a CFD modeling study on the flow inside the FM12 gas mask.
Author
Computational Fluid Dynamics; Masks; Air Flow

20040031690 Stanford Univ., Stanford, CA, USA
A Eulerian-Lagrangian Model to Simulate Two-Phase/Particulate Flows
Apte, S. V.; Mahesh, K.; Lundgren, T.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 161-171; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI

Figure 1 shows a snapshot of liquid fuel spray coming out of an injector nozzle in a realistic gas-turbine combustor. Here the spray atomization was simulated using a stochastic secondary breakup model (Apte et al. 2003a) with point-particle approximation for the droplets. Very close to the injector, it is observed that the spray density is large and the droplets cannot be treated as point-particles. The volume displaced by the liquid in this region is significant and can alter the gas-phase ow and spray evolution. In order to address this issue, one can compute the dense spray regime by an Eulerian-Lagrangian technique using advanced interface tracking/level-set methods (Sussman et al. 1994; Tryggvason et al. 2001; Herrmann 2003). This, however, is computationally intensive and may not be viable in realistic complex configurations. We therefore plan to develop a methodology based on Eulerian-Lagrangian technique which will allow us to capture the essential features of primary atomization using models to capture interactions between the fluid and droplets and which can be directly applied to the standard atomization models used in practice. The numerical scheme for unstructured grids developed by Mahesh et al. (2003) for incompressible flows is modified to take into account the droplet volume fraction. The numerical framework is directly applicable to realistic combustor geometries. Our main objectives in this work are: Develop a numerical formulation based on Eulerian-Lagrangian techniques with models for interaction terms between the fluid and particles to capture the Kelvin- Helmholtz type instabilities observed during primary atomization. Validate this technique for various two-phase and particulate flows. Assess its applicability to capture primary atomization of liquid jets in conjunction with secondary atomization models.
Derived from text
Lagrangian Function; Two Phase Flow; Fluid Jets; Fuel Sprays; Atomizing; Drops (Liquids); Particulates

20040031695 National Defence Research Establishment, Stockholm, Sweden
High Speed Combustion: Development of Experimental Techniques and Equipment for Combustion Studies III
Carlsson, T.; Jun. 2003; In Swedish
Report No.(s): PB2004-101830; FOI-R-0889-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The aim of this project is to develop experimental techniques for investigation of propulsion techniques such as the PDE-Pulse Detonation Engine as well as for comparison with computer based modeling and simulation methods. The experimental methods studied are LIF-Laser Induced Fluorescence, shadow, schlieren and interferometrical methods (primarily holography), the latter in cooperation with LTU-Luau Technical University. This report treats different methods for quantitative evaluation of shadow, schlieren and interferometrical measurements. Evaluation algorithms based on these methods have been implemented in Matlab and applied to experiments on a turbulent propane-air diffusion flame and on propagation of a jet originating from combustion of an air/hydrogen gas mixture in a cavity with a small exhaust nozzle. Descriptions are given of the experiments, the evaluations of the results and the comparisons with CFD-simulations.
NTIS
Combustion; Fluid Mechanics; Computational Fluid Dynamics; Diffusion Flames

20040031696 Stanford Univ., Stanford, CA, USA
Unstructured LES of Reacting Multiphase Flows in Realistic Gas Turbine Combustors
Ham, Frank; Apte, Sourabh; Iaccarino, Gianluca; Wu, Xiao-Hua; Herrmann, Marcus; Constantinescu, George; Mahesh, Krishnan; Moin, Parviz; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 139-160; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

As part of the Accelerated Strategic Computing Initiative (ASCI) program, an accurate and robust simulation tool is being developed to perform high-fidelity LES studies of multiphase, multiscale turbulent reacting flows in aircraft gas turbine combustor configurations using hybrid unstructured grids. In the combustor, pressurized gas from the upstream compressor is reacted with atomized liquid fuel to produce the combustion products that drive the downstream turbine. The Large Eddy Simulation (LES) approach is used to simulate the combustor because of its demonstrated superiority over RANS in predicting turbulent mixing, which is central to combustion. This paper summarizes the accomplishments of the combustor group over the past year, concentrating mainly on the two major milestones achieved this year: 1) Large scale simulation: A major rewrite and redesign of the flagship unstructured LES code has allowed the group to perform large eddy simulations of the complete combustor geometry (all 18 injectors) with over 100 million control volumes; 2) Multi-physics simulation in complex geometry: The first multi-physics simulations including fuel spray breakup, coalescence, evaporation, and combustion are now being performed in a single periodic sector (1/18th) of an actual Pratt & Whitney combustor geometry.
Author
Large Eddy Simulation; Reacting Flow; Turbulent Flow; Gas Turbine Engines; Compressors

20040031705 Stanford Univ., Stanford, CA, USA

Numerical and Experimental Investigation of the Turbulent Flow in a Ribbed Serpentine Passage

Iaccarino, Gianluca; Kalitzin, Georgi; Elkins, Christopher J.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 379-387; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, the turbulent flow in a serpentine with oblique ribs is investigated experimentally and by numerical simulations. The measurements are carried out by using Magnetic Resonance Velocimetry (MRV) and the simulations using the Immersed Boundary (IB) technique. A brief description of these two approaches is reported in following sections. The results are reported in terms of velocity distributions in various planes in the serpentine; differences between measurements and simulations are presented qualitatively and quantitatively. The study of the discrepancy allows us to identify areas of needed improvements in the turbulence modeling.

Author (revised)

Turbulent Flow; Turbulence Models

20040031706 Stanford Univ., Stanford, CA, USA

RANS Simulation of the Separated Flow over a Bump with Active Control

Iaccarino, Gianluca; Marongiu, Claudio; Catalano, Pietro; Amato, Marcello; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 389-397; In English

Contract(s)/Grant(s): NCC2-1371; Copyright; Avail: CASI; A02, Hardcopy

The objective of this paper is to investigate the accuracy of Reynolds-Averaged Navier- Stokes (RANS) techniques in predicting the effect of steady and unsteady flow control devices. This is part of a larger effort in applying numerical simulation tools to investigate of the performance of synthetic jets in high Reynolds number turbulent flows. RANS techniques have been successful in predicting isolated synthetic jets as reported by Kral et al. Nevertheless, due to the complex, and inherently unsteady nature of the interaction between the synthetic jet and the external boundary layer flow, it is not clear whether RANS models can represent the turbulence statistics correctly.

Author (revised)

Separated Flow; Boundary Layer Flow; Active Control; Unsteady Flow; Steady Flow

20040031709 Stanford Univ., Stanford, CA, USA

Toward Immersed Boundary Simulation of High Reynolds Number Flows

Kalitzin, Georgi; Iaccarino, Gianluca; [2003]; 10 pp.; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

In the immersed boundary (IB) method, the surface of an object is reconstructed with forcing terms in the underlying flow field equations. The surface may split a computational cell removing the constraint of the near wall gridlines to be aligned with the surface. This feature greatly simplifies the grid generation process which is cumbersome and expensive in particular for structured grids and complex geometries. The IB method is ideally suited for Cartesian flow solvers. The flow equations written in Cartesian coordinates appear in a very simple form and several numerical algorithms can be used for an efficient solution of the equations. In addition, the accuracy of numerical algorithms is dependent on the underlying grid and it usually deteriorates when the grid deviates from a Cartesian mesh. The challenge for the IB method lies in the representation of the wall boundaries and in providing an adequate near wall flow field resolution. The issue of enforcing no-slip boundary conditions at the immersed surface has been addressed by several authors by imposing a local reconstruction of the solution. Initial work by Verzicco et al. was based on a simple linear, one-dimensional operator and this approach proved to be accurate for boundaries largely aligned with the grid lines. Majumdar et al. used various multidimensional and high order polynomial interpolations schemes. These high order schemes, however, are keen to introduce wiggles and spurious extrema. Iaccarino & Verzicco and Kalitzin & Iaccarino proposed a tri-linear reconstruction for the velocity components and the turbulent scalars. A modified implementation that has proven to be more robust is reported in this paper. The issue of adequate near wall resolution in a Cartesian framework can initially be addressed by using a non-uniform mesh which is stretched near the surface. In this paper, we investigate an unstructured approach for local grid refinement that utilizes Cartesian mesh features. The computation of high Reynolds number wall bounded flows is particularly challenging as it requires the consideration of thin turbulent boundary layers, i.e. near wall regions with large gradients of the flow field variables. For such flows, the representation of the wall boundary has a large impact on the accuracy of the computation. It is also critical for the robustness and convergence of the flow solver.

Author

High Reynolds Number; Computational Fluid Dynamics; Flow Distribution; Cartesian Coordinates; Boundary Layer Flow

20040031710 Stanford Univ., Stanford, CA, USA

MHD Turbulence at Moderate Magnetic Reynolds Number

Knaepen, B.; Kassinos, S.; Carati, D.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 449-460; In English

Contract(s)/Grant(s): ARC-02/07-283; NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

In the present article we will consider the decay of MHD turbulence under the influence of a strong external magnetic field at moderate magnetic Reynolds numbers. Typical values of R(sub m) that are considered here range from R(sub m) approx. 0.1 to R(sub m) approx. 20. As a comparison, the initial kinetic Reynolds number common to all our simulations is Re(sub L) = 199. This means that the range of Prandtl numbers explored is 5 x 10(exp -4) to 10(exp -1). Our motivation is mainly to exhibit how the transition from the QS approximation to FMHD occurs. At the lowest values of R(sub m) studied here, the QS approximation is shown to model the flow faithfully. However, for the higher values of R(sub m) considered, it is clearly inadequate but can be replaced by another approximation which will be referred to as the Quasi-Linear (QL) approximation. Another objective of the present study is to describe how variations in the magnetic Reynolds number (while maintaining all other parameters constant) affect the dynamics of the flow. This complements past studies where variations in either the strength of the external magnetic field or the kinetic Reynolds number were considered. This article is organized as follows. In section 2 we recall the definition of the quasi-static approximation. Section 3 is devoted to the description of the numerical experiments performed using the quasi-static approximation and full MHD. In section 4 we describe the quasi-linear approximation and test it numerically against full MHD. A concluding summary is given in section 5.

Author (revised)

Magnetohydrodynamic Turbulence; Reynolds Number

20040031711 Stanford Univ., Stanford, CA, USA

Linearly Forced Isotropic Turbulence

Lundgren, T. S.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 461-473; In English

Contract(s)/Grant(s): NCC2-1371; Copyright; Avail: CASI; A03, Hardcopy

Stationary isotropic turbulence is often studied numerically by adding a forcing term to the Navier-Stokes equation. This is usually done for the purpose of achieving higher Reynolds number and longer statistics than is possible for isotropic decaying turbulence. It is generally accepted that forcing the Navier-Stokes equation at low wave number does not influence the small scale statistics of the flow provided that there is wide separation between the largest and smallest scales. It will be shown, however, that the spectral width of the forcing has a noticeable effect on inertial range statistics. A case will be made here for using a broader form of forcing in order to compare computed isotropic stationary turbulence with (decaying) grid turbulence. It is shown that using a forcing function which is directly proportional to the velocity has physical meaning and gives results which are closer to both homogeneous and non-homogeneous turbulence. Section 1 presents a four part series of motivations for linear forcing. Section 2 puts linear forcing to a numerical test with a pseudospectral computation.

Author

Isotropic Turbulence; Linearity

20040031715 Stanford Univ., Stanford, CA, USA

Turbulent Mixing of Multiphase Flow

Young, Y.-N.; Ferziger, J.; Ham, F. E.; Herrmann, M.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 239-250; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

Thus we conduct numerical simulations of multiphase fluids stirred by two-dimensional turbulence to assess the possibility of self-similar drop size distribution in turbulence. In our turbulence simulations, we also explore the non-diffusive limit, where molecular mobility for the interface is vanishing. Special care is needed to transport the non-diffusive interface. Numerically, we use the particle level set method to evolve the interface. Instead of using the usual methods to calculate the surface tension force from the level set function, we reconstruct the interface based on phase- field modeling, and calculate the continuum surface tension forcing from the reconstructed interface.

Author

Multiphase Flow; Turbulent Mixing

20040031723 Stanford Univ., Stanford, CA, USA

Quadrature Moments Method for the Simulation of Turbulent Reactive Flows

Raman, Venkatramanan; Pitsch, Heinz; Fox, Rodney O.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 261-275; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

A sub-filter model for reactive flows, namely the DQMOM model, was formulated for Large Eddy Simulation (LES) using the filtered mass density function. Transport equations required to determine the location and size of the delta-peaks were then formulated for a 2-peak decomposition of the FDF. The DQMOM scheme was implemented in an existing structured-grid LES solver. Simulations of scalar shear layer using an experimental configuration showed that the first and second moments of both reactive and inert scalars are in good agreement with a conventional Lagrangian scheme that evolves the same FDF. Comparisons with LES simulations performed using laminar chemistry assumption for the reactive scalar show that the new method provides vast improvements at minimal computational cost. Currently, the DQMOM model is being implemented for use with the progress variable/mixture fraction model of Pierce. Comparisons with experimental results and LES simulations using a single-environment for the progress-variable are planned. Future studies will aim at understanding the effect of increase in environments on predictions.

Derived from text

Turbulent Flow; Quadratures; Large Eddy Simulation

20040031724 Stanford Univ., Stanford, CA, USA

Advanced Signal Processing for Integrated LES-RANS Simulations: Anti-aliasing Filters

Schlueter, J. U.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 343-356; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

Currently, a wide variety of flow phenomena are addressed with numerical simulations. Many flow solvers are optimized to simulate a limited spectrum of flow effects effectively, such as single parts of a flow system, but are either inadequate or too expensive to be applied to a very complex problem. As an example, the flow through a gas turbine can be considered. In the compressor and the turbine section, the flow solver has to be able to handle the moving blades, model the wall turbulence, and predict the pressure and density distribution properly. This can be done by a flow solver based on the Reynolds-Averaged Navier-Stokes (RANS) approach. On the other hand, the flow in the combustion chamber is governed by large scale turbulence, chemical reactions, and the presence of fuel spray. Experience shows that these phenomena require an unsteady approach. Hence, for the combustor, the use of a Large Eddy Simulation (LES) flow solver is desirable. While many design problems of a single flow passage can be addressed by separate computations, only the simultaneous computation of all parts can guarantee the proper prediction of multi-component phenomena, such as compressor/combustor instability and combustor/turbine hot-streak migration. Therefore, a promising strategy to perform full aero-thermal simulations of gas-turbine engines is the use of a RANS flow solver for the compressor sections, an LES flow solver for the combustor, and again a RANS flow solver for the turbine section.

Author

Signal Processing; Large Eddy Simulation; Gas Turbine Engines; Navier-Stokes Equation; Reynolds Averaging

20040031726 Stanford Univ., Stanford, CA, USA

Integrated RANS-LES Computations of Turbomachinery Components: Generic Compressor/Diffuser

Schlueter, J. U.; Wu, X.; Kim, S.; Alonso, J. J.; Pitsch, H.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 357-368; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the current study is to apply the coupled RANS-LES approach to a compressor-diffuser geometry of a gas turbine. This flow configuration is important, since the outflow of the compressor alters the flow field in the subsequent diffuser. A detailed knowledge of the flow field in this section allows to optimize the difuser design in order to to achieve a decrease of pressure loss. Here, the NASA stage 35 compressor is coupled with a generic diffuser in order to assess the integrated RANS-LES approach.

Author (revised)

Reynolds Averaging; Navier-Stokes Equation; Turbomachinery; Compressors; Gas Turbines

20040031730 NASA Langley Research Center, Hampton, VA, USA

Evaluation of Flush-Mounted, S-Duct Inlets with Large Amounts of Boundary Layer Ingestion

Berrier, Bobby L.; Morehouse, Melissa B.; [2003]; 12 pp.; In English; Symposium on Vehicle Propulsion Integration, 6-9 Oct. 2003, Warsaw, Poland

Contract(s)/Grant(s): 714-05-10; No Copyright; Avail: CASI; A03, Hardcopy

A new high Reynolds number test capability for boundary layer ingesting inlets has been developed for the NASA Langley Research Center 0.3-Meter Transonic Cryogenic Tunnel. Using this new capability, an experimental investigation of four S-duct inlet configurations with large amounts of boundary layer ingestion (nominal boundary layer thickness of about 40% of inlet height) was conducted at realistic operating conditions (high subsonic Mach numbers and full-scale Reynolds numbers). The objectives of this investigation were to 1) provide a database for CFD tool validation on boundary layer ingesting inlets operating at realistic conditions and 2) provide a baseline inlet for future inlet flow-control studies. Tests were conducted at Mach numbers from 0.25 to 0.83, Reynolds numbers (based on duct exit diameter) from 5.1 million to a full-scale value of 13.9 million, and inlet mass-flow ratios from 0.39 to 1.58 depending on Mach number. Results of this investigation indicate that inlet pressure recovery generally decreased and inlet distortion generally increased with increasing Mach number. Except at low Mach numbers, increasing inlet mass-flow increased pressure recovery and increased distortion. Increasing the amount of boundary layer ingestion (by decreasing inlet throat height) or ingesting a boundary layer with a distorted (adverse) profile decreased pressure recovery and increased distortion. Finally, increasing Reynolds number had almost no effect on inlet distortion but increased inlet recovery by about one-half percent at a Mach number near cruise.

Author

Boundary Layer Thickness; Cryogenics; Ducts; Engine Inlets; High Reynolds Number; Transonic Wind Tunnels; Wind Tunnel Tests; Computational Fluid Dynamics

20040031808 Maryland Univ., College Park, MD, USA

Integrated Microfluidic Gas Sensors for Water Monitoring

Zhu, L.; Sniadecki, N.; DeVoe, D. L.; Beamesderfer, M.; Semancik, S.; DeVoe, D. L.; [2003]; 4 pp.; In English; 7th International Conference of Miniaturized Chemical and Biochemical Analysis Systems, Transducers Research Foundation 'MicroTAS 2003', 5-9 Oct. 2003, Squaw Valley, CA, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

A silicon-based microhotplate tin oxide (SnO2) gas sensor integrated into a polymer-based microfluidic system for monitoring of contaminants in water systems is presented. This device is designed to sample a water source, control the sample vapor pressure within a microchannel using integrated resistive heaters, and direct the vapor past the integrated gas sensor for analysis. The sensor platform takes advantage of novel technology allowing direct integration of discrete silicon chips into a larger polymer microfluidic substrate, including seamless fluidic and electrical interconnects between the substrate and silicon chip.

Author

Microchannels; Gas Detectors; Tin Oxides; Fluidics; Vapor Pressure

20040031831 NASA Langley Research Center, Hampton, VA, USA

Analysis of Extensive Cross-Flow Separation using Higher-Order RANS Closure Models

Morison, J. H.; Panaras, A. G.; Gatski, T. B.; Georgantopoulos, G. A.; [2003]; 11 pp.; In English; 16th AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL

Report No.(s): AIAA Paper 2003-3532; No Copyright; Avail: CASI; A03, Hardcopy

The turbulent flow fields associated with the incompressible flow over a 6:1 prolate spheroid at high angle of attack, and the supersonic flow over an ogive cylinder are studied. Both these flows are characterized by large separation and vortical flow regions and therefore provide a challenging database for comparison of turbulent closure models. Of interest is the ability to predict the effects of separation and associated vortical motion common to both flows. Two turbulent models are investigated that each represent the class of linear eddy-viscosity models (LEVMs) and explicit algebraic stress models (EASMs). Since the EASM accounts for anisotropic effects, the in- fluence of these effects on flow field predictions can be assessed. The EASM model is shown to both improve the separation location prediction and pressure trough under the secondary vortex on the 6:1 prolate spheroid at high angle of attack and high Reynolds number, and improve the prediction of the separation location on a supersonic ogive cylinder.

Author

Turbulent Flow; Flow Distribution; Eddy Viscosity; Angle of Attack; Cross Flow; Incompressible Flow; Supersonic Flow

20040031832 NASA Langley Research Center, Hampton, VA, USA, George Washington Univ., Hampton, VA, USA, General Applied Science Labs., Inc., Hampton, VA, USA

Numerical Analysis of the SCHOLAR Supersonic Combustor

Rodriguez, Carlos G.; Cutler, Andrew D.; December 2003; 35 pp.; In English

Contract(s)/Grant(s): NAS1-97110; WU 23-745-30-10

Report No.(s): NASA/CR-2003-212689; No Copyright; Avail: CASI; A03, Hardcopy

The SCHOLAR scramjet experiment is the subject of an ongoing numerical investigation. The facility nozzle and combustor were solved separate and sequentially, with the exit conditions of the former used as inlet conditions for the latter. A baseline configuration for the numerical model was compared with the available experimental data. It was found that ignition-delay was underpredicted and fuel-plume penetration overpredicted, while the pressure rise was close to experimental values. In addition, grid-convergence by means of grid-sequencing could not be established. The effects of the different turbulence parameters were quantified. It was found that it was not possible to simultaneously predict the three main parameters of this flow: pressure-rise, ignition-delay, and fuel-plume penetration.

Author

Numerical Analysis; Supersonic Combustion Ramjet Engines; Computational Fluid Dynamics; Computational Grids

20040034008 NASA Glenn Research Center, Cleveland, OH, USA

Enhanced Boiling on Micro-Configured Composite Surfaces Under Microgravity Conditions

[2004]; 4 pp.; In English

Contract(s)/Grant(s): NCC3-1060; No Copyright; Avail: CASI; A01, Hardcopy

Two experimental setups: High Heat Flux Pool Boiling Setup and Optical system of Measuring Contact Angle and Spreading Parameters were established and a series of experiments was conducted. The experimental work on the nucleate boiling performance of both Freon-113 and water on the composite surfaces has been finished and the results show that the composite surface with 25% volume fraction of graphite fibers in the copper matrix has the best enhancing performance. Stronger enhancement was obtained for water compared to Freon-113. The wall superheat initiating boiling was reduced 40% and 35% and the heat flux of the nucleate boiling was augmented up to ten times and 6.7 times, respectively. A bubble departure model has been presented to explain the enhancement mechanism of the boiling heat transfer on the composite surfaces. A powerful optical method to measure contact angle and spreading parameters of liquids on solid surfaces, including both transparent and non-transparent substrates, has been developed and successfully used in the measurements for various liquid-solid systems. The experimental work on identification of profiles near three-phase line by laser shadowgraphy method has been finished and the characteristics of the three-phase line for different liquid-solid systems were unveiled, which is very important to understand the mechanism of boiling under microgravity conditions. The four basic patterns of sessile profile were discovered through caustics and caustic-diffraction analysis by applying wave theory in shadowgraphy technology, which contributes to clearly explain the different characteristics of wetting and spreading of various liquids on a solid surface, and therefore to further understand the bubble departure mechanisms. A new working pattern of heat pipes using working fluids with positive surface-tension gradient against temperature was discovered and analyzed, and then the new heat pipe systems using this kind of working fluids have been presented. Two patent devices, i.e. Shadowgraphic Method to Measure Properties of Sessile Drops and Heat Pipe Systems Using New Working Fluids, have been developed; the former has been approved by The USA Patent & Trademark Office and the latter is being examined.

Author

Nucleate Boiling; Freon; Heat Flux; Heat Pipes; Heat Transfer; Bubbles; Boiling; Working Fluids

20040034069 NASA Johnson Space Center, Houston, TX, USA

Automated Static Culture System Cell Module Mixing Protocol and Computational Fluid Dynamics Analysis

Kleis, Stanley J.; Truong, Tuan; Goodwin, Thomas J,; January 2004; 34 pp.; In English

Report No.(s): NASA/TM-2004-212067; S-921; No Copyright; Avail: CASI; A03, Hardcopy

This report is a documentation of a fluid dynamic analysis of the proposed Automated Static Culture System (ASCS) cell module mixing protocol. The report consists of a review of some basic fluid dynamics principles appropriate for the mixing of a patch of high oxygen content media into the surrounding media which is initially depleted of oxygen, followed by a computational fluid dynamics (CFD) study of this process for the proposed protocol over a range of the governing parameters. The time histories of oxygen concentration distributions and mechanical shear levels generated are used to characterize the mixing process for different parameter values.

Author

Computational Fluid Dynamics; Protocol (Computers); Depletion; Fluid Dynamics

20040034093 NASA Glenn Research Center, Cleveland, OH, USA

CFD Analysis of the Aerodynamics of a Business-Jet Airfoil with Leading-Edge Ice Accretion

Chi, X.; Zhu, B.; Shih, T. I.-P.; Addy, H. E.; Choo, Y. K.; [2004]; 10 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA

Contract(s)/Grant(s): NAG3-2576; WBS 22-728-41-10

Report No.(s): AIAA Paper 2004-0560; No Copyright; Avail: CASI; A02, Hardcopy

For rime ice - where the ice buildup has only rough and jagged surfaces but no protruding horns - this study shows two dimensional CFD analysis based on the one-equation Spalart-Almaras (S-A) turbulence model to predict accurately the lift, drag, and pressure coefficients up to near the stall angle. For glaze ice - where the ice buildup has two or more protruding horns near the airfoil's leading edge - CFD predictions were much less satisfactory because of the large separated region produced by the horns even at zero angle of attack. This CFD study, based on the WIND and the Fluent codes, assesses the following turbulence models by comparing predictions with available experimental data: S-A, standard k-epsilon, shear-stress transport, v(exp 2)-f, and differential Reynolds stress.

Author

Computational Fluid Dynamics; Aerodynamics; Airfoils; Aircraft Icing; Leading Edges

20040034121 NASA Glenn Research Center, Cleveland, OH, USA

Thermal Characteristics and Structure of Fully-Modulated, Turbulent Diffusion Flames in Microgravity

Hermanson, J. C.; Johari, H.; Stocker, D. P.; Hegde, U. G.; [2003]; 6 pp.; In English; AIAA 42nd Aerospace Sciences Meeting, 5-8 Jan. 2004, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Turbulent jet diffusion flames are studied in microgravity and normal gravity under fully-modulated conditions for a range of injection times and a 50% duty cycle. Diluted ethylene was injected through a 2-mm nozzle at a Reynolds number of 5,000 into an open duct, with a slow oxidizer co-flow. Microgravity tests are conducted in NASA's 2.2 Second Drop Tower. Flames with short injection times and high duty cycle exhibit a marked increase in the ensemble-averaged flame length due to the removal of buoyancy. The cycle-averaged centerline temperature profile reveals higher temperatures in the microgravity flames, especially at the flame tip where the difference is about 200 K. In addition, the cycle-averaged measurements of flame radiation were about 30% to 60% greater in microgravity than in normal gravity.

Author

Combustion Physics; Flames; Turbulent Diffusion; Microgravity; Temperature Distribution

20040034211 Stanford Univ., Stanford, CA, USA

DNS and LES of a Shear-Free Mixing Layer

Knaepen, B.; Debliquy, O.; Carati, D.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 307-318; In English

Contract(s)/Grant(s): ARC-02/07-283; NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this work is twofold. First, given the computational resources available today, it is possible to reach, using DNS, higher Reynolds numbers than in Briggs et al.. In the present study, the microscale Reynolds numbers reached in the low- and high-energy homogeneous regions are, respectively, 32 and 69. The results reported earlier can thus be complemented and their robustness in the presence of increased turbulence studied. The second aim of this work is to perform a detailed and documented LES of the shear-free mixing layer. In that respect, the creation of a DNS database at higher Reynolds number is necessary in order to make meaningful LES assessments. From the point of view of LES, the shear-free mixing-layer is interesting since it allows one to test how traditional LES models perform in the presence of an inhomogeneity without having to deal with difficult numerical issues. Indeed, as argued in Briggs et al., it is possible to use a spectral code to study the shear-free mixing layer and one can thus focus on the accuracy of the modelling while avoiding contamination of the results by commutation errors etc. This paper is organized as follows. First we detail the initialization procedure used in the simulation. Since the flow is not statistically stationary, this initialization procedure has a fairly strong influence on the evolution. Although we will focus here on the shear-free mixing layer, the method proposed in the present work can easily be used for other flows with one inhomogeneous direction. The next section of the article is devoted to the description of the DNS. All the relevant parameters are listed and comparison with the Veeravalli & Warhaft experiment is performed. The section on the LES of the shear-free mixing layer follows. A detailed comparison between the filtered DNS data and the LES predictions is presented. It is shown that simple eddy viscosity models perform very well for the present test case, most

probably because the flow seems to be almost isotropic in the small-scale range that is not resolved by the LES.
Author
Direct Numerical Simulation; Large Eddy Simulation; Shear Layers; Mixing Layers (Fluids)

20040034265 NASA Glenn Research Center, Cleveland, OH, USA
Mean Flow and Noise Prediction for a Separate Flow Jet With Chevron Mixers
Koch, L. Danielle; Bridges, James; Khavaran, Abbas; February 2004; 18 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-781-30-46
Report No.(s): NASA/TM-2004-212906; AIAA Paper 2004-0189; E-14329; No Copyright; Avail: CASI; A03, Hardcopy

Experimental and numerical results are presented here for a separate flow nozzle employing chevrons arranged in an alternating pattern on the core nozzle. Comparisons of these results demonstrate that the combination of the WIND/MGBK suite of codes can predict the noise reduction trends measured between separate flow jets with and without chevrons on the core nozzle. Mean flow predictions were validated against Particle Image Velocimetry (PIV), pressure, and temperature data, and noise predictions were validated against acoustic measurements recorded in the NASA Glenn Aeroacoustic Propulsion Lab. Comparisons are also made to results from the CRAFT code. The work presented here is part of an on-going assessment of the WIND/MGBK suite for use in designing the next generation of quiet nozzles for turbofan engines.
Author
Noise Prediction; Separated Flow; Aeroacoustics; Jet Flow; Exhaust Nozzles; Two Phase Flow; Numerical Analysis

20040034717 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modelling CLPX IOP3 Radiometric Data by Means of the Dense Media Theory: Preliminary Results for the LSOS Test Site
Tedesco, Marco; Kim, Edward J.; Cline, Don; Graf, Tobias; Koike, Toshio; Armstrong, Richard; Brodzik, Mary Jo; Hardy, Janet; [2003]; 1 pp.; In English; American Geophysical Union Meeting, 8-11 Dec. 2003, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The capabilities of the Dense Media Radiative Transfer model using the Quasi Crystalline Approximation with Coherent Potential (QCA-CP) to reproduce measured radiometric data were tested using the University of Tokyo Ground Based Microwave Radiometer (GBMR-7) during the third Intensive Observation Period (IOP3) of the NASA Cold-land Processes Field Experiment (CLPX). The data were collected at the Local-Scale Observation Site (LSOS), a 0.8-ha study site consisting of two open meadows separated by trees. Intensive measurements were also made of snow depth and temperature, density, and grain size profiles. A DMRT model is needed to describe radiative transfer in a medium such as snow because the assumption of independent scattering used in classical radiative transfer theory (CRT) is not valid. Validation of the DMRT approach requires a relationship between measured snow grain size and the DMRT approximation of snow grain radius as spherical particles with a mean radius of the log-normal particle-size distribution. This relationship is very important for a better understanding of snow modelling and for practical applications. DMRT simulations were compared with observations of microwave brightnesses at 18.7, 36.5 and 89-GHz (V and H polarizations) collected on February-1 9-25, 2003. Observation angles ranged from 30\deg to 70\deg. Model inputs included measured snow parameters except mean grain size. The average snow temperature, fractional volume and depth were held constant, together with the ice and soil permittivities. The minimum and maximum measured mean grain sizes were used to test the capabilities of the DMRT to reproduce the brightnesses as upper and lower limits. The sensitivity to the largest and smallest measured grain size in the three classes of minimum, medium and maximum observed grain sizes was also investigated. DMRT particle sizes yielding a best-fit to the experimental data for each date were computed. Results show that the measured brightnesses fall within the range of simulated brightnesses using the smallest and largest measured grain size values. The DMRT best-fit radii are comparable to the average radii for the medium observed grain sizes.
Author
Simulation; Radiative Transfer; Microwave Radiometers; Models; Data Simulation

20040034793 NASA Glenn Research Center, Cleveland, OH, USA

Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems

McQuillen, John; Rame, Enrique; Kassemi, Mohammad; Singh, Bhim; Motil, Brian; December 2003; 219 pp.; In English; Two-Phase Flow, Fluid Stability and Dynamics Workshop, 15 May 2003, Cleveland, OH, USA; See also 20040034794 - 20040034808; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-101-53-01

Report No.(s): NASA/TM-2003-212598; E-14154; No Copyright; Avail: CASI; A10, Hardcopy

The Two-phase Flow, Fluid Stability and Dynamics Workshop was held on May 15, 2003 in Cleveland, Ohio to define a coherent scientific research plan and roadmap that addresses the multiphase fluid problems associated with NASA s technology development program. The workshop participants, from academia, industry and government, prioritized various multiphase issues and generated a research plan and roadmap to resolve them. This report presents a prioritization of the various multiphase flow and fluid stability phenomena related primarily to power, propulsion, fluid and thermal management and advanced life support; and a plan to address these issues in a logical and timely fashion using analysis, ground-based and space-flight experiments.

Author

Multiphase Flow; Life Support Systems; Propulsion; Fluid Management

20040034799 NASA Glenn Research Center, Cleveland, OH, USA

Multiphase Flow in Power and Propulsion Workshop Fluid Stability and Dynamics Workshop: Overview

Singh, Bhim; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 201-207; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The short term purpose of this research is to present a research plan and a roadmap developed for strategic research for the Office of Biological and Physical Research and the long term purpose is to conduct necessary ground-based and space-flight low gravity experiments, complemented by analyses, resulting in a documented framework for parameter prediction of needed by designers. This paper is presented in viewgraph form.

CASI

General Overviews; Spacecraft Propulsion; Microgravity; Stability; NASA Space Programs; Two Phase Flow

20040034800 NASA Glenn Research Center, Cleveland, OH, USA

Report on Multiphase Flow Panel

Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 29-38; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents viewgraphs on a multiphase flow panel. The topics include: 1) Discussion of Priorities; 2) Critical Issues Reduced Gravity Instabilities; 3) Severely Limiting Phase Separation; 4) Severely-Limiting Phase Change; 5) Enhancements; 6) Awareness Instabilities; 7) Awareness; 8) Methods of Resolution; 9) 2008 Space Flight; 10) 2003-2008 Ground-Based Microgravity Facilities; 11) 2003-2008 Other; 12) 2009-2015 Space Flight; 13) 2009-2015 Ground-Based Microgravity Facilities; 14) 2009-2015 Other; and 15) 2016.

CASI

Multiphase Flow; Panels; Microgravity; Space Flight; Test Facilities

20040034801 NASA Glenn Research Center, Cleveland, OH, USA

Report of the Stability and Dynamics Session

Alexander, Iwan; Chato, David; Collicott, Steven; Dadzic, Nihad; Duval, Walter; Garoff, Steven; Grayson, Gary; Hochstein, John; Kassemi, Mo; Nelson, Emily, et al.; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 39-43; In English; See also 20040034793; No Copyright; Avail: CASI; A01, Hardcopy

Important issues: Mass gauging; Stability dynamics of disconnected capillary surfaces; Slow capillary driven flow (i.e. wicking); Long-term material property evolution in micro-g; Dumping problem with freezing of dump lines.

Derived from text

Capillary Flow; Dumping; Freezing; Stability

20040034819 Lawrence Livermore National Lab., Livermore, CA

Time-Accurate Computation of Viscous Flow around Deforming Bodies Using Overset Grids

Fast, P.; Henshaw, W. D.; Apr. 02, 2001; 12 pp.; In English

Report No.(s): DE2003-15005383; UCRL-JC-140714; No Copyright; Avail: Department of Energy Information Bridge

Dynamically evolving boundaries and deforming bodies interacting with a flow are commonly encountered in fluid dynamics. However, the numerical simulation of flows with dynamic boundaries is difficult with current methods. We propose a new method for studying such problems. The key idea is to use the overset grid method with a thin, body-fitted grid near the deforming boundary, while using fixed Cartesian grids to cover most of the computational domain. Our approach combines the strengths of earlier moving overset grid methods for rigid body motion, and unstructured grid methods for flow-structure interactions. Large scale deformation of the flow boundaries can be handled without a global regridding, and in a computationally efficient way. In terms of computational cost, even a full overset grid regridding is significantly cheaper than a full regridding of an unstructured grid for the same domain, especially in three dimensions. Numerical studies are used to verify accuracy and convergence of our flow solver. As a computational example, we consider two-dimensional incompressible flow past a flexible filament with prescribed dynamics.

NTIS

Viscous Flow; Computational Grids

20040034847 NASA Glenn Research Center, Cleveland, OH, USA

Measurements of the Aeroacoustic Sound Source in Hot Jets

Bridges, James; Wernet, Mark; February 2004; 16 pp.; In English; Ninth Aeroacoustics Conference and Exhibit, 12-14 May 2003, Hilton Head, SC, USA

Contract(s)/Grant(s): WBS 22-781-30-27

Report No.(s): NASA/TM-2004-212508; AIAA Paper 2003-3130; E-14068; No Copyright; Avail: CASI; A03, Hardcopy

We have succeeded in measuring a substantial portion of the two-point space-time velocity correlation in hot, high speed turbulent jets. This measurement, crucial in aeroacoustic theory and the prediction of jet noise, has been sought for a long time, but has not been made due to the limitations of anemometry. Particle Image Velocimetry has reached a stage of maturity where sufficient measurement density in both time and space allow the computation of space-time correlations. This paper documents these measurements along with lower-order statistics to document the adherence of the jet rig and instrumentation to conventional measures of the turbulence of jets. These measures have been made for a simple round convergent nozzle at acoustic Mach numbers of 0.5, 0.9, both cold and at a static temperature ratio of 2.7, allowing some estimation of the changes in turbulence that take place with changes in jet temperature. Since the dataset described in this paper is very extensive, attention will be focused on validation of the rig and of the measurement systems, and on some of the interesting observations made from studying the statistics, especially as they relate to jet noise. Of note is the effort to study the acoustically relevant part of the space-time correlation by addressing that part of the turbulence kinetic energy that has sonic phase speed.

Author

Aeroacoustics; Turbulence Models; Jet Aircraft Noise; Turbulent Jets; Jet Flow; Velocity Distribution; Subsonic Speed

20040035558 NASA Langley Research Center, Hampton, VA, USA

Source Term Model for Vortex Generator Vanes in a Navier-Stokes Computer Code

Waithe, Kenrick A.; [2004]; 11 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA

Contract(s)/Grant(s): 23-762-40-11

Report No.(s): AIAA Paper 2004-1236; No Copyright; Avail: CASI; A03, Hardcopy

A source term model for an array of vortex generators was implemented into a non-proprietary Navier-Stokes computer code, OVERFLOW. The source term models the side force created by a vortex generator vane. The model is obtained by introducing a side force to the momentum and energy equations that can adjust its strength automatically based on the local flow. The model was tested and calibrated by comparing data from numerical simulations and experiments of a single low profile vortex generator vane on a flat plate. In addition, the model was compared to experimental data of an S-duct with 22 co-rotating, low profile vortex generators. The source term model allowed a grid reduction of about seventy percent when compared with the numerical simulations performed on a fully gridded vortex generator on a flat plate without adversely affecting the development and capture of the vortex created. The source term model was able to predict the shape and size of the stream-wise vorticity and velocity contours very well when compared with both numerical simulations and experimental data. The peak vorticity and its location were also predicted very well when compared to numerical simulations and experimental data. The circulation predicted by the source term model matches the prediction of the numerical simulation. The

source term model predicted the engine fan face distortion and total pressure recovery of the S-duct with 22 co-rotating vortex generators very well. The source term model allows a researcher to quickly investigate different locations of individual or a row of vortex generators. The researcher is able to conduct a preliminary investigation with minimal grid generation and computational time.
Author
Computational Fluid Dynamics; Computer Programs; Vortex Generators; Navier-Stokes Equation

20040035566 NASA Langley Research Center, Hampton, VA, USA
Modeling of High Speed Reacting Flows: Established Practices and Future Challenges
Baurle, R. A.; [2004]; 15 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2004-0267; No Copyright; Avail: CASI; A03, Hardcopy

Computational fluid dynamics (CFD) has proven to be an invaluable tool for the design and analysis of high- speed propulsion devices. Massively parallel computing, together with the maturation of robust CFD codes, has made it possible to perform simulations of complete engine flowpaths. Steady-state Reynolds-Averaged Navier-Stokes simulations are now routinely used in the scramjet engine development cycle to determine optimal fuel injector arrangements, investigate trends noted during testing, and extract various measures of engine efficiency. Unfortunately, the turbulence and combustion models used in these codes have not changed significantly over the past decade. Hence, the CFD practitioner must often rely heavily on existing measurements (at similar flow conditions) to calibrate model coefficients on a case- by-case basis. This paper provides an overview of the modeled equations typically employed by commercial- quality CFD codes for high-speed combustion applications. Careful attention is given to the approximations employed for each of the unclosed terms in the averaged equation set. The salient features (and shortcomings) of common models used to close these terms are covered in detail, and several academic efforts aimed at addressing these shortcomings are discussed.
Author
Navier-Stokes Equation; Reynolds Averaging; High Speed; Computational Fluid Dynamics; Propulsion; Supersonic Combustion Ramjet Engines; Combustion Physics; Design Analysis

20040035612 NASA Glenn Research Center, Cleveland, OH, USA
NASA's Microgravity Fluid Physics Strategic Research Roadmap
Motil, Brian J.; Singh, Bhim S.; February 2004; 16 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-101-53-01
Report No.(s): NASA/TM-2004-212914; E-14353; No Copyright; Avail: CASI; A03, Hardcopy

The Microgravity Fluid Physics Program at NASA has developed a substantial investigator base engaging a broad crosssection of the U.S. scientific community. As a result, it enjoys a rich history of many significant scientific achievements. The research supported by the program has produced many important findings that have been published in prestigious journals such as Science, Nature, Journal of Fluid Mechanics, Physics of Fluids, and many others. The focus of the program so far has primarily been on fundamental scientific studies. However, a recent shift in emphasis at NASA to develop advanced technologies to enable future exploration of space has provided motivation to add a strategic research component to the program. This has set into motion a year of intense planning within NASA including three workshops to solicit inputs from the external scientific community. The planning activities and the workshops have resulted in a prioritized list of strategic research issues along with a corresponding detailed roadmap specific to fluid physics. The results of these activities were provided to NASA s Office of Biological and Physical Research (OBPR) to support the development of the Enterprise Strategy document. This paper summarizes these results while showing how the planned research supports NASA s overall vision through OBPR s organizing questions.
Author
Microgravity; NASA Programs; Computational Fluid Dynamics; Research and Development; Two Phase Flow

20040035617 Lawrence Livermore National Lab., Livermore, CA
Thermal Cavity Problem
Gresho, P. M.; Sutton, S.; Oct. 2000; 18 pp.; In English
Report No.(s): DE2003-15005964; UCRL-JC-141033; No Copyright; Avail: Department of Energy Information Bridge

We present results for the 8:1 thermal cavity problem using FIDAP on 3 meshes--each using 3 elements. A brief summary

of related results is also included. This contribution comes via the rather versatile and general commercial finite element code, FIDAP. This code still offers the user a wide selection with respect to element choices, statement of governing equations, (e.g. , advective form, divergence form) implicit time integrators (variable-step or fixed step, first-order or second-order), and solution techniques for both the nonlinear and linear sets of equations. We have tested quite a number of these variations on this problem; here we report on an interesting subset and will present the remainder at the conference.
NTIS
Computational Fluid Dynamics; Cavities; Linear Equations

20040035711 Princeton Resources, Inc., NJ, USA, Colorado Univ., Colorado Springs, CO, USA
Proceedings of the International Symposium on Integrated Ferroelectrics (15th) (ISIF-15). Part 4 of 8. Volume 55, (2003)
Taylor, G. W.; 2003; 264 pp.; In English, March 9 - 12, 2003, Colorado Springs, Colorado
Report No.(s): PB2004-101702; Copyright; Avail: National Technical Information Service (NTIS)
Partial Contents: Structure and Dielectric Properties of Heteroepitaxial PMNT Thin Films; Synthesis and Characterization of Nanostructured BSTO Thin-Films for Microwave Applications; Millimeter-Wave Loaded Line Ferroelectric Phase Shifters; Electrical Characterization of PMNT Thin Films; 14GHz Tunable Filters Base on Ferroelectric Films; Microwave Characterization of BST Thin Films on LAO Interdigital Capacitor; Preparation of PZN-Based Ceramics using A Sequential Mixing Columbite Method; Figure of Merit of Tunable Ferroelectric Planar Filters.
NTIS
Conferences; Ferroelectricity; Nanostructures (Devices); Ceramics

20040035712 Princeton Resources, Inc., NJ, USA, Colorado Univ., Colorado Springs, CO, USA
Proceedings of the International Symposium on Intergrated Ferroelectrics (15th) (ISIF-15). Part 3 of 8. Volume 54, (2003)
Taylor, G. W.; 2003; 260 pp.; In English, March 9 - 12, 2003, Colorado Springs, Colorado
Report No.(s): PB2004-101701; Copyright; Avail: National Technical Information Service (NTIS)
Partial Contents: Thickness Dependence of Piezoelectric Properties for PZT Thin Films with Regard to MEMS Applications; Local Growth of Sol-Gel Films by Means of Micro hotplates; Morphology of PZT-PMN Films Grown from Airflow; Image Capture Devices Based on Charge Storage at Semiconductor-Ferroelectric Interfaces; Computation of Frequency Response of Integrated Pyroelectric Infrared Detectors; Fabrication and Electromechanical Properties of Piezoelectric Micro-Transducers for Smart Device; PZT MEMS for an Extremely Sensitive Magnetometer; Dielectric and Pyroelectric Properties of Lead Zicronate Titanate Composite Films; Growth and Studies of Calcium Doped Laser Ablated Barium Titanate Thin Films.
NTIS
Conferences; Ferroelectricity; Piezoelectricity; Fabrication

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*.

20040031643 Physics and Electronics Lab. TNO, The Hague, Netherlands
SIRPS (Staring Infrared Panoramic Sensor)
Schwering, P. B. W.; deJong, A. N.; Winkel, J.; September 2003; 28 pp.; In Dutch
Contract(s)/Grant(s): A98/KM/719; TNO Proj. 26635
Report No.(s): TD-2001-0285; FEL-01-A309; Copyright; Avail: Other Sources
This is the final report on the Netherlands SIRPS (Staring Infrared Panoramic Sensor) program. Investigation has been made on IR bird signatures and data have been collected on various types of birds at different locations. Signals have been collected of point targets at the horizon, simulating incoming missiles. It has been found that thanks to atmospheric scintillation and refraction effects, the detection process in a cluttered background becomes much easier for high frame rate sensors. These allow also adequate bird tracking, avoiding the serious bird false alarm problem. It is concluded that the future

of full stare IRST sensors is very promising and that development of these sensors can be expected in the coming decade. Author

Birds; Clutter; Infrared Signatures; Infrared Detectors; Infrared Tracking

20040031650 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Contribution of the Integrated Sensor Systems TM/Landsat-5 and SAR/ERS-1 Data to Study Northeast's land Use/Land Cover from Maranhao Island

Rangel, Mauricio Eduardo Salgado; 2003; 114 pp.; In Portuguese

Report No.(s): INPE-10032-TDI/883; Copyright; Avail: Other Sources

In this study we present and discuss the results obtained from integration of optical and microwave data, evaluating the degree of synergism between these data sets, for the detection and mapping of changes of land use/land cover, at the northeastern section of Maranhao Island. We used images of satellite TM Landsat-5 from June 1984 and July 1999, and ERS-1 SAR data from June 1995. The methodological procedures used were: (1) reduction of speckle noise from radar data, with the application of several filters with different window sizes, thus allowing the improvement of interpretation; (2) application of the technique IHS space transformation and (3) supervised classification, using the MaxVer classification algorithm. Finally the accuracy of the information set obtained was evaluated, based on the results obtained from the error matrix, using Kappa statistics. The results were compared with land use maps obtained from satellite images used during the classification process, as well as with field data. Data integration allowed to distinguish different specific characteristics of land use through color composite images, showing the synergism between multispectral and textural images.

Author

Landsat 5; Synthetic Aperture Radar; Ers-1 (Esa Satellite); Land Use; Sensors; Data Integration; Islands; Multispectral Photography

20040031751 Physics and Electronics Lab. TNO, The Hague, Netherlands

An Adaptive Data-Reduction Algorithm (for Sonar Data)

deTheije, P. A. M.; March 2003; 38 pp.; In English

Contract(s)/Grant(s): B01/KM/612; TNO Proj. 31122/01.01

Report No.(s): TD-2003-0029; FEL-03-B003; Copyright; Avail: Other Sources

By using broadband active sonar systems (e.g. for Anti-Submarine Warfare purposes) the amount of data after processing can be enormous. The number of range samples per transmission can be as large as 50,000 - 100,000, As present-day computer screens have a dimension of only 1,000 pixels, plotting this data on a computer screen asks for dedicated algorithms to do the data reduction in a clever way. This report describes a new algorithm to reduce the amount of data without loosing too much essential information. The algorithm is adaptive and uses the statistics of the background to replace each set of N samples by a single value.When applied to two common distributions (Gaussian and Rayleigh), the new algorithm performs significantly better than two often-used classical algorithms (maximum and mean). The loss in visual SNR of the new algorithm is 2 - 20 dB smaller than for the two classical algorithms.The new algorithm is patented in the Netherlands under no. 101 81 85. Extending the patent to Europe and the rest of the world is in progress.

Author

Sonar; Data Reduction; Algorithms

20040031752 Physics and Electronics Lab. TNO, The Hague, Netherlands

Satellite Sensors and Radar Sensors for Naval Fire Support (2001)

Greidanus, H.; Smith, A. J. E.; Steeghs, T. P. H.; Kleijweg, J. C. M.; Vermeulen, J. F. J.; February 2003; 43 pp.; In English

Contract(s)/Grant(s): A01/KM/852; B01/KM/853; TNO Proj. 015.31010; TNO Proj. 015.30668

Report No.(s): TD-2001-0313; FEL-02-A137; Copyright; Avail: Other Sources

The report concerns research done in 2001 on the possibilities of (a) space-based sensors and (b) radar sensors for use in Naval Fire Support (NFS) operations by the RNLN in the 2005-2010 timeframe. A non-exhaustive overview of potential sensors is given, and a start is made of characterizing these sensors for the purpose of modelling them in the NFS evaluation model. The latter is a software program currently being developed to simulate NFS operations. The sensors taken into account are spaceborne SAR and optical imagers, stand-off SAR and MTI, SAR and ISAR on piloted aircraft, SAR and MTI on UAV, ship-based sensors, and ground-based radar. Essential elements needed for the NFS evaluation model are probabilities of detection and recognition. As these are strongly dependent on sensor type and mode, target type, environment and imaging geometry, the parameter room is much too large to explore, and the present report limits itself to qualitative conclusions. More

qualitative results to be given in the next phase of the project will have to be guided by well-defined scenarios in order to give realistic limits to the number of cases to treat.
Author
Fire Control; Ships; Space Based Radar; Satellite Imagery; Radar Imagery; Remote Sensors; Satellite-Borne Instruments

20040031753 Physics and Electronics Lab. TNO, The Hague, Netherlands
Camera Motion Compensation: An Algorithm for the Compensation of Undesired Camera Motion using only Video Data
Beun, R. D. P.; Schot, H. J. M.; September 2003; 92 pp.; In English
Contract(s)/Grant(s): A01/KL/778; TNO Proj. 015.31335
Report No.(s): TD-2003-0071; FEL-03-A124; Copyright; Avail: Other Sources

Cameras mounted on moving vehicles produce images that contain not only the desired (smooth) motion, but also erratic motion. The later is caused by bumps in the terrain on which the vehicle drives. If telephoto lenses are used (as is usually the case for reconnaissance and surveillance tasks), or the vehicle drives off-road, the erratic motion will make it practically impossible to interpret the resulting images. The presented algorithm is able to determine the camera motion based on the video information alone. It uses 'static' points in the distant scene as reference points for determining the camera motion. Once the camera motion is known, a stabilized image sequence can be produced. The result is an output image sequence that looks more or less as if the camera moved smoothly over the scene, instead of erratically. The algorithm has been evaluated on recordings made from the Fennek reconnaissance vehicle. Large parts of the sequences could be successfully stabilized. Stabilization fails if the motion gets too extreme (deliberate rotation of the camera or extreme bumpy terrain), or bushes and trees block the view of the camera.
Author
Cameras; Motion; Video Compression; Algorithms

20040033373 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Improved Fine Sun Sensor Field of View Calibration
Sedlak, J.; Hashmall, J.; [2003]; 10 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA; No Copyright; Avail: CASI; A02, Hardcopy

The fine Sun sensor used on many spacecraft consists of two independent single-axis sensor heads, nominally mounted perpendicularly. These detect the Sun angle over a field of view typically of +32 deg. (There is a trade-off between accuracy and size of the field of view that allows for much latitude in any numbers quoted.) The nonlinear 'transfer' function that maps the telemetered counts into observed angles consists of 9 adjustable parameters for each axis (1 8 total). An augmented transfer function has previously been reported that achieves a significant accuracy improvement across the entire field of view. That function expands the parameter set to 12 coefficients per axis (24 total) and includes cross terms combining counts from both axes. To make the best use of the Sun sensor for attitude determination, it must be calibrated after launch. However, the large number of parameters and the nonlinearity of the problem make this a challenging task. The purpose of this paper is to examine ways to improve convergence of the parameter search algorithm. In particular, experience has shown that the problem should be broken down into several steps, solving for a selected subset of the parameters at each step. This approach has now been incorporated as an option in the calibration utility.
Author
Solar Sensors; Calibrating; View Effects; Field of View; Attitude (Inclination)

20040033991 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Calibration of Passive Microwave Hybrid Coupler-based Polarimeters
Piepmeier, J. R.; Kim, E. J.; May 02, 2003; 3 pp.; In English; 2003 International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France
Report No.(s): IGARSS2003-03.0521; No Copyright; Avail: CASI; A01, Hardcopy

Passive microwave polarimeters, or polarimetric radiometers, are important tools for Earth remote sensing. They have found utility in ocean surface wind-vector remote sensing and polarization basis rotation systems for compensating instrument or ionospheric induced rotation. The hybrid coupler-based polarimeter is a specific class of polarimeter that utilizes a 180-degree hybrid coupler to affect a correlation between the received vertical and horizontal polarization signals. This type of polarimeter requires at least four calibration states for complete calibration. One state must be a polarized signal, such as

the application of a correlated noise source. The phase balance of the noise source directly determines the quality of the calibration.
Author
Calibrating; Couplers; Remote Sensing; Radio Astronomy; Microwave Radiometers; Polarimeters

20040034094 Physics and Electronics Lab. TNO, The Hague, Netherlands
QWIP: A Study of Trends
deJong, A. N.; April 2003; 15 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 015.33132
Report No.(s): TD- 2003-0033; FEL-03-A064; Copyright; Avail: Other Sources

An analysis is given of the characteristics of Infrared cameras, using 'Quantum Well Infrared Photo-detectors' (QWIP). These detectors, operating in the 8-12 micron band, have been developed in the last decade and are serious competitors for the normally used Mercury Cadmium Telluride (MCT) detectors. A major advantage of QWIP is the greater stability and homogeneity. Disadvantages are the lower operating temperature and quantum efficiency, compared to MCT. Cameras have been built with large 2-D arrays with a Noise Equivalent Temperature Difference (NETD) below 30 mK, allowing improved detection range performance in comparison with first generation infrared cameras. Examples are given of experiments, carried out with QWIP cameras at different occasions. An important issue is the capability of QWIP material, to be constructed as a multi-band 3-5 and 8-10 micron unit. Cameras, based on this concept, allow multi-spectral target discrimination, using a single optical entrance pupil.
Author
Infrared Detectors; Quantum Wells; Cameras; Infrared Photometry

20040034120 Akron Univ., Akron, OH, USA
NE Ohio Urban Growth Monitoring and Modeling Prototype
Siebert, Loren; Klosterman, Richard E.; [October 2001]; 2 pp.; In English
Contract(s)/Grant(s): NAG3-2444
Report No.(s): OV-UA-NASA-2000-Report-2001-12-21-Rev; No Copyright; Avail: CASI; A01, Hardcopy

At the University of Akron, Dr. Loren Siebert, Dr. Richard Klosterman, and their graduate research assistants (Jung-Wook Kim, Mohammed Hoque, Aziza Parveen, and Ben Stabler) worked on the integration of remote sensing and GIs-based planning support systems. The primary goal of the project was to develop methods that use remote sensing land cover mapping and GIs-based modeling to monitor and project urban growth and farmland loss in northeast Ohio. Another research goal has been to use only GIS data that are accessible via the World Wide Web, to determine whether Ohio's small counties and townships that do not currently have parcel-level GIS systems can apply these techniques. The project was jointly funded by NASA and USGS OhioView grants during the 2000-2001 academic year; the work is now being continued under a USGS grant.
Derived from text
Farmlands; Prototypes; Remote Sensing; Support Systems; Urban Research

20040034174 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Integration, Testing and Performance of the Infrared Multi-Object Spectrometer
Ohl, Raymond G.; Connelly, Joseph A.; Boyle, Robert F.; Derro, Rebecca J.; Greenhouse, Matthew A.; Madison, Timothy J.; Mentzell, J. Eric; Sparr, Leroy M.; Hylan, Jason E.; Ray, Knute, et al.; [2003]; 2 pp.; In English; SPIE Astronomical Telescopes and Instrumentation, 21-25 Jun. 2004, Glasgow, Scotland, UK; Copyright; Avail: CASI; A01, Hardcopy

The Infrared Multi-Object Spectrometer (IRMOS) is a principle investigator-class instrument for the Kitt Peak National Observatory 2.1 m and Mayall 3.8 m telescopes. IRMOS is a near-IR (0.8 - 2.5 micron) spectrometer with low-to mid-resolving power (R = lambda/delta lambda = 300 - 3000). On the 3.8 m telescope, IRMOS produces simultaneous spectra of approximately 100 objects in its approximately 3 x 2 arcmin field of view using a commercial micro electro-mechanical systems (MEMS) digital micro-mirror device (DMD) from Texas Instruments. The multi-mirror array DMD operates as a real-time programmable slit mask. The all-reflective optical design consists of two imaging subsystems. The focal reducer images the focal plane of the telescope onto the DMD field stop, and the spectrograph images the DMD onto a large-format detector. The instrument operates at approximately 80 K, cooled by a single electro-mechanical cryocooler. The bench and all components are made from aluminum 6061-T651. There are three cryogenic mechanisms. We describe laboratory integration and test of IRMOS before shipment to Kitt Peak. We give an overview of the optical alignment technique and integration of

optical, mechanical, electrical and cryogenic subsystems. We compare optical test results to model predictions of point spread function size and morphology, contrast, and stray light. We discuss some lessons learned and conclude with a prediction for performance on the telescope.
Author
Infrared Spectrometers; Telescopes; Infrared Radiation; Optics; Imaging Techniques

20040034189 NASA Glenn Research Center, Cleveland, OH, USA
PIV Investigations of the Flow Field in the Volute of a Rotary Blood Pump
Sankovic, John M.; Kadambi, Jaikrishnan R.; Mehta, Mehul; Smith, William A.; Wernet, Mark P.; February 2004; 14 pp.; In English; 2003 Fluids Engineering Division Summer Meeting, 6-10 Jul. 2003, Honolulu, HI, USA
Contract(s)/Grant(s): WBS 22-274-00-02-17
Report No.(s): NASA/TM-2004-212617; E-14155; FEDSM2003-45490; No Copyright; Avail: CASI; A03, Hardcopy

A full-size acrylic model of a rotary blood pump was developed in order to utilize Particle Image Velocimetry (PIV) to make measurements of the fluid velocities and turbulent stresses throughout the device. The development of an understanding of the hemodynamics within the blood pump is critical to the development and validation of computational models. A blood analog solution, consisting of sodium iodide solution and glycerin, was developed to match physiological kinematic viscosity. The refractive indecies of the fluid, the pump casing and the impeller were matched to facilitate the use of PIV to make velocity measurements. Velocity measurements made in the volute exit/diffuser region are presented for pumps speeds of 3000-3850 rpm. At each speed data were obtained at a physiological pressure of 90 mmHg and at a maximum flow condition. Four hundred data pairs were used for each resultant mean velocity vector value, representing greater than an order of magnitude more data pairs than reported previously in the literature on similar devices and resulting in velocity uncertainty levels of approximately 2.9%.
Author
Blood Pumps; Flow Distribution; Particle Image Velocimetry

20040034250 NASA Johnson Space Center, Houston, TX, USA
Lunar Surface Reference Missions: A Description of Human and Robotic Surface Activities
Duke, Michael B.; Hoffman, Stephen J.; Snook, Kelly; July 2003; 136 pp.; In English
Contract(s)/Grant(s): NAG9-1447
Report No.(s): NASA/TP-2003-212793; No Copyright; Avail: CASI; A07, Hardcopy

Most medical equipment to the International Space Station (ISS) is manisfested as part of the U.S. or the Russian medical hardware systems. However, certain medical hardware is also available as part of the Human Research Facility. The HRF and the JSC Medical Operations Branch established a Memorandum of Agreement for joint use of certain medical hardware, including the HRF ultrasound system, the only diagnostic imaging device currently manifested to fly on ISS. The outcome of a medical contingency may be changed drastically, or an unnecessary evacuation may be prevented, if clinical decisions are supported by timely and objective diagnostic information. In many higher-probability medical scenarios, diagnostic ultrasound is a first-choice modality or provides significant diagnostic information. Accordingly, the Clinical Care Capability Development Project is evaluating the HRF ultrasound system for its utility in relevant clinical siruations on board ISS. For effective management of these ultrasound-supported ISS medical scenarios, the resulting data should be available for viewing and interpretation on the ground, and bidirectional voice communication should be readily available to allow ground experts (sonographers, physicians) to provide guidance to the Crew Medical Officer. It may also be vitally important to have the capability of real-time guidance via video uplink to the CMO-opertor during an exam to facilitate the diagnosis in a timely fashion.
Derived from text
Lunar Surface; Robotics; Ultrasonics; International Space Station; Space Missions; Video Communication; Manned Space Flight

20040034748 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Development of Laser-Polarized Noble Gas Magnetic Resonance Imaging (MRI) Technology
Walsworth, Ronald L.; March 2004; 12 pp.; In English
Contract(s)/Grant(s): NAG9-1489; No Copyright; Avail: CASI; A03, Hardcopy

We are developing technology for laser-polarized noble gas nuclear magnetic resonance (NMR), with the aim of enabling it as a novel biomedical imaging tool for ground-based and eventually space-based application. This emerging

multidisciplinary technology enables high-resolution gas-space magnetic resonance imaging (MRI)-e.g., of lung ventilation, perfusion, and gas-exchange. In addition, laser-polarized noble gases (3He and 1BXe) do not require a large magnetic field for sensitive NMR detection, opening the door to practical MRI with novel, open-access magnet designs at very low magnetic fields (and hence in confined spaces). We are pursuing two specific aims in this technology development program. The first aim is to develop an open-access, low-field (less than 0.01 T) instrument for MRI studies of human gas inhalation as a function of subject orientation, and the second aim is to develop functional imaging of the lung using laser-polarized He-3 and Xe-129.
Derived from text
Product Development; Lasers; Polarization; Nuclear Magnetic Resonance; Technology Assessment; Imaging Techniques

20040034796 NASA Glenn Research Center, Cleveland, OH, USA
Human Research Initiative (HRI)
Motil, Brian; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 167-181; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A code U initiative starting in the FY04 budget includes specific funding for 'Phase Change' and 'Multiphase Flow Research' on the ISS. NASA GRC developed a concept for two facilities based on funding/schedule constraints: 1) Two Phase Flow Facility (TphiFFy) which assumes integrating into FIR; 2) Contact Line Dynamics Experiment Facility (CLiDE) which assumes integration into MSG. Each facility will accommodate multiple experiments conducted by NRA selected PIs with an overall goal of enabling specific NASA strategic objectives. There may also be a significant ground-based component.
Derived from text
Spaceborne Experiments; Test Facilities; Microgravity

20040035604 Hawaii Univ., Honolulu, HI, USA
The NASA IRTF: Solar System Observations and Mission Support
Kudritzki, Rolf-Peter; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NCC5-538; No Copyright; Avail: CASI; A01, Hardcopy

This report covers the period from 1 July 2002 through 30 June 2003. The NASA Infrared Telescope Facility (IRTF) is a 3.0 m infrared telescope located at an altitude of 4.2 km on the summit of Mauna Kea in Hawaii. It was established by NASA in 1979 primarily to provide infrared observations in support of NASA's programs. The IRTF is managed and operated by the University of Hawaii (UH) Institute for Astronomy (IfA) under a five-year cooperative agreement between NASA and UH that started in February 2001. NASA provides the costs of operation, and NSF provides support for new focal plane instrumentation based on grant applications from IRTF support astronomers. Observing time is open to the entire astronomical community, and 50% of the IRTF observing time is reserved for studies of solar system objects.
Author
Infrared Telescopes; Solar System

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20040033974 Tsinghua Univ., Bejing, China
Analysis of Non-Fourier Effect and Laser-induced Thermal Damage of Laser-irradiated Layered Human Skin Tissue
Ma, Ning; Jiang, Shi-Chen; Li, He-Jie; Zhang, Xue-Xue; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 133-137; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research is to analyze the non-Fourier effect in layered human skin irradiated by laser beams, and to study the laser-induced thermal damage of the human skin. Photon transportation in the skin tissue was simulated with the Monte Carlo method. With the laser energy regarded as the internal hear source, transient temperature rising, temperature distribution and thermal damage periods in the layered human skin were analyzed with the thermal-wave model of bio-heat

transfer (TWMBT). The therapeutic period of demopathy was then discussed in detail. A theoretical analysis of this methodology is presented.
Derived from text
Mathematical Models; Skin (Anatomy); Tissues (Biology); Monte Carlo Method; Aerospace Medicine; Irradiation; Heat Tolerance; Laser Beams

20040034773 QSS Group, Inc., Seabrook, MD, USA
Comparison of Single-Event Transients Induced in an Operational Amplifier (LM124) by Pulsed Laser Light and a Broad Beam of Heavy Ions
Buchner, Steve; McMorrow, Dale; Poivey, Christian; Howard, James, Jr.; Pease, Rom; Savage, Mark; Boulghassoul, Younis; Massengill, Lloyd; [2003]; 4 pp.; In English; European Conference on Radiation and its Effects on Components and Systems, 15-19 Sep. 2003, Noordwijk, Netherlands; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

A comparison of transients from heavy-ion and pulsed-laser testing shows good agreement for many different voltage configurations. The agreement is illustrated by comparing directly individual transients and plots of transient amplitude versus width.
Author
Ion Beams; Heavy Ions; Pulsed Lasers

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20040031765 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Qualifying the Sunpower M-87N Cryocooler for Operation in the AMS-02 Magnetic Field
Mustafi, Shuvo; Banks, Stuart; Shirey, Kimberly; Warner, Brent; Leidecker, Henning; Breon, Susan; Boyle, Rob; September 4, 2003; 1 pp.; In English; 20th Space Cryogenics Workshop, 18-19 Sep. 2003, Girdwood, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

The Alpha Magnetic Spectrometer-02 (AMs-02) experiment consists of a superfluid helium dewar. The outer vapor cooled shields of the dewar are to be held at 77 K by four Sunpower M87N cryocoolers. These cryocoolers have magnetic components that might interact with the external applied field generated by the superconducting magnet, thereby degrading the cryocoolers' performance. Engineering models of the Sunpower M87N are being tested at NASA Goddard Space Flight in order to qualify them to operate in a magnetic environment similar to the AMS-02 magnetic environment. AMS-02 will be a space station based particle detector studying the properties and origin of cosmic particles including antimatter and dark matter. It uses a superconducting magnet that is cooled by the superfluid helium dewar. Highly sensitive detector plates inside the magnet will measure a particle's momentum and charge.
Derived from text
Alpha Magnetic Spectrometer; Cryogenic Equipment; Dark Matter; Liquid Helium; Radiation Counters; Superconducting Magnets; Superfluidity

20040031845 Morgan Research Corp., Huntsville, AL, USA
Macromolecular Crystallization in Microfluidics for the International Space Station
Monaco, Lisa A.; Spearing, Scott; [2003]; 5 pp.; In English; NanoTech 2003 Conference and Trade Show, 23-27 Feb. 2003, San Francisco, CA, USA
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: CASI; A01, Hardcopy

At NASA's Marshall Space Flight Center, the Iterative Biological Crystallization (IBC) project has begun development on scientific hardware for macromolecular crystallization on the International Space Station (ISS). Currently ISS crystallization research is limited to solution recipes that were prepared on the ground prior to launch. The proposed hardware will conduct solution mixing and dispensing on board the ISS, be fully automated, and have imaging functions via remote commanding from the ground. Utilizing microfluidic technology, IBC will allow for on orbit iterations. The microfluidics LabChip(R) devices that have been developed, along with Caliper Technologies, will greatly benefit researchers by allowing

for precise fluid handling of nano/pico liter sized volumes. IBC will maximize the amount of science return by utilizing the microfluidic approach and be a valuable tool to structural biologists investigating medically relevant projects.
Author
Crystallization; Molecular Biology; Proteins; Imaging Techniques; Dispensers

20040033369 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effects of Forged Stock and Pure Aluminum Coating on Cryogenic Performance of Heat Treated Aluminum Mirrors
Toland, Ronald; Ohl, Raymond G.; Barthelmy, Michael P.; Zewari, S. Wahid; Greenhouse, Matthew A.; MacKenty, John W.; [2003]; 2 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: Other Sources; Abstract Only

In spite of its baseline mechanical stress relief, aluminum 6061-T651 harbors some residual stress that may relieve and distort mirror figure to unacceptable levels at cryogenic operating temperatures unless relieved during fabrication. Cryogenic instruments using aluminum mirrors for both ground-based and space IR astronomy have employed a variety of heat treatment formulae, with mixed results. We present the results of an on-going test program designed to empirically determine the effects of different stress relief procedures for aluminum mirrors. Earlier test results identified a preferred heat treatment for flat and spherical mirrors diamond turned from blanks cut out of Al6061-T651 plate stock. Further tests have been performed on mirrors from forged stock and one set from plate stock coated with Alumiplate(TM) aluminum coating to measure the effect of these variables on cryogenic performance. The mirrors are tested for figure error and radius of curvature at room temperature and at 80 K for three thermal cycles. We correlate the results of our optical testing with heat treatment and metallographic data.
Author
Aluminum Coatings; Cryogenic Temperature; Curvature; Fabrication; Mirrors; Heat Treatment; Residual Stress; Technology Assessment

20040033993 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Control Surface Seal Development for Future Space Vehicles
DeMange, Jeffrey J.; Dunlap, Patrick H.; Steinetz, Bruce M.; November 03, 2003; 10 pp.; In English; 2003 NASA Seal/Secondary Air System Workshop, 5-6 Nov. 2003, Cleveland, OH, USA; Original contains black and white illustrations Contract(s)/Grant(s): WBS 22-794-40-4V; Copyright; Avail: CASI; A02, Hardcopy

NASA's Glenn Research Center (GRC) has been developing advanced high temperature structural seals since the late 1980s and is currently developing seals for future space vehicles as part of the Next Generation Launch Technology (NGLT) program. This includes control surface seals that seal the edges and hinge lines of movable flaps and elevons on future reentry vehicles. In these applications, the seals must operate at temperatures above 2000 F in an oxidizing environment, limit hot gas leakage to protect underlying structures, endure high temperature scrubbing against rough surfaces, and remain flexible and resilient enough to stay in contact with sealing surfaces for multiple heating and loading cycles. For this study, three seal designs were compared against the baseline spring tube seal through a series of compression tests at room temperature and 2000 F and flow tests at room temperature. In addition, canted coil springs were tested as preloaders behind the seals at room temperature to assess their potential for improving resiliency. Addition of these preloader elements resulted in significant increases in resiliency compared to seals by themselves and surpassed the performance of the baseline seal at room temperature. Flow tests demonstrated that the seal candidates with engineered cores had lower leakage rates than the baseline spring tube design. However, then the seals were placed on the preloader elements, the flow rates were higher as the seals were not compressed as much and therefore were not able to fill the groove as well. High temperature tests were also conducted to assess the compatability of seal fabrics against cermaic matrix composite (CMC) panels anticipated for use in next generation launch vehicles. These evaluations demonstrated potential bonding issues between the Nextel fabrics and CMC candidates.
Author
Seals (Stoppers); Control Surfaces; Reentry Vehicles

20040034063 NASA Glenn Research Center, Cleveland, OH, USA
High Temperature Propulsion System Structural Seals for Future Space Launch Vehicles
Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; DeMange, Jeffrey J.; November 03, 2003; 9 pp.; In English; 2003 NASA Seal/Secondary Air Systems Workshop, 5-6 Nov. 2003, Cleveland, OH, USA; Original contains black and white illustrations Contract(s)/Grant(s): 22-794-04-4V; Copyright; Avail: CASI; A02, Hardcopy

Durable, flexible sliding seals are required in advanced hypersonic engines to seal the perimeters of movable engine ramps for efficient, safe operation in high heat flux environments at temperatures of 2000 to 2500 F. Current seal designs do not meet the demanding requirements for future engines, so NASA's Glenn Research Center is developing advanced seals and preloading devices to overcome these shortfalls. An advanced ceramic wafer seal design and two types of seal preloading devices were evaluated in a series of compression, scrub, and flow tests. Silicon nitride wafer seals survived 2000 in. (1000 cycles) of scrubbing at room temperature against an Inconel 625 rub surface with no chips or signs of damage. Flow rates measured for the wafers before and after scrubbing were almost identical and were much lower than those recorded for the best braided rope seal flow blockers. Canted coil springs and silicon nitride compression springs showed promise conceptually as potential seal preloading devices to help maintain seal resiliency. A finite element model of the canted coil spring revealed that it should be possible to produce a spring out of high temperature materials for applications at 2000+ F.
Author
Seals (Stoppers); High Temperature; Launch Vehicles; Spacecraft Propulsion

20040034097 NASA Marshall Space Flight Center, Huntsville, AL, USA
2XXX Aluminum Self Reacting Friction Stir Weld Development
Brown, Randy J.; Schneider, Jules; Hartley, Paula J.; Russell, Carolyn; Lawless, Kirby; Jones, Chip; [2003]; 22 pp.; In English; Aeromat 2003, 16-18 Jun. 2003, Dayton, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

Weld process development are: (1) Execute a two-phased design of experiment (DOE) approach: process DOE to establish rotation and travel speeds and forge load;set-up DOE to establish allowable gap and centerline offset. (2) Determine the effect of process parameters on strength and weld quality: room and -320 deg F tensile testing; metalllurgical and NDE evaluation. (3) Weld quality goals: visual and radiographic acceptable; room temperature ultimate strength.
Derived from text
Weld Strength; Nondestructive Tests; Friction Stir Welding; Aluminum

20040034194 NASA Marshall Space Flight Center, Huntsville, AL, USA
Sodium Heat Pipe Module Processing For the SAFE-100 Reactor Concept
Martin, James; Salvail, Pat; [2003]; 8 pp.; In English; STAIF 2004 Conference, 8-12 Feb. 2004, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

To support development and hardware-based testing of various space reactor concepts, the Early Flight Fission-Test Facility (EFF-TF) team established a specialized glove box unit with ancillary systems to handle/process alkali metals. Recently, these systems have been commissioned with sodium supporting the fill of stainless steel heat pipe modules for use with a 100 kW thermal heat pipe reactor design. As part of this effort, procedures were developed and refined to govern each segment of the process covering: fill, leak check, vacuum processing, weld closeout, and final 'wet in'. A series of 316 stainless steel modules, used as precursors to the actual 321 stainless steel modules, were filled with 35 +/- 1 grams of sodium using a known volume canister to control the dispensed mass. Each module was leak checked to less than10(exp -10) std cc/sec helium and vacuum conditioned at 250 C to assist in the removal of trapped gases. A welding procedure was developed to close out the fill stem preventing external gases from entering the evacuated module. Finally the completed modules were vacuum fired at 750 C allowing the sodium to fully wet the internal surface and wick structure of the heat pipe module.
Author
Heat Pipes; Sodium; Test Facilities; Alkali Metals; Modules; Reactor Design

20040034217 Vaexjoe Univ., Stockholm, Sweden
Total Time on Test, TTT-Plots for Condition Monitoring of Rolling Element Bearings in Paper Mills
Al-Najjar, Basim; International Journal of COMADEM; April 2003; Volume 6, No. 2, pp. 27-32; In English
Report No.(s): ISSN 1363-7681; Copyright; Avail: Other Sources

Monitoring the mean effective life of identical bearings and their probability density function is useful to detect dramatic changes in the distribution of the time to failure/replacement, which is an indication of whether there are deviations in the quality of these bearings and in their operating/environmental conditions. When using a periodic measurement system for monitoring vibration, the time between measurements is almost always considered cons.tant. I t is usually assessed based on the maintenance staff's experience. But, using GTTT-plot, maintenance engineers can in advance predict the probability of replacement/failure of the bearing during the period to the next proposed measurement opportunity or planned stoppage, which yields a reliable planning of measurements. Consequently, an of replacement/failure is low fewer measurements are needed, but when it is high, the risk of failure can be reduced by more frequent readings. Finally, the probability of replacement/failure

of a bearing can be assessed independent of the technique being used for monitoring the condition of a bearing whether it is vibration, SPM, acoustic emission or bearing age. economic saving can be achieved. When the predicted probability
Derived from text
Roller Bearings; Service Life; Prediction Analysis Techniques

20040034257 National Renewable Energy Lab., Golden, CO
Safety and Performance Assessment of Ethanol/Diesel Blends (E-Diesel)
Waterland, L. R.; Venkatesh, S.; Unnasch, S.; Sep. 2003; 52 pp.; In English
Report No.(s): DE2003-15004720; NREL/SR-540-34817; No Copyright; Avail: Department of Energy Information Bridge

There has been a recent revival in interest in the use of ethanol-diesel fuel blends (E-diesel) in heavy-duty vehicles as a means to reduce petroleum dependency, increase renewable fuels use, and reduce vehicle emissions. At present there are five main providers of additive packages that allow the preparation, by splash blending, of stable E-diesel blends generally containing 10% to 15% ethanol. The current target market is use in centrally-fueled vehicle fleets. Because E-diesel does not meet all the ASTM specifications for diesel fuel, it probably cannot be legally sold at the retail level in most states. The major concern with the use of E-diesel derives from its flammability characteristics.
NTIS
Transportation; Diesel Fuels; Ethyl Alcohol; Combustion Products

20040034802 NASA Glenn Research Center, Cleveland, OH, USA
Report of the Stability and Dynamics Session
Alexander, Iwan; Chato, David; Collicott, Steven; Dadzic, Nihad; Duval, Walter; Garoff, Steven; Grayson, Gary; Hochstein, John; Kassemi, Mo; Nelson, Emily, et al.; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 61-70; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The plan for session are: 1. Are issues in the draft document appropriate and complete? 2. Are the issues properly organized and prioritized? 3. Is the plan well defined and suitable? 4. Are the proposed facilities adequate?
CASI
Stability; Dynamics; Porous Materials; Management Planning; Vibration

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20040031628 Building and Construction Research TNO, Delft, Netherlands
Failure Criteria with Regard to Survivability
Bosman, B.; July 09, 2003; 27 pp.; In English
Contract(s)/Grant(s): A02/KM/109; TNO Proj. 006.38109/01.04
Report No.(s): TD-2003-0010; TNO-2003-CMC-R048; Copyright; Avail: Other Sources

This study is part of program A02KM109 V058 and concerns survivability. The response of equipment, caused by underwater shock, can be described by an acceleration history. The aim of this study is to indicate the shock resistance of certain groups of equipment by maximum allowable accelerations for use in survivability studies. Such an indication is essential for judging the likelihood of failure for a given shock condition. Since vertical shock loading, in upward direction, dominates only levels for the vertical upward direction are considered. The equipment is divided in groups. As far as data are available, tables are generated of maximum allowable accelerations (expressed in g-levels) for each group. For most groups wide variations of the values found exist. These variations will be less if less data of the group are available. In case of no variation, often only one value is available.
Author
Failure; Shock Resistance; Durability

20040034065 Army Research Lab., Cleveland, OH, USA
TF41 Engine Fan Disk Seeded Fault Crack Propagation Test
Lewicki, David G.; [2003]; 6 pp.; In English; American Helicopter Society Propulsion Specialists' Meeting, 28 Oct. 2003, Williamsburg, VA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-728-30-03; No Copyright; Avail: CASI; A02, Hardcopy

Uncontained engine failures, although rare in occurrence, can have a catastrophic effect on aircraft performance and safety. Engine disk cracks can eventually lead to these type of failures. A number of techniques to detect engine disk cracks have been developed in recent years. However, these technologies have only been validated by disk spin pit tests, not actual engine tests. Due to this, a project was established to perform seeded fault engine tests on a TF41 engine disk fan. A defect was machined in the first stage fan disk of a TF41 engine. The disk was run in a spin pit to initiate a crack. Once initiated, the disk was run in an actual engine test facility. The engine was cycled by a number of start and stops with the goal of propagating the crack to disk burst through low cycle fatigue. Various crack detection techniques were installed on the engine and run real-time during the test to validate their abilities to detect disk cracks. These techniques were based on methods such as change in mass imbalance using vibration or shaft displacement, change in blade position, acoustic emission, and torsional resonance. At the completion of 4474 test cycles, the crack in the TF41 disk was determined to have grown approximately 0.025 inches. This was far less the predicted crack growth based on a fracture mechanics analysis and finite element stress analysis.
Author
Engine Failure; Engine Tests; Crack Propagation; Fracture Mechanics

20040034081 Institute of Industrial Technology TNO, Eindhoven, Netherlands
Correlations of Artificial Corrosion Tests with Outdoor Exposure for Corrosion Protective Coatings
Hoeflaak, M.; November 18, 2002; 36 pp.; In Dutch
Contract(s)/Grant(s): A01/KL/124; TNO Proj. 007.62148
Report No.(s): TD-2003-0165; TNO-42/03.006532/sec; Copyright; Avail: Other Sources

Protective coatings on aluminum and steel substrates are tested with accelerated artificial corrosion tests and by outdoor exposure. The artificial tests are the salt fog test, the fresh water immersion test, the cyclic TNO corrosion test and the Prohesion test. For the different tests the correlation coefficients with outdoor exposure are calculated. The fresh water immersion test is unsuitable for the determination of corrosion resistance, due to the very low correlations with outdoor exposure. The salt fog test only correlates well for the surface of the coating systems on steel, but not for scribes in coatings on steel and aluminum. Correlation coefficients do not improve significantly be combining different test durations and by combining different test methods. Based on overall performance the Prohesion test and the cyclic TNO corrosion test are recommended for testing the durability of protective coating systems on aluminum and steel.
Author
Accelerated Life Tests; Corrosion Tests; Protective Coatings

20040034199 Ohio Aerospace Inst., OH, USA
Advanced Seal Development
[2003]; 3 pp.; In English
Contract(s)/Grant(s): NCC3-840; No Copyright; Avail: CASI; A01, Hardcopy

Under this cooperative agreement, the work conducted was in support of the Directors Discretionary Fund and the Smart Efficient Components (SEC) Program. The goal of this continuing program is to develop an innovative Acoustic-Based Seal that shows the potential of operating with zero-leakage and zero-wear by exploiting recent developments in acoustics. By oscillating specially shaped resonating cavities at frequencies equivalent to the resonant frequency of the fluid contained by the cavity, the research group has demonstrated that high- amplitude standing pressure waves can be produced. While others are applying this technology to compressors, NASA proposes to develop a revolutionary new class of seals that will impact the turbine engine and power generation industries. The intent of this activity is to continue the formation of a strong relationship between the research initiatives at the Ohio Aerospace Institute (OAI) and the NASA Glenn Research Center (NASA GRC).
Derived from text
Acoustics; High Pressure; Seals (Stoppers)

20040034843 Lawrence Livermore National Lab., Livermore, CA
Development of a Multi-Layer Guided Wave Inspection Technique
Quarry, M.; Chinn, D.; Hay, T.; Mar. 12, 2001; 18 pp.; In English
Report No.(s): DE2003-15005388; UCRL-ID-142930; No Copyright; Avail: Department of Energy Information Bridge

This study investigates the inspection of a particular layer of a multi-layer structure using ultrasonic guided waves. Techniques based on Lamb waves have been developed for the inspection of plate structures and are well understood. Guided waves also exist in multi-layered plates as well. Energy distributions vary across the thickness of a multi-layer structure depending on the mode and frequency. Hence, a potential way to inspect the bottom layer of a structure is to find modes with sufficient energy in the bottom layer.
NTIS
Laminates; Nonintrusive Measurement; Ultrasonics

20040035647 Shiga Prefecture Univ., Shiga, Japan
Optimisation of Inspection Time Vector and Warning Level in CBM Considering Residual Life Loss and Constraint on Preventive Replacement Probability
Okumura, Susumu; Okino, Norio; International Journal of COMADEM; April 2003; Volume 6, No. 2, pp. 10-18; In English
Report No.(s): ISSN 1363-7681; Copyright; Avail: Other Sources

Condition-based maintenance (CBM) is an effective preventive maintenance policy since the policy enhances system reliability and decreases the unwanted breakdown of the target maintained system and the maintenance cost. We propose a simultaneous optimization method of the inspection time vector, which is the time series of inspection, and a warning level of the target system under the constraint of preventive maintenance probability. The developed CBM model considers the residual life loss, which is related to the average remaining time from the preventive replacement conduction time until the expected breakdown time of a maintained system as well as the incurred replacement and inspection costs, whereby the long-run average incurred cost per unit time is derived as an objective function for minimization. An algorithm to solve the optimal inspection time vector and optimal warning level is established. Numerical examples to which the constructed CBM model and the solution algorithm have been applied are shown with a variety of parameters in the CBM model, together with the comparison of the results obtained in breakdown maintenance and optimal time-based maintenance.
Author
Preventive Maintenance; Reliability; Time Series Analysis; Probability Theory; Inspection; Policies

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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*.

20040031607 Lawrence Livermore National Lab., Livermore, CA
Structured Extended Finite Element Methods of Solids Defined by Implicit Surfaces
Belytschko, T.; Mish, K.; Moes, N.; Parimi, C.; Nov. 17, 2002; 46 pp.; In English
Report No.(s): DE2003-15004927; UCRL-ID-152402; No Copyright; Avail: Department of Energy Information Bridge

A paradigm is developed for generating structured finite element models from solid models by means of implicit surface definitions. The implicit surfaces are defined by radial basis functions. Internal features, such as material interfaces, sliding interfaces and cracks are treated by enrichment techniques developed in the extended finite element method (X-FEM). Methods for integrating the weak form for such models are proposed. These methods simplify the generation of finite element models. Results presented for several examples show that the accuracy of this method is comparable to standard unstructured finite element methods.
NTIS
Finite Element Method; Solids; Mathematical Models; Mechanical Properties

20040031632 NASA Langley Research Center, Hampton, VA, USA
Physically Based Failure Criteria for Transverse Matrix Cracking
Davila, Carlos G.; Camanho, Pedro P.; November 20, 2003; 8 pp.; In English; 9th Portuguese Conference on Fracture, 18-20 Feb. 2004, Setubal, Portugal
Contract(s)/Grant(s): 719-20-40-10; Copyright; Avail: CASI; A02, Hardcopy

A criterion for matrix failure of laminated composite plies in transverse tension and in-plane shear is developed by examining the mechanics of transverse matrix crack growth. Matrix cracks are assumed to initiate from manufacturing defects and can propagate within planes parallel to the fiber direction and normal to the ply mid-plane. Fracture mechanics models of cracks in unidirectional laminates, embedded plies and outer plies are developed to determine the onset and direction of propagation for unstable crack growth. The models for each ply configuration relate ply thickness and ply toughness to the corresponding in-situ ply strength. Calculated results for several materials are shown to correlate well with experimental results.
Author
Fracture Mechanics; Mechanical Properties; Failure Analysis; Crack Propagation; Matrix Materials

20040031675 NASA Langley Research Center, Hampton, VA, USA
Automated Finite Element Analysis of Elastically-Tailored Plates
Jegley, Dawn C., Technical Monitor; Tatting, Brian F.; Guerdal, Zafer; December 2003; 52 pp.; In English
Contract(s)/Grant(s): NAS1-00135; WU 23-719-55-TA
Report No.(s): NASA/CR-2003-212679; No Copyright; Avail: CASI; A04, Hardcopy

A procedure for analyzing and designing elastically tailored composite laminates using the STAGS finite element solver has been presented. The methodology used to produce the elastic tailoring, namely computer-controlled steering of unidirectionally reinforced composite material tows, has been reduced to a handful of design parameters along with a selection of construction methods. The generality of the tow-steered ply definition provides the user a wide variety of options for laminate design, which can be automatically incorporated with any finite element model that is composed of STAGS shell elements. Furthermore, the variable stiffness parameterization is formulated so that manufacturability can be assessed during the design process, plus new ideas using tow steering concepts can be easily integrated within the general framework of the elastic tailoring definitions. Details for the necessary implementation of the tow-steering definitions within the STAGS hierarchy is provided, and the format of the ply definitions is discussed in detail to provide easy access to the elastic tailoring choices. Integration of the automated STAGS solver with laminate design software has been demonstrated, so that the large design space generated by the tow-steering options can be traversed effectively. Several design problems are presented which confirm the usefulness of the design tool as well as further establish the potential of tow-steered plies for laminate design.
Author
Finite Element Method; Automatic Control; Elastic Properties; Plates (Structural Members); Optimization; Mechanical Properties; Mathematical Models

20040034044 NASA Marshall Space Flight Center, Huntsville, AL, USA, Mississippi State Univ., Mississippi State, MS, USA
TEM study of the FSW nugget in AA2195-T81
Schneider, J. A.; Nunes, A. C., Jr.; Chen, P. S.; Steele, G.; [2004]; 21 pp.; In English
Contract(s)/Grant(s): NAG8-1859; No Copyright; Avail: CASI; A03, Hardcopy

During fiiction stir welding (FSW) the material being joined is subjected to a thermal- mechanical process in which the temperature, strain and strain rates are not completely understood. To produce a defect fiee weld, process parameters for the weld and tool pin design must be chosen carefully. The ability to select the weld parameters based on the thermal processing requirements of the material, would allow optimization of mechanical properties in the weld region. In this study, an attempt is made to correlate the microstructure with the variation in thermal history the material experiences during the FSW process.
Author
Mechanical Properties; Transmission Electron Microscopy; Friction Stir Welding; Microstructure; Aluminum-Lithium Alloys

20040034208 NASA Langley Research Center, Hampton, VA, USA
Analysis Method for Inelastic, Adhesively Bonded Joints with Anisotropic Adherends
Smeltzer, Stanley S., III; Klang, Eric C.; [2003]; 18 pp.; In English; 18th American Society for Composites Technical Conference, 20-22 Oct. 2003, Ganesville, FL, USA
Contract(s)/Grant(s): 721-21-30-01; No Copyright; Avail: CASI; A03, Hardcopy

A one-dimensional analysis method for evaluating adhesively bonded joints composed of anisotropic adherends and adhesives with nonlinear material behavior is presented in the proposed paper. The strain and resulting stress field in a general, bonded joint overlap are determined by using a variable-step, finite-difference solution algorithm to iteratively solve a system of first-order differential equations. Applied loading is given by a system of combined extensional, bending, and shear forces

that are applied to the edge of the joint overlap. Adherends are assumed to behave as linear, cylindrically bent plates using classical laminated plate theory that includes the effects of first-order transverse shear deformation. Using the deformation theory of plasticity and a modified von-Mises yield criterion, inelastic material behavior is modeled in the adhesive layer. Results for the proposed method are verified against previous results from the literature and shown to be in excellent agreement. An additional case that highlights the effects of transverse shear deformation between similar adherends is also presented.
Author
Adhesive Bonding; Bonded Joints; Deformation; Inelastic Stress; Anisotropy; Mathematical Models

20040034248 Aluminum Co. of America, USA
Effect of Fatigue Crack on Static Strength: 2014-T6, 2024-T4, 6061-T6, 7075-T6 Open-Hole Monobloc Specimens
Nordmark, Glenn E.; Eaton, Ian D.; May 1957; 23 pp.; In English
Report No.(s): NACA-TM-1428; No Copyright; Avail: CASI; A03, Hardcopy
Static tensile test results are presented for specimens of 2014-T6, 2024-T4, 6061-T6, and 7075-T6 aluminum alloy containing fatigue cracks. The results are found to be in good agreement with the results reported for similar tests from other sources. The results indicate that the presence of a fatigue crack reduced the static strength, in all cases, by an amount larger than the corresponding reduction in net area; the 6061-T6 alloy specimens were least susceptible to the crack and the 7075-T6 alloy specimens were most susceptible. It is indicated that a 7075-T6 specimen may develop as little as one-third of the expected static tensile strength when the fatigue crack was consumed only one-fourth of the original area. It was found that the static strength was substantially higher for specimens which had stop holes drilled at the end of the fatigue crack.
Author
Aluminum Alloys; Cracks; Tensile Strength

20040034252 Defence Science and Technology Organisation, Edinburgh, Australia
Compendium of Results From Firing Different Explosively Formed Projectiles
McQueen, Darren; August 2003; 110 pp.; In English
Report No.(s): DSTO-TR-1479; DODA-AR-012-868; Copyright; Avail: Other Sources
This compendium assembles the results from a series of firings utilizing different variations of Explosively Formed Projectiles (EFP'S). Variations were applied to the design of the liner, casing and explosive. Following computer numerical modelling, short listed candidates were manufactured and fired into steel witness plates. The results were then tabulated accordingly. Also used during the firing phase was Flash radiography (FXR) to study velocity and flight characteristics.
Author
Projectiles; Explosive Forming

20040034295 Lawrence Livermore National Lab., Livermore, CA
Practical Issues Associated with Mortar Projections in Large Deformation Contact/Impact Analysis
Laursen, T. A.; Ppuso, M. A.; Heinstein, M. W.; May 02, 2002; 14 pp.; In English
Report No.(s): DE2003-15005399; UCRL-JC-148194; No Copyright; Avail: Department of Energy Information Bridge
This paper concerns itself with the successful extension of these methods to encompass contact of geometrically noncoincident surfaces. The issue of patch test passage over curved interfaces will be discussed. It will be shown that a generalization of the mortar projection method is required to pass patch tests in this instance. Issues relating to the exact numerical integration of the mortar projection integrals will also be outlined, and a convergence study for a mortar tying application will be presented.
NTIS
Numerical Integration; Convergence; Deformation; Patch Tests

20040034778 NASA Marshall Space Flight Center, Huntsville, AL, USA
Foam on Tile Impact Modeling for the STS-107 Investigation
Stellingwerf, R. F.; Robinson, J. H.; Richardson, S.; Evans, S. W.; Stallworth, R.; Hovater, M.; [2004]; 11 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; Copyright; Avail: CASI; A03, Hardcopy
Following the breakup of the Space Shuttle Columbia during reentry a NASA/Contractor investigation team was formed to examine the probable damage inflicted on Orbiter Thermal Protection System elements by impact of External Tank insulating foam projectiles. The authors formed a working subgroup within the larger team to apply the Smooth Particle

Hydrodynamics code SPHC to the damage estimation problem. Numerical models of the Orbiter's tiles and of the Tank's foam were constructed and used as inputs into the code. Material properties needed to properly model the tiles and foam were obtained from other working subgroups who performed tests on these items for this purpose. Two- and three-dimensional models of the tiles were constructed, including the glass outer layer, the main body of LI-900 insulation, the densified lower layer of LI-900, the Nomex felt mounting layer, and the Aluminum 2024 vehicle skin. A model for the BX-250 foam including porous compression, elastic rebound, and surface erosion was developed. Code results for the tile damage and foam behavior were extensively validated through comparison with Southwest Research Institute foam-on-tile impact experiments carried out in 1999. These tests involved small projectiles striking individual tiles and small tile arrays. Following code and model validation we simulated impacts of larger foam projectiles on the examples of tile systems used on the Orbiter. Results for impacts on the main landing gear door are presented in this paper, including effects of impacts at several angles, and of rapidly rotating projectiles. General results suggest that foam impacts on tiles at about 500 mph could cause appreciable damage if the impact angle is greater than about 20 degrees. Some variations of the foam properties, such as increased brittleness or increased density could increase damage in some cases. Rotation up to 17 rps failed to increase the damage for the two cases considered. This does not rule out other cases in which the rotational energy might lead to an increase in tile damage, but suggests that in most cases rotation will not be an important factor.
Author (revised)
Columbia (Orbiter); Accident Investigation; Foams; Thermal Protection; Impact Damage; Damage Assessment; Tiles

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*.

20040031838 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Geoscience Laser Altimeter System (GLAS) on the ICESat Mission: Initial Science Measurement Performance
Abshire, James B.; Sun, Xiaoli; Riris, Haris; Sirota, Marcos; McGarry, J.; Palm, Steve; [2003]; 1 pp.; In English; 2003 Fall American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Geoscience Laser Altimeter System is the space lidar on the NASA ICESat mission. Its design combines an altimeter with 5 cm precision with a laser pointing angle determination system and a dual wavelength cloud and aerosol lidar. GLAS measures the range to the Earth s surface with 1064 nm laser pulses. Each laser pulse produces a precision pointing measurement from the stellar reference system (SRS) and an echo pulse waveform, which permits range determination and waveform spreading analysis. The single shot ranging accuracy is < 10 cm for ice surfaces with slopes < 2 degrees. GLAS also measures atmospheric backscatter profiles at both 1064 and 532 nm. The 1064 nm measurements use an analog Si APD detector and measure the height and profile the backscatter signal from thicker clouds. The measurements at 532 nm use photon counting detectors, and will measure the vertical height distributions of optically thin clouds and aerosol layers Before launch, the measurement performance of GLAS was evaluated using a lidar test instrument called the Bench Check Equipment (BCE). The BCE was developed in parallel with GLAS and served as an inverse altimeter, inverse lidar and a stellar source simulator. It was used to simulate the range of expected optical inputs to the GLAS receiver by illuminating its telescope with simulated background light as well as laser echoes with known powers, energy levels, widths and delay times. The BCE also allowed monitoring of the transmitted laser energy, the angle measurements of the SRS, the co-alignment of the transmitted laser beam to the receiver line of sight, and performance of the flight science algorithms. Performance was evaluated during the GLAS development, before and after environmental tests, and after delivery to the spacecraft. The ICESat observatory was launched into a 94 degree inclination, 590 km altitude circular polar orbit on January 12,2003. Beginning in early February, GLAS was powered on tested in stages. Its 1064 nm optical receiver was evaluated in a several tests using both solar background light and an internal test source. Laser 1 was activated on February 20,2003. GLAS operated with Laser 1 for 38 continuous days on orbit using its 1064 nm receiver channel, producing over 130 million individual laser measurements of the Earth s surface and atmosphere. These nadir-pointed measurements fell along the ICESat s ground track, and spanned more than 4 cycles of the initial 8-day ICESat repeat orbit. The initial GLAS measurement set shows strong echo pulses from ranging to the surface topography, oceans, ice sheets and cloud tops, as well as profiles of clouds and aerosols. The GLAS measurements have unprecedented vertical and angular resolution, and show nearly continuous height profiles of ice, land and ocean surfaces or cloud tops, as well profiles of backscatter from thin clouds and aerosol layers. Examples of these GLAS

measurements and an initial assessment of its science measurement performance will be presented.
Author
Laser Altimeters; Laser Applications; Ice, Cloud and Land Elevation Satellite; Energy Levels; Cloud Height Indicators; Background Radiation; Aerosols

20040034205 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellites Seek Gravity Signals for Remote Sensing the Seismotectonic Stresses in Earth
Liu, Han-Shou; Chen, Jizhong; Li, Jinling; [2003]; 2 pp.; In English; American Geophysical Union 2003 Fall Meeting, 8-12 Dec. 2003, Sam Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The ability of the mantle to withstand stress-difference due to superimposed loads would appear to argue against flow in the Earth s mantle, but the ironic fact is that the satellite determined gravity variations are the evidence of density differences associated with mantle flow. The type of flow which is most likely to be involved concerns convection currents. For the past 4 decades, models of mantle convection have made remarkable advancements. Although a large body of evidence regarding the seafloor depth, heat flow, lithospheric strength and forces of slab-pull and swell-push has been obtained, the global seismotectonic stresses in the Earth are yet to be determined. The problem is that no one has been able to come up with a satisfactory scenario that must characterize the stresses in the Earth which cause earthquakes and create tectonic features.
Author
Remote Sensing; Convection Currents; Heat Transmission; Seismology; Earth Mantle; Earthquakes

20040034237 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CHAMP Magnetic Anomalies of the Antarctic Crust
Kim, Hyung Rae; Gaya-Pique, Luis R.; vonFrese, Ralph R. B.; Taylor, Patrick T.; Kim, Jeong Woo; [2003]; 6 pp.; In English; 2nd CHAMP Meeting, 1-5 Sep. 2003, Potsdam, Germany; Copyright; Avail: CASI; A02, Hardcopy

Regional magnetic signals of the crust are strongly masked by the core field and its secular variations components and hence difficult to isolate in the satellite measurements. In particular, the un-modeled effects of the strong auroral external fields and the complicated- behavior of the core field near the geomagnetic poles conspire to greatly reduce the crustal magnetic signal-to-noise ratio in the polar regions relative to the rest of the Earth. We can, however, use spectral correlation theory to filter the static lithospheric and core field components from the dynamic external field effects. To help isolate regional lithospheric from core field components, the correlations between CHAMP magnetic anomalies and the pseudo magnetic effects inferred from gravity-derived crustal thickness variations can also be exploited.. Employing these procedures, we processed the CHAMP magnetic observations for an improved magnetic anomaly map of the Antarctic crust. Relative to the much higher altitude Orsted and noisier Magsat observations, the CHAMP magnetic anomalies at 400 km altitude reveal new details on the effects of intracrustal magnetic features and crustal thickness variations of the Antarctic.
Author
Crusts; Thickness; Magnetic Cores; Antarctic Regions; Spectral Correlation; Signal to Noise Ratios

20040034723 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Welcome to NASA's Earth Science Enterprise: Educational CD-ROM Activity Supplement
[1999]; 94 pp.; In English
Report No.(s): NASA/NP-1999-01-005-GSFC; No Copyright; Avail: CASI; A05, Hardcopy

Since its inception in 1958, NASA has been studying the Earth and its changing environment by observing the atmosphere, oceans, land, ice, and snow, and their influence on weather and climate. We now understand that the key to gaining a better understanding of the global environment is exploring how the Earth's systems of air, land, water, and life interact with each other. This approach-called Earth Systems Science-blends together fields like meteorology, oceanography, geology, and biology. In 1991, NASA launched a more comprehensive program to study the Earth as an integrated environmental system. They call it NASA's Earth Science Enterprise. A major component of the Earth Science Enterprise is the Earth Observing System (EOS). EOS is series of satellites to be launched over the next two decades that will be used to intensively study the Earth, with the hopes of expanding our under- standing of how natural processes affect us, and how we might be affecting them. Such studies will yield improved weather forecasts, tools for managing agriculture and forests, information for fishermen and local planners, and, eventually, the ability to predict how the climate will change in the future. Today's program is laying the foundation for long-term environmental and climate monitoring and prediction. Potentially, this

will provide the understanding needed in the future to support difficult decisions regarding the Earth's environment.
Author
Earth Observing System (Eos); Earth Sciences; Environmental Monitoring; Weather Forecasting; Predictions; Oceanography

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20040031707 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Valuation of Antropic Pressure in Cedro and Solidao County (Backland Pernambuco) Using TM Landsat Imagery and Geographical Information Systems
LemosdeSousa, Clerio; 2003; 130 pp.; In Portuguese
Report No.(s): INPE-10051-TDI/887; Copyright; Avail: Other Sources

Land use in the backlands of the Brazilian northeastern states traditionally has been used extensive and has been dominated by pastures and subsistance agriculture. Inadequate land use has caused degradation of vast areas in the region. Remote sensing and geographical information systems (GIS) are considered powerful tools for monitoring and analysis of state and dynamics of land cover. In this study, those are used for detection, characterization and quantification of land cover change in the counties Cedro and Solidao in the backlands of the Pernambuco state. Landsat imagery from 1987 and 2001 were analyzed in a GIS. In the Cedro county land cover change came out to be more pronounced and principally caused by extension of areas dedicated to agriculture and livestock production. On the other hand in the Solid o county land cover change was less intensive, probably due to its more hilly terrain where substitution of natural vegetation by agricultural land cover is hampered. Thus, different biophysical conditions in the counties demand different methodological approaches for analysis of land cover. For highly dynamic situations like in the case of the Cedro county shorter time intervals are recommended. In situations with slower change like in the case of the Solidao county lower frequency of analysis in the order of this study (intervals of 14 years) can be appropriate. Monitoring of human-induced pressures on natural systems can thus be optimized by choosing appropriate time schemes in the backlands of the Pernambuco state.
Author
Brazil; Geographic Information Systems; Landsat Satellites; Remote Sensing; Satellite Imagery; Biophysics

20040031736 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Visions of our Planet's Atmosphere, Land and Oceans: NASA/NOAA E-Theater 2003
Hasler, Fritz; [2003]; 1 pp.; In English; EOS Direct Broadcast Meeting, 15-18 Nov. 2003, Kona, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA/NOAA Electronic Theater presents Earth science observations from space in a spectacular way. Fly in from outer space to the conference location as well as the site of the 2002 Olympic Winter Games using data from NASA satellites and the IKONOS 'Spy Satellite'. See HDTV movie Destination Earth 2002 incorporating the Olympic Zooms, NBC footage of the 2002 Olympics, the shuttle, & the best NASA/NOAA Earth science visualizations. See the latest US and international global satellite weather movies including hurricanes, typhoons & 'tornadoes'. See the latest visualizations from NASA/NOAA and International remote sensing missions like Terra, Aqua, GOES, GMS , SeaWiFS, & Landsat. Feel the pulse of our planet. See how land vegetation, ocean plankton, clouds and temperatures respond to the sun & seasons. See vortexes and currents in the global oceans that bring up the nutrients to feed tiny algae and draw the fish, whales and fisherman. See the how the ocean blooms in response to these currents and El Nino/La Nina climate changes. See the city lights, fishing fleets, gas flares and bio-mass burning of the Earth at night observed by the the 'night-vision' DMSP satellite. The presentation will be made using the latest HDTV and video projection technology by: Dr. Fritz Hasler NASA/Goddard Space Flight Center
Author
Earth Sciences; Remote Sensing; Earth Atmosphere; Oceans; Land; Noaa Satellites; Video Communication

20040031758 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Visions of our Planet's Atmosphere, Land and Oceans: NASA/NOAA E-Theater 2003
Hasler, Fritz; [2003]; 1 pp.; In English; JUSTAP Meeting, 15-18 Nov. 2003, Honolulu, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA/NOAA Electronic Theater presents Earth science observations from space in a spectacular way. Fly in from outer space to the conference location as well as the site of the 2002 Olympic Winter Games using data from NASA satellites and the IKONOS 'Spy Satellite'. See HDTV movie Destination Earth 2002 incorporating the Olympic Zooms, NBC footage of the 2002 Olympics, the shuttle, & the best NASA/NOAA Earth science visualizations. See the latest US and international global satellite weather movies including hurricanes, typhoons & 'tornadoes'. See the latest visualizations from NASA/NOAA and International remote sensing missions like Terra, Aqua, GOES, GMS, SeaWiFS, & Landsat. Feel the pulse of our planet. See how land vegetation, ocean plankton, clouds and temperatures respond to the sun & seasons. See vortexes and currents in the global oceans that bring up the nutrients to feed tiny algae and draw the fish, whales and fisherman. See the how the ocean blooms in response to these currents and El Nino/La Nina climate changes. See the city lights, fishing fleets, gas flares and bio-mass burning of the Earth at night observed by the 'night-vision' DMSP satellite. The presentation will be made using the latest HDTV and video projection technology by: Dr. Fritz Hasler NASA/Goddard Space Flight Center
Author
Earth Sciences; Remote Sensing; Planetary Atmospheres; Land; Oceans; Noaa Satellites; NASA Programs; Video Communication

20040031769 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Multispectral Cloud Retrievals from MODIS
King, Michael D.; [2003]; 1 pp.; In English; Seminar at Dept. of Atmospheric Sciences, 4 Dec. 2003, Tucson, AZ, USA; No Copyright; Avail: Other Sources; Abstract Only

The Moderate Resolution Imaging Spectroradiometer (MODIS) was developed by NASA and launched onboard the Terra spacecraft on December 18,1999 and Aqua spacecraft on May 4,2002. It achieved its final orbit and began Earth observations on February 24, 2000 for Terra and June 24, 2002 for Aqua. A comprehensive set of remote sensing algorithms for cloud masking and the retrieval of cloud physical and optical properties has been developed by members of the MODIS atmosphere science team. The archived products from these algorithms have applications in climate change studies, climate modeling, numerical weather prediction, as well as fundamental atmospheric research. In addition to an extensive cloud mask, products include cloud-top properties (temperature, pressure, effective emissivity), cloud thermodynamic phase, cloud optical and microphysical parameters (optical thickness, effective particle radius, water path), as well as derived statistics. We will describe the various cloud properties being analyzed on a global basis from both Terra and Aqua, and will show characteristics of cloud optical and microphysical properties as a function of latitude for land and ocean separately, and contrast the statistical properties of similar cloud types in various parts of the world.
Author
MODIS (Radiometry); Earth Observing System (Eos); Remote Sensing; Climatology; Cloud Physics

20040031850 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA/NOAA Electronic Theater
Hasler, A. F.; [2003]; 1 pp.; In English; Harvard University Meeting, 16 Dec. 2003, Cambridge, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA/NOAA Electronic Theater presents Earth science observations and visualizations from space in a historical perspective. Fly in from outer space to Cambridge and Harvard University. Zoom through the Cosmos to SLC and site of the 2002 Winter Olympics using 1 m IKONOS 'Spy Satellite' data. Contrast the 1972 Apollo 17 'Blue Marble' image of the Earth with the latest US and International global satellite images that allow us to view our Planet from any vantage point. See the latest spectacular images from NASA/NOAA remote sensing missions like Terra, GOES, TRMM, SeaWiFS, & Landsat 7, of storms & fires like Hurricane Isabel and the LNSan Diego firestorms of 2003. See how High Definition Television (HDTV) is revolutionizing the way we do science communication. Take the pulse of the planet on a daily, annual and 30-year time scale. See daily thunderstorms, the annual blooming of the northern hemisphere landmasses and oceans, fires in Africa, dust storms in Iraq, and carbon monoxide exhaust from global burning. See visualizations featured on Newsweek, TIME, National Geographic, Popular Science covers & National & International Network TV. Spectacular new global visualizations of the observed and simulated atmosphere & oceans are shown. See the currents and vortexes in the oceans that bring up the nutrients to feed tiny plankton and draw the fish, whales and fishermen. See the how the ocean blooms in response to El Niiioh Niiia climate changes. The Etheater will be presented using the latest High Definition TV (HDTV) and video projection technology on a large screen. See the global city lights, and the great NE US blackout of August 2003 observed by the 'night-vision' DMSP satellite.
Author
Satellite Imagery; Television Systems; Remote Sensing; Earth Sciences

20040034082 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Soil Moisture Retrieval Through Changing Corn Using Active/Passive Microwave Remote Sensing

ONeill, P. E.; Joseph, A.; DeLannoy, G.; Lang, R.; Utku, C.; Kim, E.; Houser, P.; Gish, T.; May 2003; 3 pp.; In English; 2003 International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France

Report No.(s): IGARSS2003-03.0138; Copyright; Avail: CASI; A01, Hardcopy

An extensive field experiment was conducted from May-early October, 2002 at the heavily instrumented USDA-ARS (U.S. Dept. of Agriculture-Agricultural Research Service) OPE3 (Optimizing Production Inputs for Economic and Environmental Enhancement) test site in Beltsville, MD to acquire data needed to address active/passive microwave algorithm, modeling, and ground validation issues for accurate soil moisture retrieval. During the experiment, a tower-mounted 1.4 GHz radiometer (Lrad) and a truck-mounted dual-frequency (1.6 and 4.75 GHz) radar system were deployed on the northern edge of the site. The soil in this portion of the field is a sandy loam (silt 23.5%, sand 60.3%, clay 16.1%) with a measured bulk density of 1.253 g/cu cm. Vegetation cover in the experiment consisted of a corn crop which was measured from just after planting on April 17, 2002 through senescence and harvesting on October 2. Although drought conditions prevailed during the summer, the corn yield was near average, with peak biomass reached in late July.

Derived from text

Soil Moisture; Remote Sensing; Microwave Radiometers; Microwave Imagery

20040034203 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The NASA Airborne Earth Science Microwave Imaging Radiometer (AESMIR): A New Sensor for Earth Remote Sensing

Kim, Edward; November 11, 2003; 1 pp.; In English; 30th International Symposium on Remote Sensing of Environment, 10-14 Nov. 2003, Honolulu,HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The Airborne Earth Science Microwave Imaging Radiometer (AESMIR) is a versatile new airborne imaging radiometer recently developed by NASA. The AESMIR design is unique in that it performs dual-polarized imaging at all standard passive microwave frequency bands (6-89 GHz) using only one sensor headscanner package, providing an efficient solution for Earth remote sensing applications (snow, soil moisture/land parameters, precipitation, ocean winds, sea surface temperature, water vapor, sea ice, etc.). The microwave radiometers themselves will incorporate state-of-the-art receivers, with particular attention given to instrument calibration for the best possible accuracy and sensitivity. The single-package design of AESMIR makes it compatible with high-altitude aircraft platforms such as the NASA ER-2s. The arbitrary 2-axis gimbal can perform conical and cross-track scanning, as well as fixed-beam staring. This compatibility with high-altitude platforms coupled with the flexible scanning configuration, opens up previously unavailable science opportunities for convection/precip/cloud science and co-flying with complementary instruments, as well as providing wider swath coverage for all science applications. By designing AESMIR to be compatible with these high-altitude platforms, we are also compatible with the NASA P-3, the NASA DC-8, C-130s and ground-based deployments. Thus AESMIR can provide low-, mid-, and high- altitude microwave imaging. Parallel filter banks allow AESMIR to simultaneously simulate the exact passbands of multiple satellite radiometers: SSM/I, TMI, AMSR, Windsat, SSMI/S, and the upcoming GPM/GMI and NPOESS/CMIS instruments --a unique capability among aircraft radiometers. An L-band option is also under development, again using the same scanner. With this option, simultaneous imaging from 1.4 to 89 GHz will be feasible. And, all receivers except the sounding channels will be configured for 4-Stokes polarimetric operation using high-speed digital correlators in the near future. The capabilities and unique design features of this new sensor will be described, and example imagery will be presented.

Author

Airborne Equipment; Radiometers; Imaging Techniques; Microwave Frequencies; Microwave Imagery

20040034206 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Distribution and Abundance of Bird Species: Towards a Satellite, Data Driven Avian Energetics and Species Richness Model

Smith, James A.; [2003]; 4 pp.; In English; 30th International Symposium on Remote Sensing of Environment, 10-14 Nov. 2003, Honolulu, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy

This paper addresses the fundamental question of why birds occur where and when they do, i.e., what are the causative factors that determine the spatio-temporal distributions, abundance, or richness of bird species? In this paper we outline the first steps toward building a satellite, data-driven model of avian energetics and species richness based on individual bird physiology, morphology, and interaction with the spatio-temporal habitat. To evaluate our model, we will use the North

American Breeding Bird Survey and Christmas Bird Count data for species richness, wintering and breeding range. Long term and current satellite data series include AVHRR, Landsat, and MODIS.
Author
Birds; Breeding (Reproduction); Biophysics; Mathematical Models; Satellite Instruments

20040034263 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hydrological Application of Remote Sensing: Surface States -- Snow
Hall, Dorothy K.; Kelly, Richard E. J.; Foster, James L.; Chang, Alfred T. C.; [2004]; 35 pp.; In English
Report No.(s): HSA062; Copyright; Avail: CASI; A03, Hardcopy

Remote sensing research of snow cover has been accomplished for nearly 40 years. The use of visible, near-infrared, active and passive-microwave remote sensing for the analysis of snow cover is reviewed with an emphasis on the work on the last decade.
Author
Remote Sensing; Snow Cover; Satellite Imagery; Hydrological Cycle; Microwaves

20040034742 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Western Rainier Seismic Zone Airborne Laser Swath Mapping
Harding, David J.; Haugerud, Ralph A.; Johnson, Samuel Y.; Scott, Kevin M.; Weaver, Craig S.; Martinez, Diana M.; Zeigler, John C.; Latypov, Damir; [2003]; 1 pp.; In English; 2003 Seattle Annual Meeting, 2-5 Nov. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

Airborne laser swath mapping (ALSM) of the Puget Lowland conducted by TerraPoint LLC for the Purget Sound Lidar Concortium (PSLC), has been successful in revealing Holocene fault scarps and lendsliders hidden beneath the dense, temperate rain forest cover and in quantifying shoreline terrace uplift. Expanding the PSLC efforts, NASA-USGS collaboration is now focusing on topographic mapping of seismogenic zones adjacent to volcanois in the western Cascades range in order to assess the presence of active faulting and tectonic deformation, better define the extend of lahars and understand their flow processes, and characterize landslide occurrence. Mapping of the western Rainier zone (WRZ) was conducted by TerraPoint in late 2002, after leaf fall and before snow accumulation. The WRZ is a NNW-trending, approx. 30 km-long zone of seismicity west of Mount Rainier National Park. The Puget Lowland ALSM methods were modified to accommodate challenges posed by the steep, high relief terrian. The laser data, acquired with a density of approx. 2 pulses /sq m, was filtered to identify returns from the ground from which a bare Earth digital elevation model (DEM) was produced with a grid size of 1.8 m. The RMS elevation accuracy of the DEM in flat, unvegetated areas is approx. 10cm based on consistency between overlapping flight swaths and comparisons to ground control points. The resulting DEM substantially improves upon Shuttle Radar Topography Mission and USGS photogrammetric mapping. For example, the DEM defines the size and spatial distribution of flood erratics left by the Electron lahar and of megaclasts within the Round Pass lahar, important for characterizing the lahar hydraulics. A previously unknown lateral levee on the Round Pass lahar is also revealed. In addition, to illustrating geomorfic feature within the WRZ, future plans for laser mapping of the Saint Helens and Darrington seismic zones will be described.
Author
Seismology; Photomapping; Spatial Distribution; Optical Radar

20040035602 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
NASA IKONOS Radiometric Characterization
Pagnutti, Mary; Ryan, Robert E.; Kelly, Michelle; Holekamp, Kara; Daehler, Erik; Zanoni, Vicki; Schiller, Stephen; Thome, Kurtis; May 1, 2002; 45 pp.; In English; 2002 Conference on Characterization and Radiometric Calibration for Remote Sensing, 29 Apr. - 2 May 2002, Logan, UT, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-04-00038-SSC; No Copyright; Avail: CASI; A03, Hardcopy

NASA acquired imagery from the IKONOS satellite as part of its Scientific Data Purchase (SDP) program, which purchases scientific data sets from commercial sources. This viewgraph presentation describes the IKONOS satellite and its sensors, and then gives an overview of characterization efforts undertaken by NASA in cooperation with other government agencies. The characterization included relative radiometric correction, absolute radiometric characterization of data from

Lunar Lake Playa, Nevada, and calibration of data from Stennis Space Center, Mississippi.
CASI
Characterization; Satellite Imagery

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20040031740 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Burst Populations and Detector Sensitivity
Band, David L.; [2003]; 4 pp.; In English; 2003 GRB Conference; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The F(sub T) (peak bolometric photon flux) vs. E(sub p) (peak energy) plane is a powerful tool to compare the burst populations detected by different detectors. Detector sensitivity curves in this plane demonstrate which burst populations the detectors will detect. For example, future CZT-based detectors will show the largest increase in sensitivity for soft bursts, and will be particularly well- suited to study X-ray rich bursts and X-ray Flashes. Identical bursts at different redshifts describe a track in the F(sub T)-E(sub p) plane.
Author
Photons; Red Shift; Bolometers

20040031742 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analysis of Burst Observations by GLAST's LAT Detector
Band, David L.; Digel, Seth W.; December 02, 2003; 4 pp.; In English; 2003 GRB Conference; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Analyzing data from GLAST's Large Area Telescope (LAT) will require sophisticated techniques. The PSF and effective area are functions of both photon energy and the position in the field-of-view. During most of the mission the observatory will survey the sky continuously and thus the LAT will detect each count from a source at a different detector orientation; each count requires its own response function! The likelihood as a function of celestial position and photon energy will be the foundation of the standard analysis techniques. However the 20 MeV-300 GeV emission at the time of the approx.100 keV burst emission (timescale of approx.10 s) can be isolated and analyzed because essentially no non-burst counts are expected within a PSF radius of the burst location during the burst. Both binned and unbinned (in energy) spectral fitting will be possible. Longer timescale afterglow emission will require the likelihood analysis that will be used for persistent sources.
Author
Afterglows; Photons; Gamma Ray Bursts

20040034007 NASA Goddard Space Flight Center, Greenbelt, MD, USA
High-Altitude Particle Acceleration and Radiation in Pulsar Slot Gaps
Muslimov, Alex G.; Harding, Alice K.; [2004]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We explore the pulsar slot gap (SG) electrodynamics up to very high altitudes, where for most relatively rapidly rotating pulsars both the standard small-angle approximation and the assumption that the magnetic field lines are ideal stream lines break down. We address the importance of the electrodynamic conditions at the SG boundaries and the occurrence of a steady-state drift of charged particles across the SG field lines at very high altitudes. These boundary conditions and the cross-field particle motion determine the asymptotic behavior of the scalar potential at all radii from the polar cap (PC) to near the light cylinder. As a result, we demonstrate that the steady-state accelerating electric field, E(sub ll), must approach a small and constant value at high altitude above the PC. This E(sub ll) is capable of maintaining electrons moving with high Lorentz factors (approx. a few x 10(exp 7)) and emitting curvature gamma-ray photons up to nearly the light cylinder. By numerical simulations, we show that primary electrons accelerating from the PC surface to high altitude in the SG along the outer edge of the open field region will form caustic emission patterns on the trailing dipole field lines. Acceleration and emission in such an extended SG may form the physical basis of a model that can successfully reproduce some pulsar high-energy light curves.
Author
Particle Acceleration; High Altitude; Pulsars; Electrodynamics; Asymptotic Properties; Magnetic Fields

20040034085 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Consequences of Alfven Waves and Parallel Potential Drops in the Auroral Zone

Schriver, David; [2003]; 3 pp.; In English; Spring American Geophysical Union meeting, May 2002, Washington, DC, USA

Contract(s)/Grant(s): NAG5-11989; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this research is to examine the causes of field-aligned plasma acceleration in the auroral zone using satellite data and numerical simulations. A primary question to be addressed is what causes the field-aligned acceleration of electrons (leading to precipitation) and ions (leading to upwelling ions) in the auroral zone. Data from the Fast Auroral SnapshoT (FAST) and Polar satellites is used when the two satellites are in approximate magnetic conjunction and are in the auroral region. FAST is at relatively low altitudes and samples plasma in the midst of the auroral acceleration region while Polar is at much higher altitudes and can measure plasmas and waves propagating towards the Earth. Polar can determine the sources of energy streaming earthward from the magnetotail, either in the form of field-aligned currents, electromagnetic waves or kinetic particle energy, that ultimately leads to the acceleration of plasma in the auroral zone. After identifying and examining several events, numerical simulations are run that bridges the spatial region between the two satellites. The code is a one-dimensional, long system length particle in cell simulation that has been developed to model the auroral region. A main goal of this research project is to include Alfven waves in the simulation to examine how these waves can accelerate plasma in the auroral zone.

Derived from text

Field Aligned Currents; Plasma Acceleration; Auroral Zones; Electromagnetic Radiation; Computerized Simulation; Magnetohydrodynamic Waves

20040034126 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Silicon Matrix as a Charge Detector in the ATIC Experiment

Zatsepin, V. I.; Adams, J. H.; Ahn, H. S.; Bashindzhagyan, G. L.; Batkov, K. E.; Chang, J.; Christl, M.; Fazely, A. R.; Ganel, O.; Gunasingha, R. M., et al.; January 13, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Advanced Thin Ionization Calorimeter (ATIC) was built for series of long- duration balloon flights in Antarctica. Its main goal is to measure energy spectra of cosmic ray nuclei from protons up to iron nuclei over a wide energy range from 30 GeV up to 100 TeV. The ATIC balloon experiment had its first, test flight that lasted for 16 days from 28 Dec 2000 to 13 Jan 2OO1 around the continent. The ATIC spectrometer consists of a fully active BGO calorimeter, scintillator hodoscopes and a silicon matrix. The silicon matrix, consisting of 4480 pixels, was used as a charge detector in the experiment. About 25 million cosmic ray events were detected during the flight. In the paper, the charge spectrum obtained with the silicon matrix is analyzed.

Author

Cosmic Rays; Calorimeters; Energy Spectra; Ionization

20040034220 National Renewable Energy Lab., Golden, CO

Analysis of the ZnTe: Cu Contact on CdS/CdTe Solar Cells

Gessert, T. A.; Romero, M. J.; Dhere, R. G.; Asher, S. E.; Apr. 2003; 14 pp.; In English

Report No.(s): DE2003-15004689; NREL/CP-520-33940; No Copyright; Avail: Department of Energy Information Bridge

We report on the recent use of cathodoluminescence (CL) to probe the depth-dependent changes in radiative recombination that occur in CdTe devices during ZnTe:Cu contacting procedures. These types of CL measurements may be useful to assist in linking impurity diffusion (e.g., Cu) from the contact with depth-dependent variation in electrical activation within the CdTe layer. Variable-energy CL suggests that diffusion from the ZnTe:Cu contact interface may assist in reducing effects of shallow donors in the CdTe bulk, and yield higher acceptor levels in the region near the contact. CL analysis near abrupt metal discontinuities provides estimates of diffusion lengths for carriers associated with both excitonic and donor-to-acceptor pair recombination. Finally, CL measurements at increasing excitation levels (i.e., increasing electron-beam current) provides estimates of the defect state density, as well as providing evidence that discrete multiple defect bands may exist in CdTe prior to contacting.

NTIS

Solar Cells; Cadmium Tellurides; Electric Contacts; Acceptor Materials

20040034232 National Renewable Energy Lab., Golden, CO

Porous Polycrystalline Silicon Thin Film Solar Cells. Final Report 24 May 1999-24 May 2002

Fauchet, P.; Oct. 2003; 24 pp.; In English

Report No.(s): DE2003-15004831; NREL/SR-520-34824; No Copyright; Avail: Department of Energy Information Bridge

Crystalline (including multicrystalline) silicon based devices dominate the present solar cell industry due to their durability, their relatively low cost, and the vast silicon knowledge base developed by the microelectronics industry. However, the high refractive index of crystalline silicon at solar wavelengths (approximately 3.5) creates large reflection losses that must be compensated for by applying antireflective (AR) coatings. Although highly efficient double and triple layer AR coatings are available, most manufactured crystalline silicon photovoltaics employ simple and inexpensive single layer AR coatings, with relatively poor AR properties. This project has focused on the development of a simple and low cost alternative to these deposited AR coatings, using an electrochemical etching technique to form AR layers of porous silicon (PSi).
NTIS
Thin Films; Solar Cells; Polycrystals; Photovoltaic Conversion

20040034259 National Renewable Energy Lab., Golden, CO
Real Time Optics of the Growth of Textured Silicon Films in Photovoltaics
Collins, R. W.; Wronski, C. R.; Oct. 2003; 28 pp.; In English
Report No.(s): DE2003-15004830; NREL/SR-520-34823; No Copyright; Avail: Department of Energy Information Bridge
Novel optical instruments, including single and dual rotating-compensator multichannel ellipsometers, have been designed and developed to probe the evolution of the microstructure, spectroscopic optical properties, and other materials characteristics during the fabrication and processing of individual thin films and thin-film structures used in photovoltaic devices. These instruments provide a foundation for next-generation process design/control and metrology in existing and future photovoltaics technologies. In this project, the materials system studied in the greatest detail was thin-film silicon, fabricated at low temperatures by plasma-enhanced chemical vapor deposition.
NTIS
Solar Cells; Photovoltaic Conversion; Spectroscopy; Plasmas (Physics); Microstructure; Silicon Films

20040034260 National Renewable Energy Lab., Golden, CO
Research on the Hydrogen Passivation of Defects and Impurities in Si Relevant to Crystalline Si Solar Cell Materials
Stavola, M.; Sep. 2003; 22 pp.; In English
Report No.(s): DE2003-15004722; NREL/SR-520-34821; No Copyright; Avail: Department of Energy Information Bridge
Hydrogen is commonly introduced into Si solar cells to reduce the deleterious effects of defects and increase the minority carrier lifetime. Nonetheless, the methods by which hydrogen is introduced during processing and hydrogen's subsequent interactions with defects remain poorly understood. The goal of this experimental research program is to increase the understanding, at a microscopic level, of hydrogenation processes and passivation mechanisms for crystalline-Si photovoltaics.
NTIS
Passivity; Impurities; Hydrogen; Crystallinity; Solar Cells; Photovoltaic Conversion

20040034262 National Renewable Energy Lab., Golden, CO
Medium-Range Order in Amorphous Silicon Measured by Fluctuation Electron Microscopy. Final Report 23 June 1999-23 August 2002
Voyles, P. M.; Abelson, J. R.; Oct. 2003; 40 pp.; In English
Report No.(s): DE2003-15004839; NREL/SR-520-34826; No Copyright; Avail: Department of Energy Information Bridge
Despite occasional experimental hints, medium range structural order in covalently bonded amorphous semiconductors had largely escaped detection until the advent of fluctuation electron microscopy (FEM) in 1996. Using FEM, we find that every sample of amorphous silicon and germanium we have investigated, regardless of deposition method or hydrogen content, is rich in medium range order. The paracrystalline structural model, which consists of small, topologically ordered grains in an amorphous matrix, is consistent with the FEM data; but due to strain effects, materials with a paracrystalline structure appear to be amorphous in diffraction measurements. We present measurements on hydrogenated amorphous silicon deposited by different methods, some of which are reported to have greater stability against the Staebler- Wronski effect.
NTIS
Solar Cells; Electron Microscopy; Amorphous Silicon; Hydrogen

20040034845 National Renewable Energy Lab., Golden, CO, Sargent and Lundy, Engineers, Chicago, IL, USA
Assessment of Parabolic Trough and Power Tower Solar Technology Cost and Performance Forecasts
Oct. 2003; 348 pp.; In English
Report No.(s): DE2003-15005520; NREL/SR-550-34440; No Copyright; Avail: Department of Energy Information Bridge

Sargent and Lundy LLC conducted an independent analysis of parabolic trough and power tower solar technology cost and performance.
NTIS
Parabolic Reflectors; Solar Energy

20040035623 Colorado State Univ., Fort Collins, Fort Collins, CO, USA
Phase Change Materials in Floor Tiles for Thermal Energy Storage
Oct. 2002; 46 pp.; In English
Report No.(s): DE2003-820428; No Copyright; Avail: Department of Energy Information Bridge

Passive solar systems integrated into residential structures significantly reduce heating energy consumption. Taking advantage of latent heat storage has further increased energy savings. This is accomplished by the incorporation of phase change materials into building materials used in passive applications. Trombe walls, ceilings and floors can all be enhanced with phase change materials. Increasing the thermal storage of floor tile by the addition of encapsulated paraffin wax is the proposed topic of research. Latent heat storage of a phase change material (PCM) is obtained during a change in phase. Typical materials use the latent heat released when the material changes from a liquid to a solid. Paraffin wax and salt hydrates are examples of such materials. Other PCMs that have been recently investigated undergo a phase transition from one solid form to another. During this process they will release heat. These are known as solid-state phase change materials. All have large latent heats, which makes them ideal for passive solar applications. Easy incorporation into various building materials is must for these materials. This proposal will address the advantages and disadvantages of using these materials in floor tile.
NTIS
Floors; Phase Change Materials; Tiles; Energy Storage; Thermal Energy

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20040031697
Controlled Exposures of Healthy and Asthmatic Volunteers to Concentrated Ambient Particles in Metropolitan Los Angeles
Gong, H.; Sioutas, C.; Linn, W. S.; Dec. 2003; 66 pp.
Report No.(s): PB2004-103503; HEI-RR-118/03; No Copyright; Avail: CASI; A04, Hardcopy

Epidemiologic studies report health effects associated with exposure to ambient particulate matter, but underlying biologic mechanisms remain unclear. The authors evaluated pulmonary and systemic effect sin twelve healthy human adult and twelve asthmatic volunteers exposed once for 2 hours in a whole-body chamber to approximately 200 micrograms/cubic meter concentrated ambient particles (CAPs) in the line (<2.5 micrometers) size range and once to filtered air.
NTIS
Particulates; Size Distribution; Toxicology; Epidemiology

20040031698
Health Effects of Acute Exposure to Air Pollution. Part 1: Healthy and Asthmatic Subjects Exposed to Diesel Exhaust. Part 2: Healthy Subjects Exposed to Concentrated Ambient Particles
Holgate, S. T.; Sandstrom, T.; Frew, A. J.; Devlin, R. B.; Wilson, S. J.; Dec. 2003; 90 pp.
Report No.(s): PB2004-103504; HEI-RR-112/03; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of the study was to assess the impact of short-term exposure to diluted diesel exhaust on inflammatory parameters in human airways. The authors previously exposed control subjects for 1 hour to a high ambient concentration of diesel exhaust (particle concentration 300 micrograms/cubic meters - a level comparable with that found in North Sea ferries, highway underpasses, etc). Although these exposures did not have any measurable effect on standard indices of lung function, there was a marked neutrophilic inflammatory response in the airways accompanied by increases in blood neutrophil and platelet counts. Endothelial adhesion molecules were upregulated, and the expression of interleukin 8 messenger RNA was increased in a pattern consistent with neutrophilia.
NTIS
Asthma; Health; Diesel Engines; Exhaust Gases; Exhaust Emission; Air Pollution

20040031699

Validation and Evaluation of Biomarkers in Workers Exposed to Benzene in China

Qu, Q.; Shore, R.; Li, G.; Jim, X.; Chen, L. C.; Jun. 2003; 106 pp.

Report No.(s): PB2004-103506; HEI-RR-115; No Copyright; Avail: CASI; A06, Hardcopy

Human exposure to benzene is widespread because it is a component of gasoline and is also used extensviely as an industrial solvent. Exposure to high levels of benzene is associated with development of leukemia and other blood disorders, but the risks of exposure to low levels of benzene are not well understood. In the 1990s the Health Effects Institute (HEI) initiated a research program designed to study the effects of exposure to toxic air pollutants at ambient levels. HEI's Request for Applications (RFA) 93-1 supported studies to develop reliable and sensitive assays for biomarkers of benzene effect.

NTIS

Benzene; Biomarkers; Blood; Exposure; Occupational Diseases

20040031700

Revised Analyses of Time-Series Studies of Air Pollution and Health

May 2003; 314 pp.

Report No.(s): PB2004-103508; HEI/SR/TS-2003; No Copyright; Avail: CASI; A14, Hardcopy

Over the past decade, time-series studies conducted in many cities have contributed information about the association between daily changes in concentrations of airborne particulate matter (PM) and daily morbidity and mortality. In 2002, however, investigators at Johns Hopkins University and at Health Canada identified issues in the statistical model used in the majority of time-series studies. This Health Effects Institute (HEI) Special Report details attempts to address several questions raised by these discoveries. The first section addresses the impact of the issues on the HEI-funded National Morbidity, Mortality, and Air Pollution Study (NMMAPS). The second edition addresses the impact on additional studies selected by the US Environmental Protection Agency (EPA). Special panels of the Health Effects Institute contributed commentaries on the findings.

NTIS

Air Pollution; Health; Environment Protection

20040031702 Office of Air Quality Planning and Standards, Research Triangle Park, NC

Economic Impact Analysis of the Hydrochloric Acid (HC1) Production NESHAP

Feb. 2003; 18 pp.; In English

Report No.(s): PB2004-103527; EPA/452/R-03/001; No Copyright; Avail: CASI; A03, Hardcopy

This regulatory action issues final national emission standards for hazardous air pollutants (NESHAP) for hydrochloric acid (HCl) production facilities, including HCl production at fume silica facilities. The EPA has identified these facilities as major sources of hazardous air pollutant (HAP) emissions, primarily HCl. Hydrochloric acid is associated with a variety of adverse health effects. These adverse health effects include chronic health disorders (e.g., effects on the central nervous system, blood, and heart) and acute health disorders (e.g., irritation of eyes, throat, and mucous membranes and damage to the liver and kidneys). These final NESHAP would implement section 112(d) of the Clean Air Act (CAA) by requiring all HCl production facilities that are major sources to meet HAP emission standards reflecting the application of the maximum achievable control technology (MACT).

NTIS

Hydrochloric Acid; Economic Impact; Standards; Air Pollution

20040031703 Research Triangle Inst., Research Triangle Park, NC, USA

Economic Impact Analysis of the Plastic Parts and Products NESHAP

Heller, K. B.; Yang, J. C.; Depro, B. M.; Aug. 2003; 86 pp.; In English

Report No.(s): PB2004-103529; No Copyright; Avail: CASI; A05, Hardcopy

This report evaluates the economic impacts of the Surface Coating of Plastic Parts and Products NESHAP. The report includes an industry profile and assesses the impact of the regulation by comparing the engineering cost estimates to baseline company sales. The report also provides the screening analysis for small business impacts.

NTIS

Air Pollution; Economic Impact; Industries

20040031783 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Black Carbon in Estuarine (Coastal) High-molecular-weight Dissolved Organic Matter
Mannino, Antonio; Harvey, H. Rodger; [2003]; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Dissolved organic matter (DOM) in the ocean constitutes one of the largest pools of organic carbon in the biosphere, yet much of its composition is uncharacterized. Observations of black carbon (BC) particles (by-products of fossil fuel combustion and biomass burning) in the atmosphere, ice, rivers, soils and marine sediments suggest that this material is ubiquitous, yet the contribution of BC to the ocean s DOM pool remains unknown. Analysis of high-molecular-weight DOM isolated from surface waters of two estuaries in the northwest Atlantic Ocean finds that BC is a significant component of DOM, suggesting that river-estuary systems are important exporters of BC to the ocean through DOM. We show that BC comprises 4-7% of the dissolved organic carbon (DOC) at coastal ocean sites, which supports the hypothesis that the DOC pool is the intermediate reservoir in which BC ages prior to sedimentary deposition. Flux calculations suggest that BC could be as important as vascular plant-derived lignin in terms of carbon inputs to the ocean. Production of BC sequesters fossil fuel- and biomass-derived carbon into a refractory carbon pool. Hence, BC may represent a significant sink for carbon to the ocean. Author

Carbon; Molecular Weight; Dissolved Organic Matter; Fuel Combustion

20040031810 National Center for Atmospheric Research, Boulder, CO, USA
Measurement of Selected Organic Trace Gases During TRACE-P
Atlas, Elliot; [2004]; 8 pp.; In English
Contract(s)/Grant(s): NCC1-418
Report No.(s): Rept-2000-102; No Copyright; Avail: CASI; A02, Hardcopy

Major goals of the TRACE-P mission were: 1) to investigate the chemical composition of radiatively important gases, aerosols, and their precursors in the Asian outflow over the western Pacific, and 2) to describe and understand the chemical evolution of the Asian outflow as it is transported and mixed into the global troposphere. The research performed as part of this proposal addressed these major goals with a study of the organic chemical composition of gases in the TRACE-P region. This work was a close collaboration with the Blake/Rowland research group at UC-Irvine, and they have provided a separate report for their funded effort.
Derived from text

Atmospheric Composition; Trace Elements; Gas Composition; Chemical Analysis

20040033370 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Change: A View from Space
Lau, William K. M.; [2003]; 1 pp.; In English; City Univ. of Hong Kong Meeting, 14-22 Jan. 2004, Kowloon, Hong Kong; No Copyright; Avail: Other Sources; Abstract Only

In this talk, I will discuss the fundamental science and society problems associated with global change, with an emphasis on the view from space. I will provide an overview of the vision and activities of the World Climate Research Program in the next two decades. Then I will show regional climate changes and environmental problems in the East Asian region, such as biomass burning, urban pollutions, yellow sand, and their possible interaction with the Asian monsoon, particularly over Southern China.
Author

Climate Change; Air Pollution; Satellite Imagery

20040034031 NASA Marshall Space Flight Center, Huntsville, AL, USA
Changes in the Optical Properties of Simulated Shuttle Waste Water Deposits- Urine Darkening
Albyn, Keith; Edwards, David; Alred, John; January 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Manned spacecraft have historically dumped the crew generated waste waster overboard, into the environment in which the spacecraft operates, sometimes depositing the waste water on the external spacecraft surfaces. The change in optical properties of wastewater deposited on spacecraft external surfaces, from exposure to space environmental effects, is not well understood. This study used nonvolatile residue (NVR) from Human Urine to simulate wastewater deposits and documents the changes in the optical properties of the NVR deposits after exposure to ultra violet (UV) radiation. Twenty NVR samples of, 0-angstromes/sq cm to 1000-angstromes/sq cm, and one sample contaminated with 1 to 2-mg/sq cm were exposed to UV radiation over the course of approximately 6151 equivalent sun hours (ESH). Random changes in sample mass, NVR, solar

absorbance, and infrared emission were observed during the study. Significant changes in the UV transmittance were observed for one sample contaminated at the mg/sq cm level.
Author
Waste Water; Manned Spacecraft; Environment Effects; Optical Properties

20040034072 Physics and Electronics Lab. TNO, The Hague, Netherlands
In Theatre Waste Processing
vanGijlswijk, R. N.; Ansems, A. M. M.; Kwaijtaal, A.; vanScheepstal, P. G. M.; June 2003; 63 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 015.32110
Report No.(s): TD-03-0048; FEL-03-A093; Copyright; Avail: Other Sources
This report gives an insight into the suitable technologies for in theatre waste processing. It also considers a number of options on how to use these technologies during operations. These options are evaluated in a multi criteria analysis. One of the most important items in this research is the environmental effect of different options.
Author
Waste Disposal; Waste Treatment; Logistics

20040034727 Westinghouse Savannah River Co., Aiken, SC, USA
Drop Tests for the 6M Specification Package Closure Investigation
Smith, A. C.; Gelder, L. F.; Aug. 2003; 56 pp.; In English
Report No.(s): DE2003-816048; M-TRT-A-00002; No Copyright; Avail: Department of Energy Information Bridge
Results of previous tests of drum-type RAM packages employing the standard clamp-ring closures have caused concern within the DOE Complex over the DOT 6M Specification Package. To clarify these issues, the Savannah River Site's Radioactive Material Packaging Technology Group was commissioned to conduct a series of tests to determine the response of the clamp-ring closure to the regulatory Hypothetical Accident Condition (9m) drop tests, for packages at maximum allowable weight, 640-lb. Additionally, three enhanced closure designs were also tested: the Clamshell, plywood disk reinforcement, and J-Clip. The results of the tests showed that the standard closure was unable to retain its lid for both Center-of-Gravity-Over-Corner and Shallow-Angle cases, for the standard package, at its maximum allowed weight. Similar results were found for packages dropped from a reduced height. The Clamshell design provided the best performance of the enhanced closures.
NTIS
Radioactive Wastes; Packaging

20040035541 Ohio Univ., Athens. Dept. of Mechanical Engineering, Athens, OH, USA
Multi-Pollutant Control Using Membrane-Based Up-Flow Wet Electrostatic Precipitation
Reynolds, J.; Jan. 2003; 20 pp.; In English
Report No.(s): DE2003-816717; No Copyright; Avail: Department of Energy Information Bridge
This is the first quarterly report of the 'Multi-Pollutant Control Using Membrane--Based Upflow Wet Electrostatic Precipitation' project funded by the US Department of Energy's National Energy Technology Laboratory under DOE Award No. DE-FC26-02NT41592 to Croll-Reynolds Clean Air Technologies (CRCAT). In this 18 month project, CRCAT and its team members will conduct detailed emission tests of metallic and new membrane collection material within a wet electrostatic precipitator (WESP) at First Energy's Penn Power's Bruce Mansfield (BMP) plant in Shippingport, Pa. Test results performed on the existing metallic WESP during November of 2002 showed consistent results with previous test results. Average collection efficiency of 89% on SO(sub 3) mist was achieved. Additionally, removal efficiencies of 62% were achieved at very high velocity, greater than 15 ft./sec.
NTIS
Air Quality; Contaminants; Membranes; Electrostatic Precipitators

20040035634 Argonne National Lab., IL, IL, USA
Assessment of Well-to-Wheels Energy Use and Greenhouse Gas Emissions of Fischer-Tropsch Diesel
Wang, M.; Oct. 04, 2002; 32 pp.; In English
Report No.(s): DE2003-820529; No Copyright; Avail: Department of Energy Information Bridge
The middle distillate fuel produced from natural gas (NG) via the Fischer-Tropsch (FT) process has been proposed as a motor fuel for compression-ignition (CI) engine vehicles. FT diesel could help reduce U.S. dependence on imported oil. The

U.S. Department of Energy (DOE) is evaluating the designation of FT diesel as an alternative motor fuel under the 1992 Energy Policy Act (EPACT). As part of this evaluation, DOE has asked the Center for Transportation Research at Argonne National Laboratory to conduct an assessment of well-to-wheels (WTW) energy use and greenhouse gas (GHG) emissions of FT diesel compared with conventional motor fuels (i.e., petroleum diesel). For this assessment, we applied Argonne's Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model to conduct WTW analysis of FT diesel and petroleum diesel. This report documents Argonne's assessment. The results are presented in Section 2. Appendix A describes the methodologies and assumptions used in the assessment.
NTIS
Diesel Engines; Fischer-Tropsch Process; Exhaust Emission; Greenhouse Effect; Natural Gas

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*.

20040031708 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Geographic Analysis of a Mata Atlantica Site in Rio Grande do Sul State-Brazil Using Quickbird Imagery
daSilvaPinheiro, Eduardo; 2003; 186 pp.; In Portuguese
Report No.(s): INPE-10094-TDI/891; Copyright; Avail: CASI; A09, Hardcopy

In 1994, the Center for Research and Nature Conservation PRO-MATA was created, looking forward to develop studies and actions for the protection and recovery of the ecosystems from a sector of Mata Atlantica in Rio Grande do Sul, Brazil. PRO-MATA was conceived from the cooperation between the Catholic University of Rio Grande do Sul (PUCRS Pontif cia Universidade Cat lica do Rio Grande do Sul) and University of Tubingen (Germany). The objective of this study is to execute studies on the physical environment of the PRO-MATA area, using data of satellite QUICKBIRD. The main steps of the work were: creation of the DEM, geometrical correction of imagery, mapping of hydrology, geomorphology and land use/land cover, evaluate the exactness of the land use/land cover map, and geographical analysis of the data. Two field surveys were done in order to obtain information of ground truth, and to get control points. In order to correct the images we used the Rational Functional Model. The hydrologic and geomorphologic maps were done by visual interpretation. At the land use/land cover map, object oriented classification was tested. The final map of land use/land cover was created by visual interpretation. The geographic analysis allowed the identification of permanent preservation areas, transition zones and those areas susceptible to human action. A Geographic Data Bank was created for the PRO-MATA area. The results demonstrated that the QUICKBIRD images area perfectly usable for this study.
Author
Brazil; Conservation; Ecosystems; Imagery; Geomorphology; Satellite Instruments

20040034089 NASA Goddard Space Flight Center, Greenbelt, MD, USA
ICESat Observations of Southern Alaska Glaciers
Sauber, Jeanne; Molnia, Bruce F.; Mitchell, Darius; [2003]; 1 pp.; In English; 2003 Fall AGU Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

In late February and March, 2003, the Ice, Cloud, and land Elevation Satellite (ICESat) measured ice and land elevations along profiles across southern Alaska. During this initial data acquisition stage ICESat observations were made on 8-day repeat tracks to enable calibration and validation of the ICESat data products. Each profile consists of a series of single point values derived from centroid elevations of an $\approx$70 m diameter laser footprint. The points are s4pakated by $\approx$172 m along track. Data siets of 8-day observations (an ascending and descending ground track) crossed the Bering and Malaspina Glacier. Following its 1993--1995 surge; the Bering Glacier has undergone major terminus retreat as well as ike thinning in the abtation zone. During the later part of the 20th century, parts of the Malaspina thinned by about 1 m/yr. The multiple observation profiles across the Bering and Malaspina piedmont lobes obtained in February/March are being geolocated on Landsat images and the elevation profiles will be used for a number o scientific objectives. Based on our simulations of ICESat performance over the varied ice surface of the Jakobshavn Glacier of GReenland, 2003, we expect to measure annual, and possibly seasonal, ice elevation changes on the large Alaskan glaciers. Using elevation data obtained from a second laser, we plan to estimate ice elevation changes on the Bering Glacier between March and October 2003.
Author
Data Acquisition; Glaciers

20040034115 NASA Goddard Space Flight Center, Greenbelt, MD, USA

ICESat's Laser Measurements of Polar Ice and Atmospheres

Zwally, H. Jay; [2003]; 1 pp.; In English; ISMASS Workshop, 22-23 Aug. 2003, Milan, Italy; No Copyright; Avail: Other Sources; Abstract Only

NASA's Ice, Cloud and Land Elevation Satellite (ICESat) mission is designed to measure changes in elevation of the Greenland and Antarctic ice sheets beginning in January 2003. Time-series of elevation changes will enable determination of the present- day mass balance of the ice sheets, study of associations between observed ice changes and polar climate, and estimation of the present and future contributions of the ice sheets to global sea level rise. Other scientific objectives of ICESat include: global measurements of cloud heights and the vertical structure of clouds and aerosols; precise measurements of land topography and vegetation canopy heights; and measurements of sea ice roughness, sea ice thickness, ocean surface elevations, and surface reflectivity. The Geoscience Laser Altimeter System (GLAS) on ICESat has a 1064 nm laser channel for surface altimetry and dense cloud heights and a 532 nm lidar channel for the vertical distribution of clouds and aerosols. Differences between the characteristics of laser and radar altimetry, such as effective depth of the backscattered signal, elevation accuracy, and footprint location, and their relevance to inter-relating measurements from ERS, Envisat, ICESat, and Cryosat are discussed. Preliminary ICESat results obtained during the calibration and validation period of ICESat are described. ICESat is designed to operate for 3 to 5 years and should be followed by successive missions to measure ice changes for at least 15 years.

Author

Ice; Mass Distribution; Antarctic Regions; Vertical Distribution; Elevation; Depth; Climate

20040034116 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Role of Auroral Imaging in Understanding Ionosphere-Inner Magnetosphere Interactions

Spann, Jim; Khazanov, George; Mende, Stephen; [2004]; 1 pp.; In English; 30th Anniversary Yosemite Workshop Inner Magnetosphere Interactions, 6 Feb. 2004, Yosemite, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The more ways we probe the ionosphere and inner magnetosphere, the better we can understand their interaction. For example, the multifaceted imaging of geospace with the IMAGE mission complements the more traditional in situ measurements made with many previous missions. Together they have enabled new knowledge of the ionosphere-magnetosphere (IM) coupling. The role of imaging the aurora in understanding this interaction has received renewed attention recently. Based on in situ data, such as FAST or DMSP, and our recent theories, we believe that imaging multiscale features of the aurora is a key component to gaining insight into the processes and mechanisms at work. This talk will explore how auroral imaging can be used to provide improved insight of the dynamics of IM interaction on micro and meso scales, with an emphasis on the current limitations and future possibilities of quantitative analyses.

Author

Auroras; Imaging Techniques; Magnetosphere-Ionosphere Coupling; Earth Sciences

20040034236 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Reliability of CHAMP Anomaly Continuations

vonFrese, Ralph R. B.; Kim, Hyung Rae; Taylor, Patrick T.; Asgharzadeh, Mohammad F.; [2003]; 6 pp.; In English; 2nd CHAMP Meeting, 1-5 Sep. 2003, Potsdam, Germany; No Copyright; Avail: CASI; A02, Hardcopy

CHAMP is recording state-of-the-art magnetic and gravity field observations at altitudes ranging over roughly 300 - 550 km. However, anomaly continuation is severely limited by the non-uniqueness of the process and satellite anomaly errors. Indeed, our numerical anomaly simulations from satellite to airborne altitudes show that effective downward continuations of the CHAMP data are restricted to within approximately 50 km of the observation altitudes while upward continuations can be effective over a somewhat larger altitude range. The great unreliability of downward continuation requires that the satellite geopotential observations must be analyzed at satellite altitudes if the anomaly details are to be exploited most fully. Given current anomaly error levels, joint inversion of satellite and near- surface anomalies is the best approach for implementing satellite geopotential observations for subsurface studies. We demonstrate the power of this approach using a crustal model constrained by joint inversions of near-surface and satellite magnetic and gravity observations for Maude Rise, Antarctica, in the southwestern Indian Ocean. Our modeling suggests that the dominant satellite altitude magnetic anomalies are produced by crustal thickness variations and remanent magnetization of the normal polarity Cretaceous Quiet Zone.

Author

Geopotential; Magnetic Anomalies; Satellite Observation; Geomagnetism; Altitude

20040034239 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Surface Time-Variable Gravity Signals and Possible Sources Including Core Mass Flow

Chao, Benjamin F.; Kuang, Weijia; [2003]; 1 pp.; In English; American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Over two decades of geodetic satellite-laser-ranging (SLR) data show that the variation of the Earth's oblateness parameter J2 has a clear seasonal signal of amplitude of about 3e-10 and a secular decrease of about -2.8e-11/year, superimposed on some interesting interannual fluctuations. Physically, any change in mass distribution or/inside the Earth will be reflected in the time-variable gravity signal obtained outside the Earth, according to Newton s gravitational law. Therefore, such signal contains contributions from all geophysical sources that redistribute mass, on all temporal and spatial scales, including those from the core. Besides Earth rotation and geomagnetic field variations, the time-variable gravity also contains information linking Earth surface observations with internal core dynamical processes. The time scales of the gravity signal are critical in helping differentiate different contributions. The atmosphere and hydrosphere are responsible for the seasonal and much of the interannual and intraseasoanl fluctuations, while the secular trend is due mainly to the post-glacial rebound but possibly core mass flow. To estimate the latter effect, we use our MoSST (Modular, Scalable, Self-consistent, Three-dimensional) core dynamics model to forward simulate the core flow, and density variation due to the core convection. Our results suggest that, when upward continued to the surface, the J2 component of the core mass redistribution can reach an overall amplitude of e-11/year, approaching the SLR detectability and significant in geophysical terms. We also find a general westward drift of the mass flow, with a speed comparable to that of the geomagnetic westward drift.
Author

Earth Surface; Time Signals; Core Flow; Earth Rotation; Geomagnetism; Mass Distribution; Mass Flow

20040035708

Research Progress and Accomplishments: 1999-2000, Multidisciplinary Center for Earthquake Engineering Research

May 2000; In English

Report No.(s): PB2004-101676; MCEER-00-SP01; No Copyright; Avail: National Technical Information Service (NTIS)

This is a selection of papers chronicling the technical achievements of the Multidisciplinary Center for Earthquake Engineering Research during 1999-2000. 11 papers are included in this collection: Modeling Earthquake Impact on Urban Lifeline Systems: Advances and Integration; Development of Fragility Information for Structures and Nonstructural Components; Damage to Critical Facilities Following the 921 Chi-Chi, Taiwan Earthquake; Highway Bridge Seismic Design; Summary of FHWA/MCEER Project on Seismic Vulnerability of New Highway Construction; Ground Motion Prediction Methodologies for Eastern North America; Fiber Reinforced Composites for Advanced Seismic Performance of Water Supplies; The Marmara, Turkey Earthquake: Using Advanced Technology to Conduct Earthquake Reconnaissance; Restoration Activities Following the Marmara, Turkey Earthquake of August 17, 1999; Human and Institutional Perspectives of the 921 Chi-Chi, Taiwan Earthquake; Education and Educational Outreach: Using the Center Approach for Effective Knowledge Transfer, and Graduate Professional Education in Earthquake Engineering: An Integrated Approach.
NTIS

Earthquakes; Research and Development; Seismology; Structural Properties (Geology)

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040031654 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Study of the Atmospheric Nitrogen Dioxide Based in Data from Brewer Spectrophotometer

Pinheiro, Damaris Kirsch; 2003; 373 pp.; In Portuguese

Report No.(s): INPE-10017-TDI/881; Copyright; Avail: Other Sources

The Brewer Spectrophotometer was developed to measure ozone and ultraviolet radiation in the UV-B range. The measurement of other atmospheric gases, such as NO2 and SO2, is possible with some adaptations and procedures. It is possible to measure the nitrogen dioxide total column and the tropospheric and stratospheric NO2 columns. This work s objective is to establish optimized methodologies for collecting, calibrate, and a reduce data for NO2 measurements using the Brewer Spectrophotometers of the INPE network in South America. Temporal series of NO2 data were obtained for the cities of Natal and Cachoeira Paulista in Brazil, La Paz in Bolivia and Punta Arenas in Chile. In addition, special campaigns were made in Sao Paulo city, near the Petrobras Refinery in Cubatao, and at the Brazilian Antarctic Station. Intercomparisons were

made between Brewers 081 and 124, in Cachoeira Paulista, and between Brewer 124 in Cachoeira Paulista and the French ground-based spectrometer SAOZ installed in the city of Bauru. The amount of the atmospheric NO2 vertical column is very low, 300 times less than atmospheric ozone. Besides, the instrument doesn't measure the NO2 as its first priority. Because of this, NO2 data usually have high standard deviations. Even so, with the optimization of the collecting and processing of the data, very interesting results are obtained for the NO2 temporal and spacial variations. Seasonal variations in the NO2 stratospheric column were observed at all stations mentioned, with maximum in summer and minimum in winter. Seasonal variations of NO2 tropospheric columns were also observed at the stations, with maxima in winter and minima in summer. Daily variations of the NO2 stratospheric columns were measured using the twilight technique. Evening values were 1,5 times larger than morning values. For the tropospheric data, the higher values were measured in Sao Paulo, Cubatao and La Paz, respectively, with Natal following this last city. Since presently, there are only few NO2 measurements being made in the Southern Hemisphere, it appears that the Brewer can made significant contributions for the better understanding of atmospheric NO2.
Author
Nitrogen Dioxide; Spectrophotometers; Atmospheric Composition; Ultraviolet Radiation; Ozone; Data Reduction

20040031688 National Weather Service, Honolulu, HI, USA
2001 Tropical Cyclones Central North Pacific
Kelly, R. W.; Loos, T.; Kodama, K. R.; Dec. 2003; 26 pp.
Report No.(s): PB2004-102815; NOAA/TM/NWSTM/PR-49; No Copyright; Avail: CASI; A03, Hardcopy

Tropical activity was light during the 2001 season. Although the season was off to the quickest start in history with the first named tropical cyclone ever in June, there were only four total tropical cyclones, and two of them were short-lived. Tropical Storm Barbara in the East Pacific moved into Central Pacific waters June 22, but rapidly dissipated. Only two advisories were issued by the Central Pacific Hurricane Center (CPHC) on T.S. Barbara. Tropical Depression One-C developed September 11, but only lasted for twelve hours before dissipating. Tropical Depression Two-C developed September 23 over somewhat warmer waters near 10 deg N, and developed enough convection to last 48 hours. Winds persisted at 30 KT through most of its cycle as it tracked westward.
NTIS
Pacific Ocean; Tropical Storms; Cyclones; Hurricanes

20040031714 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tropospheric Wind Profiles Obtained with the GLOW Molecular Doppler Lidar during the 2002 International H2O Project
Gentry, Bruce M.; Chen, Huailin; Li, Steven X.; Mathur, Savy Asachee; Dobler, Jeremy; Hasselbrack, William; [2003]; 1 pp.; In English; 6th International Symposium on Tropospheric, 14-20 Sep. 2003, Profiling-Leipzig, Germany; Copyright; Avail: Other Sources; Abstract Only

The Goddard Lidar Observatory for Winds (GLOW) is a mobile direct detection Doppler lidar system hich uses the double edge technique to measure the Doppler shift of the molecular backscattered laser signal at a wavelength of 355 nm. In the spring of 2002 GLOW was deployed to the western Oklahoma profiling site (36 deg 33.500 min N, 100 deg 36.371 min W) to participate in the International H2O Project (MOP). During the MOP campaign over 240 hours of wind profiles were obtained with the GLOW lidar in support of a variety of scientific investigations.
Author
Troposphere; Wind Profiles; Doppler Radar; Optical Radar

20040031716 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Inferring Cloud Properties from Passive Solar Sensors
Marshak, A.; [2003]; 1 pp.; In English; Radiative Transfer and the Modeling Workshop, 13-14 Nov. 2003, Victoria, Canada; No Copyright; Avail: Other Sources; Abstract Only

The most common approach for retrieving cloud optical depth from ground-based observations uses downwelling fluxes measured by pyranometers and Multi-Filter Rotating Shadowband Radiometers (MFRSR). The key element in both retrieval techniques is the one-to-one mapping of the 'observed' fluxes into cloud optical depth through plane-parallel radiative transfer. Both methods are expected to work well only for completely overcast clouds giving an effective optical depth for the whole sky. To infer cloud optical depth locally one can assume to use a narrow-field-of view radiometer that measures radiances instead of fluxes. However, lack of one-to-one relationships between radiance and cloud optical depth, prevents the direct use

of radiances either. Here we discuss a new method for retrieving cloud optical depth from ground-based measurements of zenith radiance in the RED and near infrared (NIR) spectral regions. In addition to an algebraic combinations of spectral radiances such as Normalized Difference Cloud Index (NDCI) that largely removes nonuniqueness and the radiative effects of cloud inhomogeneity but can result in poor retrievals due to its insensitivity to cloud fraction, both RED and NIR radiances as points on the 'RED vs. NIR' plane are proposed to be used for retrieval. The proposed retrieval method is applied to a multi-channel sunphotometer (as a part of AERONET) measurements at the ARM site in Oklahoma. The results of retrieval are compared with the ones from Microwave Radiometer (MWR) and MFRSR. In addition to cloud optical depth, the new retrieval method also infers a 'radiatively effective' cloud fraction.
Author
Cloud Physics; Microwave Radiometers; Solar Sensors; Meteorology

20040031717 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observing System Simulation Experiments to Determine the Potential Impact of Space-Based Lidar Wind Profiles on Weather Prediction
Atlas, Robert; October 10, 2003; 4 pp.; In English; 30th International Symposium on Remote Sensing of Environment, 10-14 Nov. 2003, Honolulu, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy

Observing system simulation experiments (OSSE's) provide an effective means to evaluate the potential impact of a proposed observing system, as well as to determine tradeoffs in their design, and to evaluate data assimilation methodology. Great care must be taken to ensure realism of the OSSE's, and in the interpretation of OSSE results. All of the OSSE's that have been conducted to date have demonstrated tremendous potential for space-based wind profile data to improve atmospheric analyses, forecasts, and research. This has been true for differing data assimilation systems, analysis methodology, and model resolutions. OSSE's clearly show much greater potential for observations of the complete wind profile than for single-level wind data or observations of the boundary layer alone.
Author
Optical Radar; Simulation; Weather Forecasting; Wind (Meteorology); Wind Profiles

20040031721 NASA Goddard Inst. for Space Studies, New York, NY, USA
Solar Effects on Climate and the Maunder Minimum: Minimum Certainty
Rind, David; [2003]; 1 pp.; In English; Global Change Seminar, 15 Sep. 2003, New Haven, CT, USA; No Copyright; Avail: Other Sources; Abstract Only

The current state of our understanding of solar effects on climate is reviewed. As an example of the relevant issues, the climate during the Maunder Minimum is compared with current conditions in GCM simulations that include a full stratosphere and parameterized ozone response to solar spectral irradiance variability and trace gas changes. The GISS Global Climate/Middle Atmosphere Model coupled to a q-flux/mixed layer model is used for the simulations, which begin in 1500 and extend to the present. Experiments were made to investigate the effect of total versus spectrally-varying solar irradiance changes; spectrally-varying solar irradiance changes on the stratospheric ozone/climate response with both pre-industrial and present trace gases; and the impact on climate and stratospheric ozone of the preindustrial trace gases and aerosols by themselves. The results showed that: (1) the Maunder Minimum cooling relative to today was primarily associated with reduced anthropogenic radiative forcing, although the solar reduction added 40% to the overall cooling. There is no obvious distinguishing surface climate pattern between the two forcings. (2)The global and tropical response was greater than 1 C, in a model with a sensitivity of 1.2 C per W m-2. To reproduce recent low-end estimates would require a sensitivity 1/4 as large. (3) The global surface temperature change was similar when using the total and spectral irradiance prescriptions, although the tropical response was somewhat greater with the former, and the stratospheric response greater with the latter. (4) Most experiments produce a relative negative phase of the NAO/AO during the Maunder Minimum, with both solar and anthropogenic forcing equally capable, associated with the tropical cooling and relative poleward EP flux refraction. (5) A full stratosphere appeared to be necessary for the negative AO/NAO phase, as was the case with this model for global warming experiments, unless the cooling was very large, while the ozone response played a minor role and did not influence surface temperature significantly. (6) Stratospheric ozone was most affected by the difference between present day and preindustrial atmospheric composition and chemistry, with increases in the upper and lower stratosphere during the Maunder Minimum. While the estimated UV reduction led to ozone decreases, this was generally less important than the anthropogenic effect except in the upper middle stratosphere, as judged by two different ozone photochemistry schemes. (7) The effect of the reduced solar irradiance on stratospheric ozone and on climate was similar in Maunder Minimum and current atmospheric conditions.
Author
Climate Models; Middle Atmosphere; Solar Activity Effects; Solar Radiation

20040031722 Stanford Univ., Stanford, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Particle Size Distributions in Atmospheric Clouds
Paoli, Roberto; Shariff, Karim; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 39-47; In English Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

In this note, we derive a transport equation for a spatially integrated distribution function of particles size that is suitable for sparse particle systems, such as in atmospheric clouds. This is done by integrating a Boltzmann equation for a (local) distribution function over an arbitrary but finite volume. A methodology for evolving the moments of the integrated distribution is presented. These moments can be either tracked for a finite number of discrete populations ('clusters') or treated as continuum variables.
Author
Particle Size Distribution; Clouds (Meteorology); Transport Theory

20040031738 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Maryland Univ. Baltimore County, Catonsville, MD, USA
Status of Middle Atmosphere-Climate Models: Results SPARC-GRIPS
Pawson, Steven; Kodera, Kunihiko; [2003]; 1 pp.; In English; IUGG Assembly Meeting, 30 Jun. - 11 Jul. 2003, Sapporro, Japan; No Copyright; Avail: Other Sources; Abstract Only

The middle atmosphere is an important component of the climate system, primarily because of the radiative forcing of ozone. Middle atmospheric ozone can change, over long times, because of changes in the abundance of anthropogenic pollutants which catalytically destroy it, and because of the temperature sensitivity of kinetic reaction rates. There is thus a complex interaction between ozone, involving chemical and climatic mechanisms. One question of interest is how ozone will change over the next decades , as the 'greenhouse-gas cooling' of the middle atmosphere increases but the concentrations of chlorine species decreases (because of policy changes). concerns the climate biases in current middle atmosphere-climate models, especially their ability to simulate the correct seasonal cycle at high latitudes, and the existence of temperature biases in the global mean. A major obstacle when addressing this question This paper will present a summary of recent results from the 'GCM-Reality Intercomparison Project for SPARC' (GRIPS) initiative. A set of middle atmosphere-climate models has been compared, identifying common biases. Mechanisms for these biases are being studied in some detail, including off-line assessments of the radiation transfer codes and coordinated studies of the impacts of gravity wave drag due to sub-grid-scale processes. ensemble of models will be presented, along with numerical experiments undertaken with one or more models, designed to investigate the mechanisms at work in the atmosphere. The discussion will focus on dynamical and radiative mechanisms in the current climate, but implications for coupled ozone chemistry and the future climate will be assessed.
Author
Atmospheric Composition; Atmospheric Models; Ozone; Radiative Transfer; Polar Regions; Middle Atmosphere

20040031759 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Total Ozone Prediction: Stratospheric Dynamics
Jackman, Charles H.; Kawa, S. Ramdy; Douglass, Anne R.; [2003]; 1 pp.; In English; Workshop on Process-Oriented Validation, 17-19 Nov. 2003, Garmish-Partenkirchen, Germany; No Copyright; Avail: Other Sources; Abstract Only

The correct prediction of total ozone as a function of latitude and season is extremely important for global models. This exercise tests the ability of a particular model to simulate ozone. The ozone production (P) and loss (L) will be specified from a well- established global model and will be used in all GCMs for subsequent prediction of ozone. This is the 'B-3 Constrained Run' from M&MII. The exercise mostly tests a model stratospheric dynamics in the prediction of total ozone. The GCM predictions will be compared and contrasted with TOMS measurements.
Author
Stratosphere; Total Ozone Mapping Spectrometer; Computerized Simulation

20040031772 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Application of SeaWinds Scatterometer Data to Weather Analysis and Forecasting
Atlas, Robert; October 10, 2003; 4 pp.; In English; 30th International Symposium on Remote Sensing of Environment, 10-14 Nov. 2003, Honolulu, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy

The SeaWinds scatterometer (like NSCAT and ERS) is able to detect unequivocal signatures of meteorological features including cyclones, fronts, anticyclones, easterly waves and other precursors of hurricanes and typhoons. Through collaborative efforts between NASA and NOAA, National Weather Service marine forecasters are using SeaWinds data to

improve analyses, forecasts and significant weather warnings for maritime interests. This results in substantial economic savings as well as the reduction of weather related loss of life at sea. The impact of SeaWinds on Numerical Weather Prediction models is on average modest but occasionally results in significant forecast improvements.
Author
Numerical Weather Forecasting; Scatterometers; Remote Sensing; Ocean Surface; Meteorological Parameters

20040031773 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling Study of Mesospheric Planetary Waves: Genesis and Characteristics
Mayr, H. G.; Mengel, J. G.; Talaat, E. L.; Porter, H. S.; Chan, K. L.; [2003]; 30 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In preparation for the measurements from the TIMED mission and coordinated ground based observations, we discuss results for the planetary waves (PWs) that appear in our Numerical Spectral Model (NSM). The present model accounts for a tropospheric heat source in the zonal mean (m = 0), which reproduces qualitatively the observed zonal jets near the tropopause and the accompanying reversal in the latitudinal temperature variations. We discuss the PWs that are solely generated internally, i.e., without the explicit excitation sources related to tropospheric convection or topography. Our analysis shows that PWs are not produced when the zonally averaged heat source into the atmosphere is artificially suppressed, and that the PWs generally are significantly weaker when the tropospheric source is not applied. Instabilities associated with the zonal mean temperature, pressure and wind fields, which still need to be explored, are exciting PWs that have amplitudes in the mesosphere comparable to those observed. Three classes of PWs are generated in the NSM. (1) Rossby waves, (2) Rossby gravity waves propagating westward at low latitudes, and (3) Eastward propagating equatorial Kelvin waves. A survey of the PWs reveals that the largest wind amplitudes tend to occur below 80 km in the winter hemisphere, but above that altitude they occur in the summer hemisphere where the amplitudes can approach 50 meters per second. It is shown that the non-migrating tides in the mesosphere, generated by non-linear coupling between migrating tides and PWs, are significantly larger for the model with the tropospheric heat source.
Author
Mathematical Models; Mesosphere; Planetary Waves; Wind (Meteorology)

20040031775 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluating the Credibility of Transport Processes in the Global Modeling Initiative 3D Model Simulations of Ozone Recovery
Strahan, Susan E.; Douglass, Anne R.; [2003]; 41 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The Global Modeling Initiative has integrated two 35-year simulations of an ozone recovery scenario with an offline chemistry and transport model using two different meteorological inputs. Physically based diagnostics, derived from satellite and aircraft data sets, are described and then used to evaluate the realism of temperature and transport processes in the simulations. Processes evaluated include barrier formation in the subtropics and polar regions, and extratropical wave-driven transport. Some diagnostics are especially relevant to simulation of lower stratospheric ozone, but most are applicable to any stratospheric simulation. The temperature evaluation, which is relevant to gas phase chemical reactions, showed that both sets of meteorological fields have near climatological values at all latitudes and seasons at 30 hPa and below. Both simulations showed weakness in upper stratospheric wave driving. The simulation using input from a general circulation model (GMI(sub GCM)) showed a very good residual circulation in the tropics and northern hemisphere. The simulation with input from a data assimilation system (GMI(sub DAS)) performed better in the midlatitudes than at high latitudes. Neither simulation forms a realistic barrier at the vortex edge, leading to uncertainty in the fate of ozone-depleted vortex air. Overall, tracer transport in the offline GMI(sub GCM) has greater fidelity throughout the stratosphere than the GMI(sub DAS).
Author
Ozone; Computerized Simulation; Three Dimensional Models; Meteorological Parameters; Atmospheric Models

20040031777 NASA Goddard Space Flight Center, Greenbelt, MD, USA
N2O and NOy
Kawa, S. R.; Jackman, C. H.; Douglass, A. R.; Strahan, S. E.; [2003]; 1 pp.; In English; Workshop on Process-Oriented Validation, 17-19 Nov. 2003, Garmish-Partenkirchen, Germany; No Copyright; Avail: Other Sources; Abstract Only

The principal loss processes for ozone in the stratosphere are either directly or indirectly closely coupled to the abundance and distribution of reactive oxides of nitrogen (NOy). The main source of NOy in the stratosphere is N2O, a trace gas that is changing significantly as a result of anthropogenic forcing. Thus diagnosis of the distributions of N2O, NOy, and their

coupling is required to evaluate any chemistry-climate model aspiring to accurately simulate ozone change. In the NASA Assessment of the Effects of High-speed Aircraft in the Stratosphere: 1998 we found that the sensitivity of various models ozone to perturbation did correspond consistently with their background NOy distribution. Coordinated NOy and N2O mixing ratio distributions are available from observations: ER-2 aircraft in the lower stratosphere and ATMOS and balloon profiles to higher altitudes at a subset of latitudes and seasons. Although close comparison to these diagnostics is crucial, unfortunately the distributions are due to a combination of transport and chemical processes, and isolating the source of differences is not always simple. However, in combination with other transport and photochemical diagnostics, comparison with N2O and NOy can be very instructive in evaluation of model processes and performance.
Author
Nitrogen Oxides; Contaminants; Ozone; Stratosphere; Climate Models

20040031778 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CRYSTAL-FACE Analysis and Simulations of the July 23rd Extended Anvil Case
Starr, David; [2003]; 1 pp.; In English; CRYSTAL-FACE Analysis and Simulations of the July 23rd Extended Anvil Case, 4 Dec. 2003, Grand Forks, ND, USA; No Copyright; Avail: Other Sources; Abstract Only

A key focus of CRYSTAL-FACE (Cirrus Regional Study of Tropical Anvils and cirrus Layers - Florida Area Cirrus Experiment) was the generation and subsequent evolution of cirrus outflow from deep convective cloud systems. Present theoretical background and motivations will be discussed. An integrated look at the observations of an extended cirrus anvil cloud system observed on 23 July 2002 will be presented, including lidar and millimeter radar observation; from NASA s ER-2 and in-situ observations from NASA s WB-57 and University of North Dakota Citation. The observations will be compared to results of simulations using 1-D and 2-D high-resolution (100 meter) cloud resolving models. The CRMs explicitly account for cirrus microphysical development by resolving the evolving ice crystal size distribution (bin model) in time and space. Both homogeneous and heterogeneous nucleation are allowed in the model. The CRM simulations are driven using the output of regional simulations using MM5 that produces deep convection similar to what was observed. The MM5 model employs a 2 km inner grid (32 layers) over a 360 km domain, nested within a 6-km grid over a 600-km domain. Initial and boundary conditions for the 36-hour MM5 simulation are taken from NCEP Eta model analysis at 32 km resolution. Key issues to be explored are the settling of the observed anvil versus the model simulations, and comparisons of dynamical properties, such as vertical motions, occurring in the observations and models. The former provides an integrated measure of the validity of the model microphysics (fallspeed) while the latter is the key factor in forcing continued ice generation.
Author
Anvil Clouds; Cirrus Clouds; Computerized Simulation; Tropical Regions; Florida

20040031796 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Evidence That Nitric Acid Increases Relative Humidity in Low-Temperature Cirrus Clouds
Gao, R. S.; Popp, P. J.; Fahey, D. W.; Marcy, T. P.; Herman, R. L.; Weinstock, E. M.; Baumgardner, D. G.; Garrett, T. J.; Rosenlof, K. H.; Thompson, T. L., et al.; Science; January 23, 2004; Volume 303, pp. 516-520; In English
Contract(s)/Grant(s): NAG5-11611; Copyright; Avail: Other Sources

In situ measurements of the relative humidity with respect to ice (RH(sub(i)) and of nitric acid (HNO3) were made in both natural and contrail cirrus clouds in the upper troposphere. At temperatures lower than 202 kelvin, RH(sub i) values show a sharp increase to average values of over 130% in both cloud types. These enhanced RH(sub i) values are attributed to the presence of a new class of NHO3- containing ice particles (Delta-ice). We propose that surface HNO3 molecules prevent the ice/vapor system from reaching equilibrium by a mechanism similar to that of freezing point depression by antifreeze proteins. Delta-ice represents a new link between global climate and natural and anthropogenic nitrogen oxide emissions. Including Delta-ice in climate models will alter simulated cirrus properties and the distribution of upper tropospheric water vapor.
Author
Nitric Acid; Humidity; Cirrus Clouds; Ice; Climatology; Climate Models

20040031799 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Nitric Acid Uptake on Subtropical Cirrus Cloud Particles
January 9, 2004; 41 pp.; In English
Contract(s)/Grant(s): NAG5-11611; Copyright; Avail: CASI; A03, Hardcopy

The redistribution of HNO3 via uptake and sedimentation by cirrus cloud particles is considered an important term in the upper tropospheric budget of reactive nitrogen. Numerous cirrus cloud encounters by the NASA WB-57F high-altitude

research aircraft during CRYSTAL-FACE were accompanied by the observation of condensed-phase HNO3 with the NOAA chemical ionization mass spectrometer. The instrument measures HNO3 with two independent channels of detection connected to separate forward- and downward-facing inlets that allow a determination of the amount of HNO3 condensed on ice particles. Subtropical cirrus clouds, as indicated by the presence of ice particles, were observed coincident with condensed-phase HNO3 at temperatures of 197 K - 224 K and pressures of 122 hPa - 224 hPa. Maximum levels of condensed-phase HNO3 approached the gas-phase equivalent of 0.8 ppbv. Ice particle surface coverages as high as 1.4- 10(exp 14) molecules/sq cm were observed. A dissociative Langmuir adsorption model, when using an empirically derived HNO3 adsorption enthalpy of -11.0 kcal/mol, effectively describes the observed molecular coverages to within a factor of 5. The percentage of total HNO3 in the condensed phase ranged from near zero to 100% in the observed cirrus clouds. With volume-weighted mean particle diameters up to 700 pm and particle fall velocities up to 10 m/s, some observed clouds have significant potential to redistribute HNO3 in the upper troposphere.
Author
Nitric Acid; Cirrus Clouds; Reactivity; Nitrogen; Troposphere; Mass Spectrometers; Vapor Phases

20040031805 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status of NASA Satellite, Field Observations, and Numerical Modeling Addressing the Impact of Urbanization on Short and Long Term Precipitation Variability
Shepherd, J. Marshall; Manyin, Michael; Burian, Steve; Garza, Carlos; [2003]; 4 pp.; In English; AMS 84th Annual Meeting, 11-15 Jan. 2004, Seattle, WA, USA; Copyright; Avail: CASI; A01, Hardcopy

There is renewed interest in the impacts of urbanization on global change as witnessed by special sessions at the Fall AGU and Annual AMS meeting. A comprehensive satellite, modeling, and field campaign program is underway to assess the impact of urbanization on precipitation.
Derived from text
Mathematical Models; NASA Programs; Satellite Observation; Cities; Precipitation (Meteorology); Mesoscale Phenomena; Variability

20040031806 Maryland Univ. Baltimore County, Catonsville, MD, USA
On the Eastward Travelling Wavenumber Two in the Northern Stratosphere
Pawson, Steven; Krueger, Kirstin; [2003]; 1 pp.; In English; IUGG 2003 Assembly, 30 Jun. - 11 Jul. 2003, Sapporro, Japan; No Copyright; Avail: Other Sources; Abstract Only

Disturbances in the middle atmosphere are often interpreted in the framework of waves superimposed on a zonal-mean flow. This paper presents an analysis of travelling waves in the northern hemisphere stratosphere, concentrating on planetary wavenumber two (W2). Space-time spectral analysis reveals the existence of a substantial eastward-travelling planetary W2 at high latitudes in winter. While a similar feature is well documented in the southern hemisphere stratosphere, where it is observed in most winters, this northern hemisphere counterpart is less common and has not been examined in detail. A climatology of occurrence of the wave is given for the northern stratospheric winter. It is denoted as the quasi-16-day eastward travelling W2, because of its dominant periodicity, which ranges from about one to three weeks. Although the wave has some similarities with the southern hemispheric wave, there is much larger interannual and intraseasonal variability in the northern hemisphere. will emphasize the variations in the spatial and temporal structure of this wave, as isolated in meteorological analyses of radiosonde and satellite data. The possible role of these travelling waves in preconditioning the stratosphere as a precursor to sudden stratospheric warmings in both hemispheres will be discussed.
Author
Atmospheric Heating; Climatology; Periodic Variations; Southern Hemisphere; Spectrum Analysis; Traveling Waves

20040031807 Maryland Univ. Baltimore County, Catonsville, MD, USA
The Reanalysis for Stratospheric Trace Gas Studies
Pawson, Steven; [2003]; 1 pp.; In English; Presentation at IUGG 2003 Assembly, 30 Jun. - 11 Jul. 2003, Sapporro, Japan; No Copyright; Avail: Other Sources; Abstract Only

The 'Reanalysis for Stratospheric Trace Gas Studies' (ReSTS) project intends to provide a state-of-the-art meteorological dataset for use in chemistry-transport models (CTMs). The initial focus is on the period from May 1991 until April 1995, which encompasses the initial few years of observations from NASA's Upper Atmosphere Research Satellite (UARS) as well as the abrupt increase and slow decay of volcanic aerosol loading from Mount Pinatubo. The reanalysis is being performed using NASA's operational 'GEOS-4' data assimilation system. The results presented in this paper will begin with an overview

of the meteorology of the ReSTS period, validating the ReSTS data against independent analyses, followed by an evaluation of the system statistics (the 'Observation minus Forecast' for different input data types). Some sensitivities to the assumptions made in the assimilation process will be presented, including aspects of the forecast model and the statistical model used in the observation-forecast merging. Aspects of trace-gas transport will be discussed, focussing on the on-line water vapor distribution (which is a quasi-inert trace gas in the stratosphere), off-line transport studies of ozone and selected long-lived species, as well as assimilated ozone. The results will be discussed in the context of transport studies and our ability to use reanalyzed datasets to examine long-term variations in the meteorology and composition of the middle atmosphere.
Author
Meteorology; Trace Elements; Stratosphere; Rare Gases; Data Processing; On-Line Systems; Upper Atmosphere Research Satellite (Uars); Atmospheric Composition; Aerosols

20040031809 Massachusetts Inst. of Tech., Cambridge, MA, USA
Microwave Observations of Precipitation and the Atmosphere
Staelin, David H.; Rosenkranz, Philip W.; February 23, 2004; 8 pp.; In English
Contract(s)/Grant(s): NAG5-11390; No Copyright; Avail: CASI; A02, Hardcopy

This research effort had three elements devoted to improving satellite-derived passive microwave retrievals of precipitation rate: morphological rain-rate retrievals, warm rain retrievals, and extension of a study of geostationary satellite options. The morphological precipitation-rate retrieval method uses for the first time the morphological character of the observed storm microwave spectra. The basic concept involves: 1) retrieval of point rainfall rates using current algorithms, 2) using spatial feature vectors of the observations over segmented multi-pixel storms to estimate the integrated rainfall rate for that storm (cu m/s), and 3) normalization of the point rain-rate retrievals to ensure consistency with the storm-wide retrieval. This work is ongoing, but two key steps have been completed: development of a segmentation algorithm for defining spatial regions corresponding to single storms for purposes of estimation, and reduction of some of the data from NAST-M that will be used to support this research going forward. The warm rain retrieval method involved extension of Aquai/AIRS/AMSU/HSB algorithmic work on cloud water retrievals. The central concept involves the fact that passive microwave cloud water retrievals over approx. 0.4 mm are very likely associated with precipitation. Since glaciated precipitation is generally detected quite successfully using scattering signatures evident in the surface-blind 54- and 183-GHz bands, this new method complements the first by permitting precipitation retrievals of non-glaciated events. The method is most successful over ocean, but has detected non-glaciated convective cells over land, perhaps in their early formative stages. This work will require additional exploration and validation prior to publication. Passive microwave instrument configurations for use in geostationary orbit were studied. They employ parabolic reflectors between 2 and 4 meters in diameter, and frequencies up to approx.430 GHz; this corresponds to nadir spot diameters as small as 10 km.
Author
Convection; Microwave Sensors; Microwave Spectra; Precipitation (Meteorology); Storms

20040031839 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Native Peoples-Native Homelands Climate Change Workshop: Lessons Learned
Maynard, Nancy G.; [2003]; 1 pp.; In English; AGU Fall Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Native Peoples-Native Homelands Climate Change Workshop was held on October 28 through November 01,1998, as part of a series of workshops being held around the U.S. to improve the understanding of the potential consequences of climate variability and change for the Nation. This workshop was specifically designed by Native Peoples to examine the impacts of climate change and extreme weather variability on Native Peoples and Native Homelands from an indigenous cultural and spiritual perspective and to develop recommendations as well as identify potential response actions. The workshop brought together interested Native Peoples, representatives of Tribal governments, traditional elders, Tribal leaders, natural resource managers, Tribal College faculty and students, and climate scientists fiom government agencies and universities. It is clear that Tribal colleges and universities play a unique and critical role in the success of these emerging partnerships for decision-making in addition to the important education function for both Native and non-Native communities such as serving as a culturally-appropriate vehicle for access, analysis, control, and protection of indigenous cultural and intellectual property. During the discussions between scientists and policy-makers from both Native and non-Native communities, a number of important lessons emerged which are key to building more effective partnerships between Native and non-Native communities for collaboration and decision-making for a more sustainable future. This talk summarizes the key issues, recommendations, and lessons learned during this workshop.
Author
Climate Change; Weather; Access Control; Decision Making; Education; Policies; Protection; Variability

20040031846 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Comment on 'Modeling of Convective-Stratiform Precipitation Processes: Sensitivity to Partitioning Methods' by Matthias Steiner

Lang, Steve; Tao, W.-K.; Simpson, J.; Ferrier, B.; October 08, 2003; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Despite the obvious notion that the presence of hail or graupel is a good indication of convection, the model results show this does not provide an objective benchmark partly due to the unrealistic presence of small amounts of hail or graupel throughout the anvil in the model but mainly because of the significant amounts of hail or graupel, especially in the tropical TOGA COARE simulation, in the transition zone. Without use of a 'transition' category, it is open to debate as how this region should best be defined, as stratiform or as convective. So, the presence of significant hail or graupel contents in this zone significantly degrades its use an objective benchmark for convection. The separation algorithm comparison was done in the context of a cloud-resolving model. These models are widely used and serve a variety of purposes especially with regard to retrieving information that cannot be directly measured by providing synthetic data sets that are consistent and complete. Separation algorithms are regularly applied in these models. However, as with any modeling system, these types 'of models are constantly being improved to overcome any known deficiencies and make them more accurate representations of observed systems. The presence of hail and graupel in the anvil and the bias towards heavy rainfall rates are two such examples of areas that need improvement. Since, both of these can effect the perceived performance of the separation algorithms, the Lang et al. (2003) study did not want to overstate the relative performance of any specific algorithms.

Derived from text

Atmospheric Models; Clouds (Meteorology); Convection; Algorithms

20040031847 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Elevated Ozone in the Troposphere over the Atlantic and Pacific Oceans in the Northern Hemisphere

Chandra, S.; Ziemke, J. R.; Tie, Xuexi; [2003]; 13 pp.; In English

Contract(s)/Grant(s): NAG5-494; No Copyright; Avail: CASI; A03, Hardcopy

Tropospheric column ozone (TCO) is derived from differential measurements of total column ozone from Nimus-7 and Earth Probe TOMS, and stratospheric column ozone from the Microwave Limb Sounder instrument on the Upper Atmospheric Research Satellite. It is shown that TCO during summer months over the Atlantic and Pacific Oceans at northern mid-latitudes is about the same (50-60 Dobson Units) as over the continents of North America, Europe and Asia, where surface emissions of nitrogen oxides from industrial sources, biomass and biofuel burning and biogenic emissions are significantly larger. This nearly uniform zonal variation in TCO is modulated by surface topography of the Rocky and Himalayan mountains and Tibetan Plateau where TCO is reduced by 20-30 Dobson Units. The zonal characteristics of TCO derived from satellite measurements are well simulated by a global chemical transport model called MOZART-2 (Model of Ozone and Related Chemical Tracers, version 2). The model results are analyzed to delineate the relative importance of various processes contributing to observed zonal characteristics of TCO, and they are shown that the surface emission of NOx contributes about 50% of the TCO at northern mid-latitudes, especially over the continents of North America, Europe and Asia. The result of TCO derived from TOMS and the analysis from MOZART-2 indicate that TCO is a very useful tool to study tropospheric O3 pollution resulting from surface emissions of pollutants.

Author

Ozone; Upper Atmosphere; Troposphere; Atmospheric Composition; Biomass Burning; Contaminants

20040031848 NASA Goddard Space Flight Center, Greenbelt, MD, USA

High-Resolution Simulation of Hurricane Bonnie (1998), Part 1, The Organization of Vertical Motion

Braun, Scott A.; Montgomery, Michael T.; Pu, Zhaoxia; [2003]; 73 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

Hurricanes are well known for their strong winds and heavy rainfall, particularly in the intense rainband (eyewall) surrounding the calmer eye of the storm. In some hurricanes, the rainfall is distributed evenly around the eye so that it has a donut shape on radar images. In other cases, the rainfall is concentrated on one side of the eyewall and nearly absent on the other side and is said to be asymmetric. This study examines how the vertical air motions that produce the rainfall are distributed within the eyewall of an asymmetric hurricane and the factors that cause this pattern of rainfall. We use a sophisticated numerical forecast model to simulate Hurricane Bonnie, which occurred in late August of 1998 during a special NASA field experiment designed to study hurricanes. The simulation results suggest that vertical wind shear (a rapid change in wind speed or direction with height) caused the asymmetric rainfall and vertical air motion patterns by tilting the hurricane vortex and favoring upward air motions in the direction of tilt. Although the rainfall in the hurricane eyewall may surround

more than half of the eye, the updrafts that produce the rainfall are concentrated in very small-scale, intense updraft cores that occupy only about 10% of the eyewall area. The model simulation suggests that the timing and location of individual updraft cores are controlled by intense, small-scale vortices (regions of rapidly swirling flow) in the eyewall and that the updrafts form when the vortices encounter low-level air moving into the eyewall.
Author
Hurricanes; Wind Velocity; Vertical Air Currents; Rain; Fronts (Meteorology); Forecasting

20040031849 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Extratropical Stratosphere-Troposphere Mass Exchange
Schoeberl, Mark; [2003]; 1 pp.; In English; AGU Fall Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Global net mass flux between the troposphere and the stratosphere can be computed simply by estimating the heating rate along the 380K isentropic surface and the time rate of change of the lower most stratosphere (region between the tropopause and 380K). Given the net tropopause mass flux and the cross tropopause diabatic flux, the residual adiabatic mass flux can be estimated. These fluxes have been computed using three different meteorological data sets, the FVGCM and two assimilation data sets, FVDAS, and UKMO, using the 3.5 PVU defined tropopause. For all three data sets, the extratropical diabatic flux across the tropopause is generally to be larger than the net flux cross tropopause flux implying that there is a net extra-tropical adiabatic flux of air from the troposphere into the middle world stratosphere. This adiabatic flux is four to five times larger than the flux into the stratosphere across the tropical tropopause. For the FVDAS, the tropopause diabatic flux is smaller than UKMO as a result of colder tropopause temperatures. The difference in the diabatic mass fluxes by almost a factor of two between the two data assimilation meteorological analyses is much larger than the interannual variability in the UKMO or FVGCM data sets. Compared to radiosonde estimated tropopause temperatures, both data assimilation tropopause temperatures are warm biased due to a low bias in the tropopause heights. These comparisons point to the PV determination of the tropopause height as the source of the differences in the mass fluxes.
Author
Stratosphere; Troposphere; Heat Transfer; Atmospheric Circulation; Meteorological Parameters; Heating

20040031852 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Space Borne Cloud and Aerosol Measurements by the Geoscience Laser Altimeter System: Initial Results
Spinhirne, James D.; Palm, Steven P.; Hlavka, Dennis L.; Hart, William D.; Mahesh, Ashwin; Welton, Ellsworth J.; [2003]; 1 pp.; In English; IUGG 2003 Confernce, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

In January 2003 the Geoscience Laser Altimeter System (GLAS) was successfully launched into orbit. Beginning in March 2003 GLAS will provide global coverage lidar measurement of the height distribution of clouds and aerosol in the atmosphere for up to five years. The characteristic and value of the unique data will be presented. The instrument is a basic backscatter lidar that operates at two wavelengths, 532 and 1064 nm. The mission data products for atmospheric observations include the calibrated, observed, attenuated backscatter cross section for cloud and aerosol; height detection for multiple cloud layers; planetary boundary layer height; cirrus and aerosol optical depth and the height distribution of aerosol and cloud scattering cross section profiles. The data is expected to significantly enhance knowledge in several areas of atmospheric science, in particular the distribution, transport and influence of atmospheric aerosol and thin clouds. Measurements of the coverage and height of polar and cirrus cloud should be significantly more accurate than previous global observations. In March and April 2003, airborne and ground based data verification experiments will be carried out. Initial results from the verification experiments and the first several months of operation will be presented.
Author
Aerosols; Cloud Cover; Measuring Instruments; Radar Measurement; Laser Altimeters

20040033368 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Biomass Studies in Monsoon Regions Under the Coordinated Enhanced Observing Period (CEOP)
Lau, William K. M.; [2003]; 1 pp.; In English; Hong Kong Observatory and City Univ. of Hong Kong Meeting, 14-22 Jan. 2004, Kowloon, Hong Kong; No Copyright; Avail: Other Sources; Abstract Only

CEOP is an international program sponsored by the World Climate Research Project (WCRP) aiming at an integrated approach towards better understanding and prediction of the global water cycle. I will discuss the scientific rationale and

approach that underpin the program, especially with regard to the important implications on variability of climate and rainfall in monsoon regions around the world.
Author
Hydrological Cycle; Annual Variations

20040033376 Gerber Scientific, Inc., Reston, VA, USA
Parameterization of the Vertical Variability of Tropical Cirrus Cloud Microphysical and Optical Properties
Gerber, Hermann E.; February 20, 2004; 36 pp.; In English
Contract(s)/Grant(s): NAG5-11618; No Copyright; Avail: CASI; A03, Hardcopy

Cloud Integrating Nephelometers (CIN) were flown on the U. North Dakota Citation aircraft and the NASA WB-57 aircraft for the purpose of measuring in-situ the optical extinction coefficient and the asymmetry parameter (g) at a wavelength of 635 nm of primarily ice particles encountered during the NASA CRYSTAL-FACE study of large cumulus clouds (Cu) and their anvils found in the southern Florida region. The probes performance was largely successful and produced archived data for vertical profiles of extinction, asymmetry parameter, and effective radius (Re), the latter being obtained by combining CIN and CVI (total water; Oregon State U.) measurements. Composites of the CIN and CVI data describing the average microphysical and optical behavior of the Cu and their anvils showed the following: The extinction increases with height as a result of the size of the particles also decreasing with height as shown by the Re measurements; near the top of anvils the size of the primary ice particles is about 10-um radius; and the value of g does not vary significantly with height and has a mean value of about 0.73 consistent with the idea that ambient ice crystals are primarily of complex shape and reflect solar radiation more efficiently than particles of pristine crystal shape. Other observations include: The g measurements were found to be an indicator of the phase of the cloud permitting identification of the clouds with water droplets, rain, and ice; visual ranges as small as several tens of meters were occasionally found in 'extinction cores' that coincided with strong updraft cores; and comparison of the cloud probes on the Citation showed significant disagreement.
Author
Optical Properties; Tropical Regions; Cloud Physics; Cirrus Clouds; Parameterization

20040033935 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Impact of Aerosols on Cloud and Precipitation Processes: Cloud-Resolving Model Simulations
Tao, Wei-Kuo; Khain, A.; Simpson, S.; Johnson, D.; Li, X.; Remer, L.; [2003]; 1 pp.; In English; Weather Analysis Forecasting, 15-17 Sep. 2003, Taipei, Taiwan, Province of China; No Copyright; Avail: Other Sources; Abstract Only

Cloud microphysics are inevitable affected by the smoke particle (CCN, cloud condensation nuclei) size distributions below the clouds. Therefore, size distribution parameterized as spectral bin microphysics are needed to explicitly study the effect of atmospheric aerosol concentration on cloud development, rainfall production, and rainfall rates convective clouds. Recently, two detailed spectral-bin microphysical schemes were implemented into the Goddard Cumulus Ensembel (GCE) model. The formulation for the explicit spectral-bim 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 plate-like), snow (dendrites and aggregates), groupel and frozen drops/hall] 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 cloud systems in the west Pacific warm pool region and in the mid-latitude using identical thermodynamic conditions but with different concentrations of CCN: a low 'clean' concentration and a high 'dirty' concentration. Besides the initial differences in aerosol concentration, preliminary results indicate that the low CCN concentration case produces rainfall at the surface sooner than the high CCN case but has less cloud water mass aloft. Because the spectral-bim model explicitly calculates and allows for the examination of both the mass and number concentration of cpecies in each size category, a detailed analysis of the instantaneous size spectrum can be obtained for the two cases. It is shown that since the low CCN case produces fever droplets, larger size develop due to greater condencational and collectional growth, leading to a broader size spectrum in comparison to the high CCN case.
Author
Aerosols; Clouds (Meteorology); Impact; Precipitation (Meteorology); Cumulus Clouds; Thermodynamics

20040033990 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Three-Parameter Inversion of the Drop Size Distribution Using NASA/TRMM Microwave Link Data

Rincon, Rafael F.; Lang, Roger H.; Meneghini, Robert; March 24, 2003; 3 pp.; In English; International Geoscience and Remote Sensing Symposium 2003, 2003, Toulouse, France

Report No.(s): Rept-1; Copyright; Avail: CASI; A01, Hardcopy

Attenuation measurements at 25 and 38 GHz performed with the NASA/TRMM Microwave Link provide information about the drop size distribution (DSD) along the propagation path. Additional path-average measurements along the Link path, such as a third attenuation measurement or the rain rate from well-calibrated raingauges, can provide further DSD information. This paper explores an inversion procedure for determining simultaneously three parameters of a gamma DSD by using three measurements. Also, some preliminary results obtained using Link data are presented.

Author

Drop Size; Microwave Attenuation; NASA Programs; Data Links; Meteorological Parameters

20040033997 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Promise and Capability of NASA's Earth Observing System to Monitor Human-Induced Climate Variations

King, M. D.; [2003]; 1 pp.; In English; American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Earth Observing System (EOS) is a space-based observing system comprised of a series of satellite sensors by which scientists can monitor the Earth, a Data and Information System (EOSDIS) enabling researchers worldwide to access the satellite data, and an interdisciplinary science research program to interpret the satellite data. The Moderate Resolution Imaging Spectroradiometer (MODIS), developed as part of the Earth Observing System (EOS) and launched on Terra in December 1999 and Aqua in May 2002, is designed to meet the scientific needs for satellite remote sensing of clouds, aerosols, water vapor, and land and ocean surface properties. This sensor and multi-platform observing system is especially well suited to observing detailed interdisciplinary components of the Earth s surface and atmosphere in and around urban environments, including aerosol optical properties, cloud optical and microphysical properties of both liquid water and ice clouds, land surface reflectance, fire occurrence, and many other properties that influence the urban environment and are influenced by them. In this presentation I will summarize the current capabilities of MODIS and other EOS sensors currently in orbit to study human-induced climate variations.

Author

Earth Observing System (Eos); Cloud Physics; Climate; Aerosols

20040034000 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Definition of International GPM GV Research Program

Smith, Eric A.; [2003]; 2 pp.; In English; 1st International GPM GV Requirements Workshop, 4-7 Nov. 2003, Abingdon, UK; No Copyright; Avail: Other Sources; Abstract Only

The Global Precipitation Measurement (GPM) Mission will consist of a constellation of rain-measuring satellites, the main member of which (the core satellite) will serve as the measurement reference to the other members of the constellation. The core satellite is being developed jointly by the National Aeronautics and Space Administration (NASA) and the newly-named Japan Aerospace Exploration Agency (JAXA -- previously NASDA) along with its government partner, the Communications Research Laboratory (CRL). The GPM mission was proposed as a follow-up mission to the Tropical Rainfall Measuring Mission (TRMM) by both NASA and NASDA based on the unparalleled scientific success of TRMM, and has recently been joined by the European Space Agency (ESA) via its formulation of the European GPM mission (i.e., EGPM). GPM is an ambitious mission designed to produce accurate and frequent global observations of precipitation (both rain and snow) made possible by replacing the TRMM satellite with the new core satellite carrying an advanced radar-radiometer system, and serving as the centerpiece for the constellation of some eight (8) additional satellites being provided through international cooperation. The core satellite is to be flown up to high latitudes (inclined some 65-70 degrees), and will carry a Ku/Ka-band, nadir-scanning, dual-frequency precipitation radar (DPR) that is being developed by JAXA and CRL, along with a large aperture, extended frequency-range, conically-scanning passive microwave radiometer being developed by NASA and its industrial partners. Each constellation satellite will also carry some type of multi-channel passive microwave radiometer (as well as a multi-beam Ka-band radar in the case of EGPM) whose rain estimates will be calibrated and referenced to those made by the core satellite, producing for the first time fully-global, continuous, and bias-free precipitation datasets. GPM data will be delivered in near-realtime, taking a major step toward the operational use of precipitation information for model initialization and data assimilation in a number of application areas such as hazardous weather forecasting, flood warning, fresh water resource assessment, and crop growth prediction. In addition, GPM data will

complement the now-existing global temperature record, allowing for improved assessments of climate change, particularly those processes in which the global water cycle both forces and responds to climatic drifts in global temperature conditions. A foremost element of this international constellation mission is a parallel international ground validation (GV) network. This GV network is needed to determine uncertainties in the rain retrievals, critical for application of the retrieval information in weather and hydrometeorological modeling and climate diagnostics, as well as assurances that the satellite retrievals of surface rainfall are consistent with those actually measured at the surface. The key aspects of this network is that it must be worldwide and created through the GPM partnership process. Therefore the network will consist of a confederation of government agencies, academic organizations, private institutions, and individual scientists from a collection of nations who have initiated the process by gathering in Abingdon to develop the fundamentals of the international GPM GV research programme. Therefore in keeping with our responsibilities as the front-runners of the programme, the main objectives of this workshop are: (1) to present and share opinions on interests, perspectives, and concerns about GPM GV research; (2) to examine the conceptual and/or planned GPM GV site templates from NASA, NASDA, ESA, and other partners; (3) to define the main scientific objectives of the international GPM GV research programme; (4) to formulate a preliminary set of international GPM GV science and measurement requirements; and (5) to convene a Steering Committee to aid the organization of the GPM GV program, to document its science implementation plans, and to aid planning for follow-up GPM GV meetings.
Author
Precipitation Measurement; Constellations; Weather Forecasting; Floods; Crop Growth; Atmospheric Temperature

20040034001 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA GPM GV Science Requirements
Smith, E.; [2003]; 1 pp.; In English; 1st International GPM GV Workshop, 4-7 Nov. 2003, Abington, UK; No Copyright; Avail: Other Sources; Abstract Only

An important scientific objective of the NASA portion of the GPM Mission is to generate quantitatively-based error characterization information along with the rainrate retrievals emanating from the GPM constellation of satellites. These data must serve four main purposes: (1) they must be of sufficient quality, uniformity, and timeliness to govern the observation weighting schemes used in the data assimilation modules of numerical weather prediction models; (2) they must extend over that portion of the globe accessible by the GPM core satellite to which the NASA GV program is focused - (approx.65 degree inclination); (3) they must have sufficient specificity to enable detection of physically-formulated microphysical and meteorological weaknesses in the standard physical level 2 rainrate algorithms to be used in the GPM Precipitation Processing System (PPS), i.e., algorithms which will have evolved from the TRMM standard physical level 2 algorithms; and (4) they must support the use of physical error modeling as a primary validation tool and as the eventual replacement of the conventional GV approach of statistically intercomparing surface rainrates fiom ground and satellite measurements. This approach to ground validation research represents a paradigm shift vis-&-vis the program developed for the TRMM mission, which conducted ground validation largely as a statistical intercomparison process between raingauge-derived or radar-derived rainrates and the TRMM satellite rainrate retrievals -- long after the original satellite retrievals were archived. This approach has been able to quantify averaged rainrate differences between the satellite algorithms and the ground instruments, but has not been able to explain causes of algorithm failures or produce error information directly compatible with the cost functions of data assimilation schemes. These schemes require periodic and near-realtime bias uncertainty (i.e., global space-time distributed conditional accuracy of the retrieved rainrates) and local error covariance structure (i.e., global space-time distributed error correlation information for the local 4-dimensional space-time domain -- or in simpler terms, the matrix form of precision error). This can only be accomplished by establishing a network of high quality-heavily instrumented supersites selectively distributed at a few oceanic, continental, and coastal sites. Economics and pragmatics dictate that the network must be made up of a relatively small number of sites (6-8) created through international cooperation. This presentation will address some of the details of the methodology behind the error characterization approach, some proposed solutions for expanding site-developed error properties to regional scales, a data processing and communications concept that would enable rapid implementation of algorithm improvement by the algorithm developers, and the likely available options for developing the supersite network.
Author
Constellations; Rain Gages; Numerical Weather Forecasting; Error Analysis; Atmospheric Models

20040034019 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Weather Workshop
Gallagher, D. L.; [2004]; 1 pp.; In English; MSFC Educator Resource Center: Teacher Workshop, 27 Jan. 2004, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

This workshop will focus on what space weather is about and its impact on society. An overall picture will be 'painted' describing the Sun's influence through the solar wind on the near-Earth space environment, including the aurora, killer electrons at geosynchronous orbit, million ampere electric currents through the ionosphere and along magnetic field lines, and the generation of giga-Watts of natural radio waves. Reference material in the form of Internet sites will be provided so that teachers can discuss space weather in the classroom and enable students to learn more about this topic.
Author
Aerospace Environments; Images; Magnetic Fields; Solar Wind; Space Weather

20040034037 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Global S$_1$ Ocean Tide
Ray, Richard D.; Egbert, G. D.; [2003]; 1 pp.; In English; American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The small S$_1$ ocean tide is caused primarily by diurnal atmospheric pressure loading. Its excitation is therefore unlike any other diurnal tide. The global character of $S-1$ is here determined by numerical modeling and by analysis of Topex/Poseidon satellite altimeter data. The two approaches yield reasonably consistent results, and large ($ greater than $l\cm) amplitudes in several regions are further confirmed by comparison with coastal tide gauges. Notwithstanding their excitation differences, S-1 and other diurnal tides are found to share several common features, such as relatively large amplitudes in the Arabian Sea, the Sea of Okhotsk, and the Gulf of Alaska. The most noticeable difference is the lack of an S-1 Antarctic Kelvin wave. These similarities and differences can be explained in terms of the coherences between near-diurnal oceanic normal modes and the underlying tidal forcings. While gravitational diurnal tidal forces excite primarily a 28-hour Antarctic-Pacific mode, the S$_1$ air tide excites several other near-diurnal modes, none of which has large amplitudes near Antarctica.
Author
Tides; Antarctic Regions; Arabian Sea; Atmospheric Pressure; Diurnal Variations; Kelvin Waves; Mathematical Models; Oceans

20040034038 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Visions of our Planet's Atmosphere, Land and Oceans: NASA/NOAA E-Theater 2003
Hasler, Fritz; [2003]; 1 pp.; In English; CEOS Meeting, 17-20 Nov. 2003, Colorado Springs, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA/NOAA Electronic Theater presents Earth science observations from space in a spectacular way. Fly in from outer space to the conference location as well as the site of the 2002 Olympic Winter Games using data from NASA satellites and the IKONOS 'Spy Satellite'. See HDTV movie Destination Earth 2002 incorporating the Olympic Zooms, NBC footage of the 2002 Olympics, the shuttle, & the best NASA/NOAA Earth science visualizations. See the latest US and international global satellite weather movies including hurricanes, typhoons & 'tornadoes'. See the latest visualizations from NASA/NOAA and International remote sensing missions like Terra, Aqua, GOES, GMS, SeaWiFS, & Landsat. Feel the pulse of OUT planet. See how land vegetation, ocean plankton, clouds and temperatures respond to the sun & seasons. See vortexes and currents in the global oceans that bring up the nutrients to feed tiny algae and draw the fish, whales and fisherman. See the how the ocean blooms in response to these currents and El Nino/La Nina climate changes. See the city lights, fishing fleets, gas flares and bio-mass burning of the Earth at night observed by the 'night-vision' DMSP satellite. The presentation will be made using the latest HDTV and video projection technology by: Dr. Fritz Hasler NASA/Goddard Space Flight Center.
Author
Earth Sciences; Remote Sensing; Earth Atmosphere; Noaa Satellites; NASA Programs; Weather

20040034042 National Center for Atmospheric Research, Boulder, CO, USA
Effective Ice Particle Densities for Cold Anvil Cirrus
Heymsfield, Andrew J.; Schmitt, Carl G.; Bansemer, Aaron; Baumgardner, Darrel; Weinstock, Elliot M.; Smith, Jessica; [2002]; 9 pp.; In English
Contract(s)/Grant(s): NAG5-11611; Copyright; Avail: CASI; A02, Hardcopy

This study derives effective ice particle densities from data collected from the NASA WB-57F aircraft near the tops of anvils during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers (CRYSTAL) Florida Area Cirrus Experiment (FACE) in southern Florida in July 2002. The effective density, defined as the ice particle mass divided by the volume of an equivalent diameter liquid sphere, is obtained for particle populations and single sizes containing mixed particle habits using

measurements of condensed water content and particle size distributions. The mean effective densities for populations decrease with increasing slopes of the gamma size distributions fitted to the size distributions. The population-mean densities range from near 0.91 g/cu m to 0.15 g/cu m. Effective densities for single sizes obey a power-law with an exponent of about -0.55, somewhat less steep than found from earlier studies. Our interpretations apply to samples where particle sizes are generally below 200-300 microns in maximum dimension because of probe limitations.
Author
Ice; Particle Mass; Size Distribution; Cirrus Clouds

20040034048 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mars Express MARSIS Radar: A Prediction of the Effect of Overlying Ice on Detecting Polar Basal Lakes and Inter-Glacial Aquifers
Farrell, W. M.; Plaut, J. J.; Gurnett, D. A.; Picardi, G.; February 2004; 14 pp.; In English
Report No.(s): NASA/TM-2004-212749; Rept-2004-00837-0; No Copyright; Avail: CASI; A03, Hardcopy

The penetration of the MARSIS radar signal into the polar ice mass is modeled to determine the capability of the instrument to locate sub-glacial aquifers. As a ground penetrating radar, the orbiting MARSIS transmits a signal greater than 1 W between 1-5 MHz. In this work we will investigate the effect of ice conductive losses on the radar-detection of subsurface aquifers. Based on wave propagation analysis, it is found that for a bulk ice conductivity below 10-5 S/m, conductive losses in the medium are not significant. However, if the bulk ice conductivity is relatively large (greater than 10-5 S/m), the reflected signal from any deep aquifer will be absorbed as it propagates in the lossy ice medium limiting the probing depth.
Author
Aquifers; Glaciers; Lakes; Mars Express; Polar Regions; Radar Detection; Basalt

20040034050 Colorado State Univ., Fort Collins, CO, USA
African Dust Aerosols as Atmospheric Ice Nuclei
DeMott, Paul J.; Brooks, Sarah D.; Prenni, Anthony J.; Kreidenweis, Sonia M.; Sassen, Kenneth; Poellot, Michael; Rogers, David C.; Baumgardner, Darrel; [2003]; ISSN 0094-8276; 8 pp.; In English
Contract(s)/Grant(s): NAG5-11611; NAG5-11476; NAG5-11503
Report No.(s): Paper 2003GL017410; Copyright; Avail: CASI; A02, Hardcopy

Measurements of the ice nucleating ability of aerosol particles in air masses over Florida having sources from North Africa support the potential importance of dust aerosols for indirectly affecting cloud properties and climate. The concentrations of ice nuclei within dust layers at particle sizes below 1 pn exceeded 1/cu cm; the highest ever reported with our device at temperatures warmer than homogeneous freezing conditions. These measurements add to previous direct and indirect evidence of the ice nucleation efficiency of desert dust aerosols, but also confirm their contribution to ice nuclei populations at great distances from source regions.
Author
Ice Nuclei; Aerosols; Dust; Atmospheric Physics; Atmospheric Composition

20040034055 NASA Goddard Inst. for Space Studies, New York, NY, USA
The Use of Sage Water Vapor Data for Investigating Climate Change Issues
Rind, D.; [2003]; 1 pp.; In English; SOSST Meeting, 6-8 May 2003, Williamsburg, VA, USA; No Copyright; Avail: Other Sources; Abstract Only

SAGE water vapor data has proven valuable for addressing several of the important issues in climate change research. It has been used to investigate how the upper troposphere water vapor responds to warming and convection, a key question in understanding the water vapor feedback to anthropogenic global warming. In the case of summer versus winter differences, SAGE results showed that the upper tropospheric relative humidity remained approximately constant; this result was in general agreement with how a GCM handled the seasonal difference, and gave credence to the argument that the GCM was not overestimating the water vapor feedback associated with convection. In addition, the convection-water vapor relationship was investigated further using SAGE water vapor and ISCCP cloud data. The results showed that upper tropospheric drying did appear to occur simultaneously with deep convective events in the tropics, only to be replaced by moistening a few hours later, associated (most likely) with the reevaporation of moisture from anvil clouds. The total effect was, again, a moistening of the upper troposphere associated with convection. Calculation of the actual trends in upper tropospheric moisture is a potential goal for SAGE data usage; trends calculated with radiosonde data, or instruments calibrated with radiosonde data have the problem of the effect of changing radiosonde instruments. SAGE data have in effect been used to compare different

radiosondes through comparisons, and could continue to do so. SAGE 3 should also help clarify the absolute accuracy of SAGE retrievals in the troposphere. and its consequences. Model results show that water vapor increases can help explain the observations of stratospheric cooling, along with increasing C02 and ozone reduction. SAGE has been shown to provide trends similar to those of some other satellite and in situ retrievals, with increasing water vapor over time. However, SAGE is impacted by aerosol contamination which must be removed from the data; approaches used in the past will be reviewed. The SAGE water vapor errors, if taken literally, would make it hard to justify using SAGE data for such trends, and the error bars must be investigated. Stratospheric water vapor increases, like tropospheric increases, would lead to noticeable warming at the surface, and their changes must be quantified.
Author
Water Vapor; Data Acquisition; Climate Change; Upper Atmosphere; Troposphere; Global Warming; Ozone

20040034075 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Science Applications International Corp., Greenbelt, MD, USA
Estimating the Tropospheric Ozone Distribution by the Assimilation of Satellite Data
Hayashi, Hiroo; Stajner, Ivanka; Winslow, Nathan; Jones, Dylan B. A.; Pawson, Steven; Thompson, Anne M.; [2003]; 1 pp.; In English; IUGG 2003 Assembly, 30 Jun. - 11 Jul. 2003, Sapporro, Japan; No Copyright; Avail: Other Sources; Abstract Only

Tropospheric ozone is important to the environment, because it acts as a strong oxidant to control the concentrations of many reduced gases (methane, carbon monoxide, ...), its radiative forcing plays a significant role in the greenhouse effect, and direct contact with ozone is harmful to human health. Tropospheric ozone, whose main sources are intrusion from the stratosphere and chemical production from source gases associated with urban pollution or biomass burning, varies on a wide range of spatial and temporal scales. Its transport and chemistry can be influenced by weather, seasonal, or multiannual variability. Despite the importance of tropospheric ozone, it contributes only about 10% of the total ozone loading in the atmosphere. Consequently, satellite instruments lose sensitivity below the stratospheric ozone peak, and provide little information about middle and lower tropospheric ozone. This talk will discuss recent modifications made to the satellite ozone data assimilation system at NASA's Data Assimilation Office (DAO) in order to provide better tropospheric ozone columns and profiles. We use a version of the system that assimilates only the data from the Solar Backscatter UltraViolet/2 (SBUV/2) instrument. The quality of the assimilated ozone in the tropical troposphere is evaluated by comparison with independent observations obtained from the Southern Hemispheric Additional Ozonesondes (SHADOZ) network. It is shown that the quality of ozone fields is sensitive to the winds used in the transport model. Increasing the vertical resolution of the model also has a beneficial impact. The assimilated ozone in the lower troposphere was substantially improved by inclusion of tropospheric ozone production, loss, and dry deposition rates from the Harvard GEOS-CHEM model. The mechanisms behind these results will be examined and the implications for our understanding of tropospheric ozone will be discussed.
Author
Troposphere; Ozone; Satellite Sounding; Data Processing

20040034104 NASA Langley Research Center, Hampton, VA, USA
Interannual and Long-Term Changes in Middle Atmosphere Temperature from Haloe
Remsbwerg, Ellis; Deaver, Lance; [2003]; 4 pp.; In English; 15th Symposium on Global Change and Climate Variations, January 2004, Seattle, WA, USA
Contract(s)/Grant(s): RTOP 621-25-99; No Copyright; Avail: CASI; A01, Hardcopy

Radiative models of the middle atmosphere indicate that the largest temperature response due to steadily increasing amounts of atmospheric CO2 should occur at pressure altitudes between 1 and 0.1 hPa (about 48 to 64 km) and be of the order of 0.5 to 0.6 K/decade on a pressure surface . Such a rate assumes that there is no trend in ozone or in the dissipation of wave activity for that region of the middle atmosphere. This rate of cooling is only of the order of 0.20 to 0.25% per decade, which is a small trend to discern from observations. We have analyzed the 11-year, Version 19 (or V19) temperature versus pressure profile (or T(p)) time series from the UARS Halogen Occultation Experiment (HALOE) for such trends at selected pressure levels. The HALOE T(p) time series are being obtained using CO2 transmission data centered at 2.8 micrometers and from a single instrument that uses the limb solar occultation measurement geometry, which provides significant advantages for the calibration of its single profiles.
Author
Halogen Occultation Experiment; Temperature Profiles; Pressure Distribution

20040034105 NASA Goddard Space Flight Center, Greenbelt, MD, USA, George Mason Univ., Fairfax, VA, USA
Low Frequency Oscillations in Assimilated Global Datasets Using TRMM Rainfall Observations
Tao, Li; Yang, Song; Zhang, Zhan; Hou, Arthur; Olson, William S.; [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

Global datasets for the period May-August 1998 from the Goddard Earth Observing System (GEOS) data assimilation system (DAS) with/without assimilated Tropical Rainfall Measuring Mission (TRMM) precipitation are analyzed against European Center for Medium-Range Weather Forecast (ECMWF) output, NOAA observed outgoing longwave radiation (OLR) data, and TRMM measured rainfall. The purpose of this study is to investigate the representation of the Madden-Julian Oscillation (MJO) in GEOS assimilated global datasets, noting the impact of TRMM observed rainfall on the MJO in GEOS data assimilations. A space-time analysis of the OLR data indicates that the observed OLR exhibits a spectral maximum for eastward-propagating wavenumber 1-3 disturbances with periods of 20-60 days in the 0deg-30degN latitude band. The assimilated OLR has a similar feature but with a smaller magnitude. However, OLR spectra from assimilations including TRMM rainfall data show better agreement with observed OLR spectra than spectra from assimilations without TRMM rainfall. Similar results are found for wavenumber 4-6 disturbances. There is a spectral peak for eastward-propagating wavenumber 4-6 disturbances with periods of 20-40 days near the equator, while for westward-moving disturbances, a spectral peak is noted for periods of 30-50 days near 25degN. To isolate the MJO, a 30-50 day band filter is selected for this study. It was found that the eastward-propagating waves from the band-filtered observed OLR between 10degs- 10degN are located in the eastern hemisphere. Similar patterns are evident in surface rainfall and the 850 hPa wind field. Assimilation of TRMM-observed rainfall reveals more distinct MJO features in the analysis than without rainfall assimilation. Similar analyses are also conducted over the Indian summer monsoon and East Asia summer monsoon regions, where the MJO is strongly related to the summer monsoon active-break patterns.
Author
Oscillations; Earth Observing System (Eos); Madden-Julian Oscillation; Rain; Weather Forecasting

20040034110 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Comparison of Latent Heat Fluxes over Global Oceans for Four Flux Products
Chou, Shu-Hsien; Nelkin, Eric; Ardizzone, Joe; Atlas, Robert M.; Journal of Climate; November 05, 2003; 39 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

To improve our understanding of global energy and water cycle variability, and to improve model simulations of climate variations, it is vital to have accurate latent heat fluxes (LHF) over global oceans. Monthly LHF, 10-m wind speed (U10m), 10-m specific humidity (Q10h), and sea-air humidity difference (Qs-Q10m) of GSSTF2 (version 2 Goddard Satellite-based Surface Turbulent Fluxes) over global Oceans during 1992-93 are compared with those of HOAPS (Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data), NCEP (NCEP/NCAR reanalysis). The mean differences, standard deviations of differences, and temporal correlation of these monthly variables over global Oceans during 1992-93 between GSSTF2 and each of the three datasets are analyzed. The large-scale patterns of the 2yr-mean fields for these variables are similar among these four datasets, but significant quantitative differences are found. The temporal correlation is higher in the northern extratropics than in the south for all variables, with the contrast being especially large for da Silva as a result of more missing ship data in the south. The da Silva has extremely low temporal correlation and large differences with GSSTF2 for all variables in the southern extratropics, indicating that da Silva hardly produces a realistic variability in these variables. The NCEP has extremely low temporal correlation (0.27) and large spatial variations of differences with GSSTF2 for Qs-Q10m in the tropics, which causes the low correlation for LHF. Over the tropics, the HOAPS LHF is significantly smaller than GSSTF2 by approx. 31% (37 W/sq m), whereas the other two datasets are comparable to GSSTF2. This is because the HOAPS has systematically smaller LHF than GSSTF2 in space, while the other two datasets have very large spatial variations of large positive and negative LHF differences with GSSTF2 to cancel and to produce smaller regional-mean differences. Our analyses suggest that the GSSTF2 latent heat flux, surface air humidity, and winds are likely to be more realistic than the other three flux datasets examined, although those of GSSTF2 are still subject to regional biases.
Author
Latent Heat; Heat Flux; Oceans; Tropical Regions

20040034117 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Quasi-Equilibria of the Rotunno-Emanuel Tropical Cyclone Model
Chao, Winston C.; Chen, Baode; [2003]; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Long-term integrations using the Rotunno-Emanuel (RE) model demonstrate that given sufficient elapsed time the weak initial vortex specified by R E can also lead to tropical cyclogenesis, albeit at a slower growth rate. Thus the RE notion of

the finite-amplitude nature of tropical cyclogenesis is valid only if the period of examination is limited to the first eight days. These results also show that, if initial vortex as specified by RE is used, prior to cyclogenesis the model state does not resemble the observed pre-genesis disturbances in the sense that there is no precipitation in the center of the disturbance. Another experiment using the same model but with the initial vortex replaced by a disturbance with a different structure shows that a state resembling the observed pre-genesis disturbances can be simulated and this state can lead to spontaneous cyclogenesis, a rapid transition between two quasi-equilibria. This spontaneous cyclogenesis is associated with the generation of a new convective region at large radius and its subsequent contraction, which reminds one of the observed eye-wall replacement, but the distinction from the latter is obvious.
Author
Tropical Storms; Mathematical Models; Cyclogenesis; Equilibrium Flow; Precipitation (Meteorology); Quasi-Steady States

20040034122 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Validation of the Poisson Stochastic Radiative Transfer Model
Zhuravleva, Tatiana; Marshak, Alexander; January 2004; 26 pp.; In English
Contract(s)/Grant(s): NAS5-012; DE-A105-90ER-91069; RFBR-03-05-64655a; Copyright; Avail: CASI; A03, Hardcopy

A new approach to validation of the Poisson stochastic radiative transfer method is proposed. In contrast to other validations of stochastic models, the main parameter of the Poisson model responsible for cloud geometrical structure - cloud aspect ratio - is determined entirely by matching measurements and calculations of the direct solar radiation. If the measurements of the direct solar radiation is unavailable, it was shown that there is a range of the aspect ratios that allows the stochastic model to accurately approximate the average measurements of surface downward and cloud top upward fluxes. Realizations of the fractionally integrated cascade model are taken as a prototype of real measurements.
Author
Mathematical Models; Poisson Equation; Stochastic Processes; Cloud Physics; Radiative Heat Transfer; Radiative Transfer

20040034123 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Precipitation Measurement (GPM) Orbit Design and Autonomous Maneuvers
Folta, David; Mendelsohn, Chad; [2003]; 2 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

The NASA Goddard Space Flight Center's Global Precipitation Measurement (GPM) mission will meet a challenge of measuring worldwide precipitation every three hours. The GPM spacecraft, part of a constellation, will be required to maintain a circular orbit in a high drag environment to accomplish this challenge. Analysis by the Flight Dynamics Analysis Branch has shown that the prime orbit altitude of 40% is necessary to prevent ground track repeating. Combined with goals to minimize maneuver impacts to science data collection and enabling reasonable long-term orbit predictions, the GPM project has decided to fly an autonomous maneuver system. This system is a derivative of the successful New Millennium Program technology flown onboard the Earth Observing-1 mission. This paper presents the driving science requirements and goals of the mission and shows how they will be met. Analysis of the orbit optimization and the AV requirements for several ballistic properties are presented. The architecture of the autonomous maneuvering system to meet the goals and requirements is presented along with simulations using a GPM prototype. Additionally, the use of the GPM autonomous system to mitigate possible collision avoidance and to aid other spacecraft systems during navigation outages is explored.
Author
Data Acquisition; Derivation; Precipitation Measurement; Trajectory Optimization; Simulation

20040034128 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Research on TRMM and GPM Through Collaboration Between JAXA & NASA
Smith, Eric A.; [2003]; 1 pp.; In English; 105th Kenkyu Happyou Kai (CRL Open Lectures), 19-20 Nov. 2003, Tokyo, Japan; No Copyright; Avail: Other Sources; Abstract Only

The Japan Aerospace Exploration Agency (JAXA) is conducting joint research with the Communications Research Laboratory (CRL) and the National Aeronautics and Space Administration (NASA) on a new constellation satellite observation project called Global Precipitation Measurement (GPM), the main satellite of which is planned for launch in 2008 by JAXA. This GPM project was proposed as a follow-up mission to the Tropical Rainfall Measuring Mission (TRMM) by both the Japanese and American sides based on the unparalleled scientific success of TRMM. A major reason for TRMM's success was the use of the worlds first spaceborne rain radar, the Precipitation Radar (PR) system developed by the National

Space Development Agency of Japan (NASDA, now JAXA) and CRL. Measurements from this instrument have ushered in many new scientific findings and have opened a new era of precipitation measuring from space. GPM is an ambitious project which will produce accurate and frequent global observations of precipitation (both rain and snow) made possible by replacing TRMM with a new core satellite carrying an advanced radar-radiometer system, and serving as the centerpiece for a constellation of some eight (8) additional satellites being provided through international cooperation. The core satellite is to be flown up to high latitudes (inclined some 65-70 degrees), and will carry a dual-frequency precipitation radar (DPR) that will be newly developed by JAXA and CRL, along with a large aperture, extended frequency-range passive microwave radiometer being provided by NASA. Each constellation satellite will also carry some type of multi-channel passive microwave radiometer whose rain estimates will be calibrated and referenced to those made by the core satellite, producing for the first time fully-global, continuous, and bias-free precipitation datasets. GPM data will be delivered in near-realtime, taking a major step toward the operational use of precipitation information for model initialization and data assimilation in a number of application areas such as hazardous weather forecasting, flood warning, fresh water resource assessment, and crop growth prediction. In addition, GPM data will complement the now-existing global temperature record, allowing for improved assessments of climate change, particularly those processes in which the global water cycle both forces and responds to climatic drifts in global temperature conditions.
Author
Japan; NASA Programs; Trmm Satellite; Precipitation Measurement; Satellite Observation; Meteorological Radar

20040034129 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status of Validation Program for Tropical Rainfall Measuring Mission (TRMM)
Adler, Robert; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Tropical Rainfall Measuring Mission (TRMM) is in its sixth year of operation. This successful research mission, a joint U.S./Japan effort, has become-a key element in the routine monitoring of global precipitation. The package of rain measuring instrumentation, including the first meteorological radar in space, continues to function perfectly, and with the increase in orbital altitude (from 350 km to 400 km) the mission will hopefully continue for a number of years. The validation effort has been a combination of routine use of 1) ground-based radar and raingauge measurements for comparison with the satellite-based estimates, 2) the use of field experiment data for evaluation of the satellite data products and investigation of some of the assumptions in the satellite retrievals, and 3) use of other comparison data sets, including atoll and buoy gauges over ocean and research and operational gauge data sets over land. The status of the program will be described along with 'lessons learned'. Near term plans for improved validation products and new thrusts related to validation of TRMM-based multi-satellite products that extend into middle latitudes will be outlined.
Author
Precipitation (Meteorology); Trmm Satellite; Meteorological Radar; Meteorological Parameters

20040034130 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Stochastic Model of Space-Time Variability of Mesoscale Rainfall: Statistics of Spatial Averages
Kundu, Prasun K.; Bell, Thomas L.; [2003]; 19 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A characteristic feature of rainfall statistics is that they depend on the space and time scales over which rain data are averaged. A previously developed spectral model of rain statistics that is designed to capture this property, predicts power law scaling behavior for the second moment statistics of area-averaged rain rate on the averaging length scale L as L right arrow 0. In the present work a more efficient method of estimating the model parameters is presented, and used to fit the model to the statistics of area-averaged rain rate derived from gridded radar precipitation data from TOGA COARE. Statistical properties of the data and the model predictions are compared over a wide range of averaging scales. An extension of the spectral model scaling relations to describe the dependence of the average fraction of grid boxes within an area containing nonzero rain (the 'rainy area fraction') on the grid scale L is also explored.
Author
Mathematical Models; Mesoscale Phenomena; Rain; Stochastic Processes; Statistical Analysis; Variability; Spatial Dependencies

20040034133 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Facets and Challenges of Managing the Development of a $1 Billion Satellite
Loiacono, John; December 03, 2003; 30 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the folloving: Presidents budget. Office of Administrator chart. Aura project organization chart.

Agreements. Aura observatory configuration. Aura science questions. EOS Aura atmospheric profile measurements. Science objectives: tracking ozone layer recovery; global measurements of air quality; impact of atmospheric constituente on climate. MLS instruments, OH measurement example. Osone monitoring instrument (OMI). OMI technology. OMI will track global ozone changes.
CASI
Air Quality; Climate; Observatories; Ozone; Ozonosphere; Monitors

20040034176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Equation for Moist Entropy in a Precipitating and Icy Atmosphere
Tao, Wei-Kuo; Simpson, Joanne; Zeng, Xiping; [200]; 37 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Moist entropy is nearly conserved in adiabatic motion. It is redistributed rather than created by moist convection. Thus moist entropy and its equation, as a healthy direction, can be used to construct analytical and numerical models for the interaction between tropical convective clouds and large-scale circulations. Hence, an accurate equation of moist entropy is needed for the analysis and modeling of atmospheric convective clouds. On the basis of the consistency between the energy and the entropy equations, a complete equation of moist entropy is derived from the energy equation. The equation expresses explicitly the internal and external sources of moist entropy, including those in relation to the microphysics of clouds and precipitation. In addition, an accurate formula for the surface flux of moist entropy from the underlying surface into the air above is derived. Because moist entropy deals 'easily' with the transition among three water phases, it will be used as a prognostic variable in the next generation of cloud-resolving models (e. g. a global cloud-resolving model) for low computational noise. Its equation that is derived in this paper is accurate and complete, providing a theoretical basis for using moist entropy as a prognostic variable in the long-term modeling of clouds and large-scale circulations.
Author
Entropy; Ice; Mathematical Models; Moisture

20040034195 NASA Ames Research Center, Moffett Field, CA, USA
Understanding the Effect of Land Cover Classification on Model Estimates of Regional Carbon Cycling in the Boreal Forest Biome
Kimball, John; Kang, Sinkyu; July 9, 2003; 4 pp.; In English; American Geophysical Union Meeting, 5-10 Dec. 2002, San Francisco, CA, USA
Contract(s)/Grant(s): NAG2-1531; No Copyright; Avail: CASI; A01, Hardcopy

The original objectives of this proposed 3-year project were to: 1) quantify the respective contributions of land cover and disturbance (i.e., wild fire) to uncertainty associated with regional carbon source/sink estimates produced by a variety of boreal ecosystem models; 2) identify the model processes responsible for differences in simulated carbon source/sink patterns for the boreal forest; 3) validate model outputs using tower and field- based estimates of NEP and NPP; and 4) recommend/prioritize improvements to boreal ecosystem carbon models, which will better constrain regional source/sink estimates for atmospheric C02. These original objectives were subsequently distilled to fit within the constraints of a 1 -year study. This revised study involved a regional model intercomparison over the BOREAS study region involving Biome-BGC, and TEM (A.D. McGuire, UAF) ecosystem models. The major focus of these revised activities involved quantifying the sensitivity of regional model predictions associated with land cover classification uncertainties. We also evaluated the individual and combined effects of historical fire activity, historical atmospheric CO2 concentrations, and climate change on carbon and water flux simulations within the BOREAS study region.
Derived from text
Atmospheric Composition; Carbon Dioxide Concentration; Climate Change; Cycles; Forests

20040034202 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Microphysical Characterization of Ice in Hurricane Erin for Wideband Passive Microwave Comparisons
Skofronick-Jackson, G.; Holthaus, Eric; Halverson, J.; Heymsfield, G.; Hood, R.; Lambrigtsen, B.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In order to better understand the characteristics of frozen hydrometeors in hurricane systems, computed brightness temperatures were compared with observations of Hurricane Erin from CAMEX-4 radiometers on the ER-2 aircraft. These wideband observations ranged from 10.7 to 183 plus or minus 10 GHz. In order to initialize the cloud profiles used in the radiative transfer calculations, radar reflectivities from an ER-2 instrument were converted to mass contents at specified height levels. Dropsonde data from the ER-2 and modeled Hurricane Andrew data were used to generate profiles of temperature,

pressure, and relative humidity and to provide surface wind speed and ocean temperature. Four different ice (size and density) parameterizations were used to compute brightness temperature values. The comparisons between the calculated and observed brightness temperatures show that in general the Grenfell and Warren particle size distribution does the best job of matching the observations for most of the high frequencies. These high frequencies (greater than or equal to 85 GHz) are particularly sensitive to frozen particles. The Sehkon and Srivastava particle size distribution produced brightness temperatures that were too cold in most cases. On the other hand, the fluffy snow particle parameterizations with and without a melting layer produced brightness temperatures that were much warmer than the observations at these high frequencies. All low frequency calculations track the observations well except in the eye of Hurricane Erin where the surface wind speed and/or near surface temperatures were not properly adjusted to warm the brightness temperature calculations to values closer to the observations. Overall, this work shows that selecting a proper ice particle parameterization can be difficult and additional in situ measurements are needed to define appropriate parameterizations.
Author
Hurricanes; Microwaves; Parameterization; Radiometers; Meteorological Parameters; Wideband Communication

20040034204 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Passive and Active Detection of Clouds: Comparisons between MODIS and GLAS Observations
Mahesh, Ashwin; Gray, Mark A.; Palm, Stephen P.; Hart, William D.; Spinhirne, James D.; [2003]; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The Geoscience Laser Altimeter System (GLAS), launched on board the Ice, Cloud and Land Elevation Satellite in January 2003 provides space-borne laser observations of atmospheric layers. GLAS provides opportunities to validate passive observations of the atmosphere for the first time from space with an active optical instrument. Data from the Moderate Resolution Imaging Spectrometer aboard the Aqua satellite is examined along with GLAS observations of cloud layers. In more than three-quarters of the cases, MODIS scene identification from spectral radiances agrees with GLAS. Disagreement between the two platforms is most significant over snow-covered surfaces in the northern hemisphere. Daytime clouds detected by GLAS are also more easily seen in the MODIS data as well, compared to observations made at night. These comparisons illustrate the capabilities of active remote sensing to validate and assess passive measurements, and also to complement them in studies of atmospheric layers.
Author
Cloud Cover; Laser Altimeters; Imaging Spectrometers; Atmospheric Stratification

20040034243 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Maryland Univ. Baltimore County, Catonsville, MD, USA
Advanced Observation Operators for GPS Radio Occultation, Part 1, Validation of the 2D Ray Tracing Approach with CHAMP and SAC-C bending angle and refractivity data
Poli, P.; Joiner, J.; Quarterly Journal of the Roayl Meteorological Society; 2003; Volume 129, pp. 1-999; In English; Copyright; Avail: Other Sources

Global Positioning System (GPS) Radio Occultations (RO) bending angles and refractivity data characterize mostly the vertical structure of the Earth's atmosphere. We answer the question whether proper simulation of GPS RO data for data assimilation can be obtained with one-dimensional vertical operators, or if accounting also for horizontal atmospheric structures via ray-tracing makes a positive difference when compared with real data. We present a detailed implementation of a geometrical optics multi-plane two-dimensional (2D) ray-tracing as an observation operator to simulate GPS RO bending angles and refractivities within the Finite Volume Data Assimilation System (FVDAS). Comparisons of the outputs of that 2D observation operator with those of simpler ID observation operators are used to generate estimates of errors induced by neglecting tangent point drift (TPD) and horizontal gradients (HG). These error estimates are then confronted with errors estimates derived using 6335 real CHAMP and SAC-C occultations. The agreement for TPD-induced (HG-induced) errors is remarkably positive at altitudes 10-30 km (below 10 km). Comparisons in bending angles O - B STD of the outputs of the multi-plane 2D ray-tracer with those of a vertical Abel transform show reductions of about 8% of the usual O - B bending angle STD due to TPD in the stratosphere (3% due to HG, in the troposphere only). In terms of refractivity, the O - B STD reductions are about 1520% for TPD and 3-5% for HG in the same regions. These reductions are obtained using either 6-hour forecasts or analyses as backgrounds, and using Geometrical Optics (GO) or Canonical Transform (CT) data.
Author
Geometrical Optics; Global Positioning System; Radio Occultation; Ray Tracing; Transformations (Mathematics); Two Dimensional Models

20040034245 NASA Marshall Space Flight Center, Huntsville, AL, USA

Use of EOS Data in AWIPS for Weather Forecasting

Jedlovec, Gary J.; Haines, Stephanie L.; Suggs, Ron J.; Bradshaw, Tom; Darden, Chris; Burks, Jason; [2003]; 1 pp.; In English; 20th Conference on Weather Analysis and Forecasting, 15 Jan. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

Operational weather forecasting relies heavily on real time data and modeling products for forecast preparation and dissemination of significant weather information to the public. The synthesis of this information (observations and model products) by the meteorologist is facilitated by a decision support system to display and integrate the information in a useful fashion. For the NWS this system is called Advanced Weather Interactive Processing System (AWIPS). Over the last few years NASA has launched a series of new Earth Observation Satellites (EOS) for climate monitoring that include several instruments that provide high-resolution measurements of atmospheric and surface features important for weather forecasting and analysis. The key to the utilization of these unique new measurements by the NWS is the real time integration of the EOS data into the AWIPS system. This is currently being done in the Huntsville and Birmingham NWS Forecast Offices under the NASA Short-term Prediction Research and Transition (SPORT) Program. This paper describes the use of near real time MODIS and AIRS data in AWIPS to improve the detection of clouds, moisture variations, atmospheric stability, and thermal signatures that can lead to significant weather development. The paper and the conference presentation will focus on several examples where MODIS and AIRS data have made a positive impact on forecast accuracy. The results of an assessment of the utility of these products for weather forecast improvement made at the Huntsville NWS Forecast Office will be presented.

Author

Earth Observing System (Eos); Weather Forecasting; Decision Support Systems

20040034264 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Numerical Study of Hurricane Erin (2001), Part 1, Model Verification and Storm Evolution

Wu, Liquang; Braun, Scott A.; Halverson, J.; Heymsfield, G.; [2003]; 57 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 Erin (2001) at high resolution (4-km spacing) from its early development as a tropical depression on 7 September 2001, through a period of rapid intensification into a strong hurricane (8-9 September), and finally into a stage during which it maintains its intensity on 10 September. These three stages of development, intensification, and maintenance in the simulation are in good agreement with the observed evolution of Erin. The simulation shows that during the development and early portions of the intensification stages, intensification is favored because the environmental wind shear is weak and the system moves over a warm tongue of water. As Erin intensifies, the wind'shear gradually increases with the approach of an upper-level trough and strengthening of a low-level high pressure system. By 10 September, the wind shear peaks and begins to decrease, the storm moves over slightly cooler waters, and the intensification ends. Important structural changes occur at this time as the outer precipitation shift from the northeastern and eastern sides to the western side of the eye and precipitation begins to surround the entire eye to initiate the development of a secondary wind maximum and an outer eyewall. The simulation is used to investigate the role of vertical wind shear in the changes of the precipitation structure that took place between 9-10 September by examining the effects of both storm-relative flow changes and changes in the shear-induced tilt. Qualitative agreement is found between the divergence pattern and advection of vorticity by the relative flow with convergence (divergence) generally associated with asymmetric inflow (outflow) in the eyewall region. The shift in the outer precipitation is consistent with a shift in the low-level relative inflow from the northeastern to the northwestern side of the storm. The changes in the relative flow are associated with changes in the winds as the hurricane moves relative to the upper tough and the low-level high pressure system. Examination of the shear-induced tilt of the vortex shows that the change in the tilt direction is greater than that of the shear direction as the tilt shifts from a northerly orientation to northwesterly. Consistent with theory for adiabatic vortices, the maximum low-level convergence and upper-level divergence (and the maximum upward motion) occurs in the direction of tilt. Consequently, both mechanisms may play roles in the changes in the precipitation pattern.

Author

Numerical Analysis; Hurricanes; Models; Storms; Evaluation; High Resolution; Atmospheric Models

20040034726 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Latent Heating Retrieval from TRMM Observations Using a Simplified Thermodynamic Model

Grecu, Mircea; Olson, William S.; [2003]; 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

A procedure for the retrieval of hydrometeor latent heating from TRMM active and passive observations is presented. The procedure is based on current methods for estimating multiple-species hydrometeor profiles from TRMM observations. The species include: cloud water, cloud ice, rain, and graupel (or snow). A three-dimensional wind field is prescribed based on the retrieved hydrometeor profiles, and, assuming a steady-state, the sources and sinks in the hydrometeor conservation equations are determined. Then, the momentum and thermodynamic equations, in which the heating and cooling are derived from the hydrometeor sources and sinks, are integrated one step forward in time. The hydrometeor sources and sinks are reevaluated based on the new wind field, and the momentum and thermodynamic equations are integrated one more step. The reevalution-integration process is repeated until a steady state is reached. The procedure is tested using cloud model simulations. Cloud-model derived fields are used to synthesize TRMM observations, from which hydrometeor profiles are derived. The procedure is applied to the retrieved hydrometeor profiles, and the latent heating estimates are compared to the actual latent heating produced by the cloud model. Examples of procedure's applications to real TRMM data are also provided.
Author
Latent Heat; Atmospheric Models; Thermodynamics; Hydrometeors; Velocity Distribution

20040035547 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MODIS Retrieval of Dust Aerosol
Remer, Lorraine A.; Kaufman, Yoram J.; Tanre, Didier; [2003]; 1 pp.; In English; 2nd International Workshop on Mineral Dust, 10-12 Sep. 2003, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The MODerate resolution Imaging Spectroradiometer (MODIS) currently aboard both the Terra and Aqua satellites produces a suite of products designed to characterize global aerosol distribution, optical thickness and particle size. Never before has a space-borne instrument been able to provide such detailed information, operationally, on a nearly global basis every day. The three years of Terra-MODIS data have been validated by comparing with co-located AERONET observations of aerosol optical thickness and derivations of aerosol size parameters. Some 8000 comparison points located at 133 AERONET sites around the globe show that the MODIS aerosol optical thickness retrievals are accurate to within the pre-launch expectations. However, the validation in regions dominated by desert dust is less accurate than in regions dominated by fine mode aerosol or background marine sea salt. The discrepancy is most apparent in retrievals of aerosol size parameters over ocean. In dust situations, the MODIS algorithm tends to under predict particle size because the reflectances at top of atmosphere measured by MODIS exhibit the stronger spectral signature expected by smaller particles. This pattern is consistent with the angular and spectral signature of non-spherical particles. All possible aerosol models in the MODIS Look-Up Tables were constructed from Mie theory, assuming a spherical shape. Using a combination of MODIS and AERONET observations, in regimes dominated by desert dust, we construct phase functions, empirically, with no assumption of particle shape. These new phase functions are introduced into the MODIS algorithm, in lieu of the original options for large dust-like particles. The results will be analyzed and examined.
Author
Aerosols; Particle Size Distribution; MODIS (Radiometry); Dust; Atmospheric Models

20040035607 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Precipitation Processes Developed During ARM (1997), TOGA COARE (1992), GATE (1974), SCSMEX (1998), and KWAJEX (1999): Consistent 2D, Semi-3D and 3D Cloud Resolving Model Simulations
Tao, W-K.; [2003]; 1 pp.; In English; 6th Workshop on Regional Climate Simulation, 18-20 Sep. 2003, Chung-Li, Taiwan, Province of China; No Copyright; Avail: Other Sources; Abstract Only

Real clouds and cloud systems are inherently three-dimensional (3D). Because of the limitations in computer resources, however, most cloud-resolving models (CRMs) today are still two-dimensional (2D). A few 3D CRMs have been used to study the response of clouds to large-scale forcing. In these 3D simulations, the model domain was small, and the integration time was 6 hours. Only recently have 3D experiments been performed for multi-day periods for tropical cloud systems with large horizontal domains at the National Center for Atmospheric Research (NACAR) and at NASA Goddard Space Flight Center . At Goddard, a 3D Goddard Cumulus Ensemble (GCE) model was used to simulate periods during TOGA COARE, SCSMEX and KWAJEX using 512 by 512 km domain (with 2 km resolution). The results indicate that surface precipitation and latent heating profiles are very similar between the 2D and 3D GCE model simulations. The reason for the strong similarity between the 2D and 3D CRM simulations is that the same observed large-scale advective tendencies of potential temperature, water vapor mixing ratio, and horizontal momentum were used as the main focusing in both the 2D and 3D models. Interestingly, the 2D and 3D versions of the CRM used at CSU showed significant differences in the rainfall and cloud statistics for three ARM cases. The major objectives of this paper are: (1) to assess the performance of the super-parameterization technique, (2) calculate and examine the surface energy (especially radiation) and water budgets, and (3) identify the differences and

similarities in the organization and entrainment rates of convection between simulated 2D and 3D cloud systems.
Author
Rain; Clouds (Meteorology); Two Dimensional Models; Three Dimensional Models; Atmospheric Models; Water Vapor

20040035626 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
A Comparative Study of Turbulence Structure in the Atmospheric Surface Layer Above Pantanal Wetland in Dry and Wet Seasons
MarcelodeMattosZeri, Luis; 2003; 116 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9910/TDI/877; Copyright; Avail: CASI; A06, Hardcopy

Fast response data, collected at a 25 m height micrometeorological tower at sampling rate of 20.8 Hz during the wet season, and of 16 Hz during the dry season, in PantanalWetland, were used in this study. In a first step these data were submitted to Vickers e Mahrt (1997) and Mahrt (1998) consistency tests, so the percentual of non-stationary situations was established. Structure characteristics of the atmospheric surface layer (ASL) were determined by the calculations of turbulence statistical variables such as fluxes, and errors associated, and other scales such as mu(sub star), Tau(sub star) and omega - mu and omega - Tau correlation coefficients. The fluxes were calculated using the covariance method. The diurnal variation os these parameters was compared and it was observed that the period with more differences between the two seasons was the period after the sunset. Time-scale signal analysis, using the Morlet Wavelet, denote the possibility of existence of interactions between gravity waves and turbulence in this period. Coherent structures characteristics in wind velocity and temperature signals were also compared. The fractions of momentum flux and sensible heat flux associated with sweep-ejection coherent structures were also calculated.
Author
Atmospheric Stratification; Surface Layers; Turbulence; Micrometeorology; Time Signals; Correlation Coefficients

20040035631 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Influence of the Pacific and Atlantic Ssts in the South America Monsoon Rainfall
AugustoPaixaoVeiga, Jose; 2003; 134 pp.; In Portuguese; Original contains color and black and white illustrations
Report No.(s): INPE-9905/TDI/876; Copyright; Avail: CASI; A07, Hardcopy

Monthly information of outgoing long wave radiation (OLR), sea surface temperature (SST), and rainfall from 22 meteorological stations in eastern South America were used to identify the rainfall characteristics of the South American Monsoon systems (SAMS). The 1961-1999 rainfall climatology for the area allowed the identification of two seasons with marked precipitation regimes: a well defined rainy season in December, January and February, and a dry season in June, July and August. The period where the summer monsoon in South America is more intense was identified from September-February, and this can hold up to 80% of the annual total rainfall. The onset of the rainy season as estimated from outgoing long wave radiation pentad climatology 1974-1996 showed that on the northeastern part of the monsoon area, rainy seasons are shorter as compared to the rest of the region. The dates of the onset of the rainy season during the whole period 1974-1996 show large interannual variability, that does not seem to be related to El Nino or La Nina. The correlation analysis between sea surface temperature anomalies and rainfall in the monsoon area, represented by the Summer Monsoon Rainfall Index (IMV), show that both Atlantic and Pacific affect the variability of rainfall on the region. In the Pacific, 4 areas that may exert some influence on the IMV were identified: Nino 3.4-Nino 4, Chilean central coast, south central Pacific and the western Pacific of Northeast of Australia. This influence can be related to an atmospheric-oceanic coupling, that favours the propagation of Rossby waves that affect the South Atlantic Convergence Zone and possibly the monsoon rainfall variability. In the Pacific Ocean, correlation fields exhibit a North-South dipole type pattern that lasts at least 4 months (July- October), followed by a region of negative correlations between November and December. On the Atlantic, the band of negative SST-rainfall correlations between 5deg and 20degS can be explained through the intensification of the winds related to these SST anomalies, which entails a stronger moisture transport into the continent and thus an increment of rains on this area. In addition, an effect of convection and latent heat release in Amazonia combined with modifications in the intensity-location of the Bolivian high can also affect moisture transport from this region to the monsoon area, thus affecting the intensity of the summer rains on the monsoon area.
Author
Sea Surface Temperature; Monsoons; Rain; Climatology; Long Wave Radiation

20040035638 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Intercontinental Transport of Tropical Ozone from Biomass Burning: Views from Satellite and SHADOZ (Southern Hemisphere Additional Ozonesondes) Soundings

Thompson, Anne M.; July 27, 2003; 1 pp.; In English; Gordon Conference, 7-12 Sep. 2003, Big Sky, MT, USA; No Copyright; Avail: Other Sources; Abstract Only

The atmospheric impacts of tropical fires came to attention in the 1970's and there has been interest in the connection between these fires and ozone since about 1980. Photochemically reactive gases released by fires (e.g. NO, CO, volatile organic carbon) interact as they do in an urban environment to form ozone. Tropical meteorology also plays a part in tropospheric ozone distributions in the tropics - through large-scale circulation, deep convection, regional phenomena (West African and Asian monsoon) - and variations associated with El-Nino and the Quasi- biennial Oscillation have been reported. This Poster is an overview of observations, taken from satellite and from ozone soundings, that illustrate regional influences and intercontinental-range ozone transport in the tropics.

Author

Tropical Meteorology; Ozone; Biomass; Quasi-Biennial Oscillation; Photochemical Reactions

20040035639 NASA Goddard Space Flight Center, Greenbelt, MD, USA

TRMM Data Mining Service at the Goddard Earth Sciences (GES) DISC DAAC Tropical Rainfall Measuring Mission (TRMM)

March 2002; 4 pp.; In English; ASPRS Meeting, 5-9 May 2002, Anchorage, AK, USA

Report No.(s): NP-2003-4-547-GSFC; No Copyright; Avail: CASI; A01, Hardcopy

TRMM has acquired more than four years of data since its launch in November 1997. All TRMM standard products are processed by the TRMM Science Data and Information System (TSDIS) and archived and distributed to general users by the GES DAAC. Table 1 shows the total archive and distribution as of February 28, 2002. The Utilization Ratio (UR), defined as the ratio of the number of distributed files to the number of archived files, of the TRMM standard products has been steadily increasing since 1998 and is currently at 6.98.

Author

Information Systems; Data Mining; Trmm Satellite; Rain

20040035640 Lawrence Livermore National Lab., Livermore, CA

PCMDI Analysis of Candidate Atmospheric Models for CCSM

Wehner, M. F.; Taylor, K.; Doutriaux, C.; AchutaRao, K.; Gleckler, P.; Dec. 2000; 166 pp.; In English

Report No.(s): DE2003-15005971; UCRL-JC-141573; No Copyright; Avail: Department of Energy Information Bridge

This report is intended to give a summary analysis of the candidate model configurations under consideration by NCAR for the atmospheric component of next version of the Community Climate System Model (CCSM). Intercomparison results are presented for each of the models available prior to the Atmospheric Model Working Group (AMWG) meeting, December 12-14, 2000. We present four types of figures in this report. The traditional methods of viewing zonal mean surface fields, latitude-longitude maps and zonal mean latitude-height cross sections are straightforward. In each of these cases, we present DJF and JJA climatological averages and a difference from an observational or reanalysis data set. The fourth method of analyzing the candidates' model performance involves the use of 'performance portraits' and is explained in the report.

NTIS

Climatology; Atmospherics

20040035651 NASA Marshall Space Flight Center, Huntsville, AL, USA

Transition from Research to Operations: Assessing Value of Experimental Forecast Products within the NWSFO Environment

Lapenta, William M.; Wohlman, Richard; Bradshaw, Tom; Burks, Jason; Jedlovec, Gary; Goodman, Steve; Darden, Chris; Meyer, Paul; [2003]; 1 pp.; In English; 20th Conference on Weather Analysis and Forecasting, 11-15 Jan. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA Short-term Prediction Research and Transition (SPoRT) Center seeks to accelerate the infusion of NASA Earth Science Enterprise (ESE) observations, data assimilation and modeling research into NWS forecast operations and decision-making. To meet long-term program expectations, it is not sufficient simply to give forecasters sophisticated workstations or new forecast products without fully assessing the ways in which they will be utilized. Close communication must be established between the research and operational communities so that developers have a complete understanding of

user needs. In turn, forecasters must obtain a more comprehensive knowledge of the modeling and sensing tools available to them. A major goal of the SPoRT Program is to develop metrics and conduct assessment studies with NWS forecasters to evaluate the impacts and benefits of ESE experimental products on forecast skill. At a glance the task seems relatively straightforward. However, performing assessment of experimental products in an operational environment is demanding. Given the tremendous time constraints placed on NWS forecasters, it is imperative that forecaster input be obtained in a concise unobtrusive manor. Great care must also be taken to ensure that forecasters understand their participation will eventually benefit them and WFO operations in general. Two requirements of the assessment plan developed under the SPoRT activity are that it 1) Can be implemented within the WFO environment; and 2) Provide tangible results for BOTH the research and operational communities. Supplemental numerical quantitative precipitation forecasts (QPF) were chosen as the first experimental SPoRT product to be evaluated during a Pilot Assessment Program conducted 1 May 2003 within the Huntsville AL National Weather Service Forecast Office. Forecast time periods were broken up into six- hour bins ranging from zero to twenty-four hours. Data were made available for display in AWIPS on an operational basis so they could be efficiently incorporated into the forecast process. The methodology used to assess the value of experimental QPFs compared to available operational products is best described as a three-tier approach involving both forecasters and research scientists. Tier-one is a web-based survey completed by duty forecasters on the aviation and public desks. The survey compiles information on how the experimental product was used in the forecast decision making process. Up to 6 responses per twenty-four hours can be compiled during a precipitation event. Tier-two consists of an event post mortem and experimental product assessment performed daily by the NASA/NWS Liaison. Tier-three is a detailed breakdown/analysis of specific events targeted by either the NWS SO0 or SPoRT team members. The task is performed by both NWS and NASA research scientists and may be conducted once every couple of months. The findings from the Pilot Assessment Program will be reported at the meeting.
Author
Forecasting; Meteorological Services; Predictions; Earth Sciences

20040035672 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Surface and Atmospheric Parameters Derived from AIRS/AMSU Data on Aqua
Susskind, Joel; [2003]; 4 pp.; In English; International Symposium on Remote Sensing, 9-15 Nov. 2003, Waikiki, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy

AIRS (Atmospheric Infra-Red Sounder) and AMSU (Advanced Microwave Sounding Unit) comprise the advanced atmospheric and surface sounding system flying on the Aqua satellite launched in May 2002. Monthly mean fields derived from AIRS/AMSU data will be used to extend the climate record (1979-2002) contained in the TOVS Pathfinder Path A Data Set to further study climate variability and trends. Sample daily and monthly mean results derived from AIRS/AMSU data are presented, validated, and compared to equivalent results taken from ECMWF analyses.
Author
Advanced Microwave Sounding Unit; Atmospheric Sounding; Meteorological Parameters; Satellite Sounding

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*.

20040031728 Stanford Univ., Stanford, CA, USA
Numerical Simulation of Regional Circulation in the Monterey Bay Region
Tseng, Y. H.; Dietrich, D. E.; Ferziger, J. H.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 115-126; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study is to produce a high-resolution numerical model of Mon- terey Bay area in which the dynamics are determined by the complex geometry of the coastline, steep bathymetry, and the in uence of the water masses that constitute the CCS. Our goal is to simulate the regional-scale ocean response with realistic dynamics (annual cycle), forcing, and domain. In particular, we focus on non-hydrostatic e ects (by comparing the results of hydrostatic and non-hydrostatic models) and the role of complex geometry, i.e. the bay and submarine canyon, on the nearshore circulation. To the best of our knowledge, the current study is the rst to simulate the regional circulation in the vicinity of Monterey Bay using a non-hydrostatic model. Section 2 introduces the high resolution Monterey Bay area regional model (MBARM). Section 3

provides the results and veri cation with mooring and satellite data. Section 4 compares the results of hydrostatic and non-hydrostatic models.
Author
Monterey Bay (Ca); Water Circulation; Hydrostatics

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*.

20040031638 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Detection of Radiation Damage in a Low Level Radiation Environment
vanderSchans, G. P.; Timmerman, A. J.; June 2003; 24 pp.; In English
Contract(s)/Grant(s): A00/M/401; TNO Proj. 014.12842
Report No.(s): TD-2002-0218; PML-2003-A44; Copyright; Avail: Other Sources

Aim of this study is to investigate the potentials of new methods to determine accumulating and/or temporal damage in genetic material (DNA) of humans result- ing from exposure to low levels of ionizing radiation during military operations in a Low Level Radiation (LRR) environment.
Author
Deoxyribonucleic Acid; Radiation Effects

20040031644 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Direct Effects of Physostigmine as a Pretreatment in Guinea Pigs: Side Effects and Efficacy against Soman
Philippens, I. H. C. H. M.; Groen, B.; Vanwersch, R. A. P.; October 2003; 31 pp.; In English
Contract(s)/Grant(s): A01/CO/4EY; TNO Proj. 014.12841
Report No.(s): TD-2002-0214; PML-2003-A40; Copyright; Avail: Other Sources

The goal of this study is to examine the role of direct effects of physostigmine (PHY) as a pretreatment in the protection against 2x LD50 soman intoxication. This was done by comparing the side effects and efficacy achieved by using (+)PHY, a stereoisomer of PHY that hardly inhibits the enzyme acetylcholinesterase (AChE), with the normally used compound (-)PHY in male guinea pigs. The side effects and efficacy of both pretreatment regimes were tested against 2x LD50 soman intoxication by using behavioural and neurophysiological read-out systems. The appearance of side effects was comparable between the two treatment groups: there were hardly any side effects found. After soman intoxication, the severity of symptoms was comparable between the two treatment groups. The AChE inhibition of the pretreatment has no effect on reducing the severity of the signs. In both groups the appearance of convulsions did lead to dead within 24 hours. Considering the results, one can conclude that the inhibition of AChE alone is not responsible for the protection against post intoxication symptomatology and incapacitation.
Author
Intoxication; Cholinesterase

20040031779 Washington Univ., Saint Louis, MO, USA
Inactivation of Semicircular Canals Causes Adaptive Increases in Otolith-driven Tilt Responses
Angelaki, Dora E.; Newlands, Shawn D.; Dickman, J. David; Journal of Neurophysiology; March 2002; Volume 87, No. 3, pp. 1635-1640; In English
Contract(s)/Grant(s): NAG2-1493; Copyright; Avail: Other Sources; Abstract Only

Growing experimental and theoretical evidence suggests a functional synergy in the processing of otolith and semicircular canal signals for the generation of the vestibulo-ocular reflexes (VORs). In this study we have further tested this functional interaction by quantifying the adaptive changes in the otolith-ocular system during both rotational and translational movements after surgical inactivation of the semicircular canals. For 0.1- 0.5 Hz (stimuli for which there is no recovery of responses from the plugged canals), pitch and roll VOR gains recovered during earth- horizontal (but not earth-vertical) axis rotations. Corresponding changes were also observed in eye movements elicited by translational motion (0.1 - 5 Hz). Specifically, torsional eye movements increased during lateral motion, whereas vertical eye movements increased during fore-aft motion. The findings indicate that otolith signals can be adapted according to compromised strategy that leads to

improved gaze stabilization during motion. Because canal-plugged animals permanently lose the ability to discriminate gravitoinertial accelerations, adapted animals can use the presence of gravity through otolith-driven tilt responses to assist gaze stabilization during earth-horizontal axis rotations.
Author
Eye Movements; Gravitation; Otolith Organs; Reflexes; Semicircular Canals

20040033970 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering, Volume 16, No. 2
Li, Jian-Hui, Editor; April 2003; ISSN 1002-0837; 82 pp.; In English; In Chinese; See also 20040033971 - 20040033989
Report No.(s): CN-11-2774/R; Copyright; Avail: Other Sources

The following reports are presented for inclusion into the database: Effects of Dietary Supplementation of Certain Nutrients on Maze Performance and Biochemical Indices in Mice after Exposure to +Gz Changes of Reactivity of Rabbit Femoral Venous Rings after 21 d Simulated Weightlessness Induced Vestibular Disorders in Guinea Pigs and Its Countermeasure by Preconditioning Effects of 21 d -6 deg Head Down Bed-rest on Pulmonary Gas Distribution and Little Airway Function Preventive Effects of Exercise Training on Bone Loss During 21 d -6 deg Head Down Bed-rest; Preliminary Study on the Effects of 'Planning Treatment According to Diagnosis' on Physiological Changes During Simulated Weightlessness; Effects of 'Qiang Gu Kang Wei' Compound Prescription on Biochemical Indices of Bone and Related Organs in Rats Under Simulated Weightlessness Effects of 'Qiang Gu Kang Wei' Compound Prescription on Bone Metabolism in Rats Under Simulated Weightlessness; Observation on Protective Effect of Hearing Protectors on Infrasound; Effect of Infrasound on Visual Electrophysiology in Mice; Effects of Rotating Clinostat Simulated Weightlessness on the Differentiation-related Gene Expression of ROS17/2.8 Cells; Recognition of Eastern and Western Faces with Internal and External Features: An ERP Study; Physical Simulation of Human Body Metabolism in Sealed Module on the Ground; Analysis of Non-Fourier Effect and Laser-induced Thermal Damage of Laser-irradiated Layered Human Skin Tissue; An Adaptive Algorithm for Reducing Reverberation; Integer Multiple Rhythm in the Spontaneous Beating Rhythm of Cardiac Myocytes and Its Possible Mechanism; Detection of Single-nucleotide Polymorphism in the 5'-flanking Region of the Human Tissue Kallikrein Gene; Signal Detection and Analysis of the Transient-evoked Otoacoustic Emissions and Its Application;and Weightlessness or Weightlessness Simulation and Vascular Remodeling.
CASI
Aerospace Medicine; Weightlessness Simulation; Signal Detection; Physiological Effects

20040033971 Institute of Aviation Medicine, Beijing, China
High Gy Induced Vestibular Disorders in Guinea Pigs and Its Countermeasure by Preconditioning
Jia, Hong-Bo; Yu, Li-Shen; Liu, Zheng; Xie, Su-Jiang; Wang, Jin-Ling; Bi, Hong-Zhe; Liu, Guang-Li; Space Medicine and Medical EngineeringVolume 16, No. 2; April 2003, pp. 88-92; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to explore if high G exposure can cause vestibular disorder in guinea pigs and the possibility of preventing it by preconditioning with exposure to a low hypergravity environment before high G stimulus.Their vestibular related behavior, and choline acetyltransferase activity in VNC in brain stem were investigated by immunohistochemistry technique, and the relative gamma were analysed.
Author (revised)
High Gravity Environments; Physiological Effects

20040033972 Fourth Military Medical Univ., Xi'an, China
Effect of Infrasound on Visual Electrophysiology in Mice
Shi, Li; Zhang, Zuo-Ming; Chen, Jing-Zao; Liu, Jing; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 115-119; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to investigate the possible effects of infrasound on visual functions. One hundred fifty mice were utilized in the study. Four groups were exposed to infrasound of 8 Hz, 90 dB, 9 Hz, 130 dB, 16 Hz, 90 dB, and 16 Hz, 130 dB 2h/d respectively. Exposure times were 1,1,4,7,14, and 21 d respectively. Electroretinogram, oscillatory potentials, and visual evoked potential were recorded after exposure.
Author (revised)
Infrasonic Frequencies; Vision; Physiological Effects

20040033973 Fourth Military Medical Univ., Xi'an, China

Effects of Rotating Clinostat Simulated Weightlessness on the Differentiation-related Gene Expression of ROS17/2.8 Cells

Wang, Bing; Zhang, Shu; Wu, Xing-Yu; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 120-122; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this investigation was to examine the effects of rotating clinostat simulated weightlessness on the differentiation-related gene expression of ROS17/2.8 (rat osteosarcoma cells). Cells were exposed to rotating clinostat simulated weightlessness for 24,48, and 72 h with control group in 1G condition. Total RNA in cells was isolated and reverse transcription PCR analysis was made. Gene expression of type 1 collagen chain and alkaline phosphatase were examined by their rations to B-actin.

Author (revised)

Weightlessness Simulation; Clinostats; Gene Expression

20040033978 Institute of Space Medico-Engineering, Beijing, China

Effects of 'Qiang Gu Kang Wei' Compound Prescription on Bone Metabolism in Rats Under Simulated Weightlessness

Fan, Quan-Chun; Li, Yong-Zhi; Bai, Gui-Er; Duan, Yuan-Ru; Xie, Jun-Shui; Shi, Hong-Zhi; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 107-109; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this investigation was to examine the effects of 'Qiang Gu Kang Wei' prescription on bone metabolism in rats. Bone biomechanical properties, density, mineral content, and biochemical markers of bone metabolism were examined.

Author (revised)

Bone Mineral Content; Weightlessness Simulation

20040033981 Institute of Aviation Medicine, Beijing, China

Effects of Dietary Supplementation of Certain Nutrients on Maze Performance and Biochemical Indices in Mice after Exposure to +Gz

Yang, Chang-Lin; Jin, Yan-Bin; Yu, Hong; Yi, Chang-Rong; Cheng, Jie; Zhan, Hao; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 79-82; In English; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to explore the possible effects of nutritional supplements on brain function as reflected by Water Maze test performance in mice after Gz exposure.High sustained + Gz is frequently encountered in military aviation activities and is one of the greatest concerns in aviation medicine.

Author

Diets; Brain; Biological Effects

20040033982 Institute of Space Medico-Engineering, Beijing, China

Changes of Reactivity of Rabbit Femoral Venous Rings after 21 d Simulated Weightlessness

Liang, Wen-Bin; Jiang, Shi-Zhong; Shen, Xian-Yun; Dong, Jian-Wen; Ma, Tie-Min; Sun, Lei; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 83-87; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of tis research was to study the effects of simulated weightlessness on reactivity of leg veins. Vascular bathing techniques were used to measure the contractile responses of rabbit femoral venous rings to Ht, PE, and KCl, and the dilatory responses to ACh, and SNP after horizontal confinement or head down tilt confinement for 21 d.

Author (revised)

Weightlessness Simulation; Cardiovascular System

20040033985 Institute of Space Medico-Engineering, Beijing, China

Effects of 'Qiang Gu Kang Wei' Compound Prescription on Biochemical Indices of Bone and Related Organs in Rats Under Simulated Weightlessness

Li, Yong-Zhi; Shi, Hong-Zhi; Fan, Quan-Chun; Bai, Gui-e; Duan, Yuan-Ru; Xie, Jun-Shui; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 103-106; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this investigation was to examine the effects of 'Qiang Gu Kang Wei' prescription on biochemical indices of bone and related organs in tail-suspended rats. The Ca, P in serum, osteocalcin in serum and bone, oxyproline hydroxyproline in bone, alkaliphosphatase in serum, small intestine and bone was examined.

Author (revised)

Weightlessness Simulation; Bone Mineral Content; Biochemistry

20040034078 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Procedure for Diagnosis of Exposure to Lewisite for Application in Field Laboratories
Fidder, A.; Noort, D.; August 2003; 21 pp.; In Dutch
Contract(s)/Grant(s): AO1CO522; TNO Proj. 014.12900
Report No.(s): PML-2003-A65; TD-2002-0239; Copyright; Avail: Other Sources

In this report a procedure is described for semi-quantitative diagnosis of exposure to Lewisite. The procedure is based on extraction of bound and free 2-chlorovinylarsonous acid (CVAA, an important metabolite of Lewisite) from blood or urine, after treatment with 2,3-dimercapto-1-propanol (BAL). After further derivatization with heptafluorobutyryl imidazole, the CVAA-BAL derivative could be analyzed at a 40 fmol level under electron impact conditions. With this procedure, in vitro exposure of human blood to 1 nM of Lewisite could be determined. The procedure is expected to be applicable in a field laboratory.
Author
Diagnosis; Chemical Analysis; Biomedical Data; Blood

20040034256 Defence Science and Technology Organisation, Edinburgh, Australia
An Analysis of Wound Statistics in Relation to Personal Ballistic Protection
Brady, Christopher G.; August 2003; 19 pp.; In English
Report No.(s): DSTO-TN-0510; DODA-AR-012-864; Copyright; Avail: Other Sources

This report summarizes data on gunshot and fragmentation wounds (collectively called 'missile wounds') drawn from journal articles available in the public domain. Wound location is discussed with respect to military personal body armour (helmets and protective vests). The data is reviewed according to areas of past conflict (Vietnam, Persian Gulf, Northern Ireland, Lebanon and Croatia). It was found that helmets offered significant protection against fragments. This is important given that fragmentation wounds accounted for up to 90% of all missile injuries. The head should be considered to be a high priority area of protection, given that it received up to 7 times more wounds than would be expected given its size relative to the the body. Also, in some conflicts, over 35% of wounds were to the upper-mid chest, supporting the idea that a bullet-resistant strip is needed in this area.
Author
Fragments; Projectiles; Armor; Helmets; Injuries

20040035592 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Prophylaxis against Organophosphorus Nerve Agents: State of the Art
Philippens, I. H. C. H. M.; July 2003; 47 pp.; In English
Contract(s)/Grant(s): A98/M/541; TNO Proj. 014.14088
Report No.(s): TD-2002-0168; PML-2002-A94; Copyright; Avail: Other Sources

Prophylaxis against chemical warfare agents may reduce the extent of the intoxication and thereby improve the prognosis for the patient. Prophylaxis is only available for nerve agents. Exposure to nerve agents is currently not restricted to the battlefield. The problem of destruction of the chemical stockpiles after the Chemical Weapons Convention and the abuse by terrorist organizations will increase the risk of exposure. Since treatment for intoxications with at least some of these organophosphorous (OP) acetylcholinesterase (AChE) inhibitors is still far from ideal, research efforts are devoted towards finding an effective prophylaxis. A successful prophylaxis optimally should fulfill 3 conditions: 1) It should offer a high protection rate; 2) It should not cause side effects, and; 3) It should protect against post-intoxication incapacitation. The mechanism of action of the currently available prophylaxis pyridostigmine, a reversible AChE inhibitor, is to protect a fraction of the enzyme from binding with irreversible OP AChE-inhibitors. However, because of its structure, pyridostigmine hardly penetrates the brain and will therefore not protect the brain AChE sufficiently. This may lead to brain damage and post-intoxication incapacitation. Therefore, alternatives for pyridostigmine should be evaluated. For the near future, subchronic prophylaxis with physostigmine and scopolamine seems to be the best choice and most promising alternative to prevent OP intoxication. For the intermediary term, research towards compounds with another mechanism of action, like procyclidine, should be considered. And for the long term the use of scavengers can be evaluated.
Author
Chemical Warfare; Chemical Defense; Prophylaxis; Phosphates

20040035603 Defence Science and Technology Organisation, Edinburgh, Australia
Mental Models Theory and Military Decision-making: A Pilot Experimental Model
Sparkes, Jason; Huf, Sam; July 2003; 35 pp.; In English
Report No.(s): DSTO-GD-0368; DODA-AR-012-819; Copyright; Avail: Other Sources

This report presents research undertaken as a Vacation Student project, December 2001 to February 2002 which examined an account of human inductive reasoning termed Mental Models theory. The theory predicts that problems for decision-makers arising from basic cognitive processes may have been instrumental in some catastrophic decisions in industry and war fighting. In particular, construction of the mental models used when making critical decisions is vulnerable to both problem complexity and a systematic 'falsity' bias. These vulnerabilities occur because of the limited capacity of human working memory that restricts both the type and the number of component models. An experiment was conducted to test central predictions of the theory.
Author
Memory; Vulnerability; Cognition

20040035677 Xian Jiaotong Univ., China
Effects of Simulated Weightlessness on Myosin Heavy Chain Expression of Soleus Intrafusal Muscle Fibers in Rats
Tang, Bin; Fan, Xiao-Li; Wu, Su-Di; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 235-238; In English; See also 20040035673
Contract(s)/Grant(s): NNSFC-30070830; Copyright; Avail: Other Sources
Objective: To examine the myosin heavy chain expression in intrafusal fibers in rat soleus muscle before and after simulated weightlessness and to analyse the mechanism involved in muscle spindle deterioration during simulated weightlessness. Method: The rats were divided into 3 groups: 7 d, 14 d tail-suspension group and control group. Control and experimental spindles were examined using monoclonal antibodies specific for myosin heavy chains of slow-tonic (ALD58) and fast-twitch (MF30) chicken muscles by the immunoperoxidase reaction utilizing the ABC (avidin-biotin-complex) method.
Author
Weightlessness Simulation; Muscles

20040035678 Fourth Military Medical Univ., Xi'an, China
Changes of Dentin, Dental Pulp and Periodontium Tissue in Tail-suspended Rats
Yuan, Lin-Tian; Wen, Ling-Ying; Luo, Ya-Ning; Hu, Pei-Zhen; Jiang, Wei-Zhong; Wu, Xing-Yu; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 248-252; In Chinese; See also 20040035673; Copyright; Avail: Other Sources
Objective:To investigate the metabolic changes of calcium and phosphorus in dentin, dental pulp and periodontium in tail-suspended rats, and the functions of TGF-p1 , c-fos, collagen-I and collagen IV in dentin, dental pulp and periodentium. Method Relative percentage contents of Ca , P in dentin, dental pulp and periodontium were measured with scanning electron microscope and energy spectrum analytical system in 3 groups of rats. The expression of TGF-P1 , c-fos , collagen-I and collagen IV were also observed. Result In the suspension group, the relative percentage content of Ca declined significantly, while P increased slightly. There were no significant differences of Ca, P in alveolar bone. The expressions of TGF-p1 , c-fos and colla- gen-I declined, but the expression of collagen-IV in pulp vessel increased. There were no significant changes of expressions of TGF-p1 , c-fos, collagen-I and collagen-IV in the vicinity of PDL. After adopting artificial countermeasures, the above expressions restored partly. Conclusion Weightlessness might cause abnormal mineralization in dentin, and 1. 5 G artificial countermeasures could eliminate the above changes of mineral metabolism. The poor mineralization of dentin might be associated with the reduced secretion of TGF-p1 , c-fos and collagen-I in tail-suspended rats.
Author
Weightlessness Simulation; Teeth; Phosphorus Metabolism; Calcium Metabolism

20040035680 Jinan Military General Hospital, Jinan, China
Changes of Osteocalcin in Bone and Bone Marrow in Tail Suspended Rats
Fu, Chong-Jian; Yu, Bing-Bing; Yang, Lian-Jia; Zhang, Li-Fan; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 260-263; In Chinese; See also 20040035673; Copyright; Avail: Other Sources
Objective: To study osteocakin(OC) changes in bone and marrow and calcium deposition in bone and cartilage under simulated weightlessness. Method: Twenty SD rats were randomly divided into 14 d and 28 d tail suspension group and 2 corresponding control groups. Histological samples were in situ hybridized and trichrome stained. Result OC expression of bone and marrow of rats were lower in tail suspended rats than that in the control(P <O. 0 5) . OC expression in 14 d tail suspended rats were higher than that in 28 d tail suspen- ded group (P < 0.05) . Mineralization was inhibited, and demineralization of furmer and cartilage mineralized matrix was prominent. Demineralization was more prominent in 28 d

group. Conclusion OC levels in bone and marrow of rats were lower after tail suspension. Calcium deposition was inhibited in bone and cartilage. Demineralization was prominent after long term hindlimb unloading.
Author
Weightlessness Simulation; Bone Demineralization; Cartilage

20040035681 Fourth Military Medical Univ., Xi'an, China
Changes of Potassium Channel Activity of Hindlimb Arterial Smooth Muscle Cells in Tail-suspended Rats
Fu, Zhao-Jun; Cheng, Hong-Wei; Zhang, Li-Fan; Ma, Jin; Zhang, Le-Ning; Ma, Xiao-Wu; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 253-256; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

Objective:To examine the change of potassium channel function in hindlimb arterial smooth muscle cells in tail-suspended rats and to elucidate the underlying electro-physiological mechanisms responsible for the depressed vascular responsiveness of hindlimb arteries induced by simulated weightlessness. Method The contractile responsiveness of femoral arterial rings of 1 -wk and 4-wk tail-suspended rats to potassium channel blockers, tetraethylammonium chloride (TEA) and 4-aminopyridine (4-AP) , were recorded, and the cur- rents of large conductance calcium-dependet potassium channel (BK,,) and voltage activated potassium channel (K,) of vascular smooth muscle cells (VSMCs) in saphenous arteries from 1 -wk tail-suspended rats were recorded using the whole cell recording mode of patch clamp technique. Result The femoral arteries from of 1- wk and 4-wk tail-suspended rats showed a decreased contractile response to 60 mM KC1, and the ratio of their contractile responses induced by TEA or 4-AP to their responses induced by 60 mM KC1 increased significantly after 1 -wk and 4-wk simulated weightlessness. However no difference was found between 1 -wk and 4-wk tail- suspended rats. The whole cell current recording showed that BK,, current densities and K, current densities of VSMCs in saphenous artery increased significantly after 1 -wk simulated weightlessness. Conclusion The contractile response of hindlimb arteries to KC1 decreased after simulated weightlessness. The activities of BK, and K, of smooth muscle cells in hindlimb arteries from tail-suspended rats increased, and these changes might be among the electro-physiological mechanisms involved in the depressed vasoreactivity of hindlimb arteries due to simulated weightlessness.
Author
Weightlessness Simulation; Arteries; Muscles

20040035688 Institute of Aviation Medicine, Beijing, China
Changes of Cardiac Catecholamines in Rats after Repeated +Gz Exposures and Protective Effects of Low-G Preconditioning and Tea Polyphenols
Zhan, Hao; Zhang, Zheng; Xin, Yi-Mei; Li, Tong; Wei, Si-Huang; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 239-242; In English; See also 20040035673
Contract(s)/Grant(s): PLA-01MB051; Copyright; Avail: Other Sources

The objective: To observe whether repeated + Gz exposures could induce metabolic disorder of cardiac catecholamines in rats as well as the protective effects of low-G preconditioning and tea polyphenols (TP) . Method Thirty-two male Wistar rats were randomly divided into 4 groups (n. = 8) : group A (control) , only submitted to + 1 Gz 5 min; group B(+ 10 Gz stress) , exposed to + 10 Gz 30 s ,5 times/d with + 1 Gz 1 min interval ,3 d/wk , for 3 wk in total ; group C (low G preconditioning) , + Gz stress parameters were the same to that of group B ,but the rats were submitted to + 2 Gz 5 min 1 h prior to + 10 Gz exposure; group D(TP pro- tection) , + Gz stress parameters were the same to that of group B, but TP was given orally to the rats at the dose of 200 mg/kg 1 h prior to + 10 Gz exposure. These animals were decapitated on the next morning of the last centrifuge run, and the hearts were taken out and stored in liquid nitrogen immediately. The contents of noradrenaline (NA) ,adrenaline(AD) , dopamine (DA) and serotonin (5-HT) in myocardial tissue were determinedusing HPLC with electrochemical detector.
Author
Catecholamine; Phenols; Myocardium; Microgravity; Antioxidants

20040035689 Institute of Space Medico-Engineering, Beijing, China
Effects of Simulated Weightlessness and Mechanical Loading on Bone Interstitial Fluid Flow in Rats
Ma, Yong-Jie; Yuan, Yan-Hong; Xie, Li-Qin; Li, Ying-Hui; Wan, Yu-Min; Shi, Zhi-Zheng; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 257-259; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

Objective: To investigate the effects of simulated weightlessness and mechanical loading on bone in- terstitial fluid flow.

Method: Thirty-six male Spargue-Danley rats were divided into 3 groups: the control group, the tail-suspension group, and the tail-suspension plus mechanical loading group, with four rats in each group. All the rats were injected via a lateral tail vein with horseradish peroxidase on the 21st day of the experiment. Tibial tissue specimens were explanted, fixed, decalcified and cut into 30 pm frozen sections 3 h after the intravenous injection. Result There were less peroxidase reaction product in the bony matrix and bone lacunae in tail-suspended rats than the control and tail-suspended plus mechanical loading rats. Conclusion Tail-suspension decreased fluid movement through the bone, while mechanical loading increased it.
Author
Weightlessness Simulation; Tibia; Enzyme Activity

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20040033975 Institute of Space Medico-Engineering, Beijing, China
Integer Multiple Rhythm in the Spontaneous Beating Rhythm of Cardiac Myocytes and Its Possible Mechanism
Liu, Zhi-Qiang; Gu, Hua-Guang; Yang, Ming-Hao; Yang, Fen; Fan, Shao-Guang; Ren, Wei; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 142-144; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research is to introduce the characteristics of the integer multiple rhythm of cultured cardiac myocytes and to explore the cause of its generation. Spontaneous beating rhythms of cultured cardiac myocytes were observed with photometry system, and stochastic Chay model was used to simulate the experimental results. Integer multiple rhythm was observed in the experiment. This kind of rhythm is similar to phenomena of sinus arrest. The integer multiple rhythm similar to that of the experiments was simulated in stochastic Chay model, and was demonstrated to be induced by the mechanism of autonomous stochastic resonance. The integer multiple rhythm observed in the experiment might be generated via the effect of autonomous stochastic resonance.
Derived from text
Cells (Biology); Culture Techniques; Stochastic Processes; Autonomy; Heart; Synchronism; Resonance

20040033977 Institute of Space Medico-Engineering, Beijing, China
Preventive Effects of Exercise Training on Bone Loss During 21 d -6 deg Head Down Bed-rest
Liu, Yu-Sheng; Huang, Wei-Fen; Li, Li-Ping; Zhong, Chong-Fa; Dong, Rong-Di; Sun, Hong-Yi; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 96-99; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to observe the protective effects of exercise training during 21 d-6 degree head down bed rest on bone loss. Ten healthy young men were utilized for the study.Femur bone mineral density, serun bone gla protein as well as hydroxyproline/creatinine were determined before and during the experiments.
Author
Bone Demineralization; Physiological Effects; Weightlessness Simulation

20040033979 Fourth Military Medical Univ., Xi'an, China
Weightlessness or Weightlessness Simulation and Vascular Remodeling
Yue, Yong; Yao, Yong-Jie; Sun, Xi-Qing; Wu, Xing-Yu; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 152-156; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

Weightlessness is inavoidable during spaceflight. It brings profound physiological effects on human body. Vascular remodeling is one of the important changes of cardiovascular system caused by weightlessness or simulated weightlessness. The paper summarized the studies on the effects of weightlessness or weightlessness simulation on vascular remodeling in recent years. The emergence and development of the concept of vascular remodeling were briefly reviewed. The advances of study on vascular remodeling in recent years was briefly discussed with the points focused on the effects of weightlessness or weightlessness simulation on cardiovascular remodeling and its mechanism. It is proposed that cardiovascular remodeling might be important in studying the causes of orthostatic intolerance after spaceflight.
Author
Weightlessness; Weightlessness Simulation; Cardiovascular System; Human Body; Aerospace Medicine; Physiological Effects

20040033980 Institute of Space Medico-Engineering, Beijing, China

Preliminary Study on the Effects of 'Planning Treatment According to Diagnosis' on Physiological Changes During Simulated Weightlessness

Wang, Bao-Zhen; Li, Yong-Zhi; Xin, Bing-Mu; Fan, Quan-Chun; Wang, Jing; Xue, Chun-Mei; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 100-102; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to observe effects of the planning treatment according to diagnosis on body syndromes casued by simulated weightlessness. Ten subjects underwent HDT-6 degrees for 14 d. Differentiation of syndromes were made and parameters related to different syndromes, including plasma cortisone, blood viscosity, red cell deformation, excretion rate of urine xylose, and amount of urine were evaluated.

Author (revised)

Weightlessness Simulation; Physiological Effects

20040033984 People's Liberation Army Hospital, Xinxiang, China

Effects of 21 d -6 deg Head Down Bed-rest on Pulmonary Gas Distribution and Little Airway Function

Wei, Shi-Qiang; Su, Shuang-Ning; Lu, Li-Li; Li, Yong-Zhi; Zhong, Chong-Fa; Ren, Hong-Ru; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 93-95; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to probe the effect of 21-d 6 degree head down bed rest on pulmonary gas distribution and little airway function. These indices were measured in 16 healthy male subjects before , during, and after the experiment.

Author (revised)

Pulmonary Functions; Weightlessness Simulation

20040033989 Sichuan Univ., Chengdu, China

Detection of Single-nucleotide Polymorphism in the 5'-flanking Region of the Human Tissue Kallikrein Gene

Wei, Fang; Chen, Chen; Wang, Zheng-Rong; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 145-146; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research is to determine an efficient detective method studying the single-nucleotide polymorphism (SNP) in the promoter region of human tissue kallikrein gene. A 180-bp fragment containing the polymorphic region amplified by PCR using human genome as the template, was analyzed by hybridization with the oligonucleotide probe and direct DNA sequencing. 12 persons were homogeneous with negative hybridization results, while the mutation of G insertion existed in the other, of whom 2 were heterogeneous. The results of hybridization were in accordance with those of DNA sequencing. With good accuracy and specificity, the ASO method is more economical to be used to detect the promoter region polymorphism of kallikrein gene in large population.

Derived from text

Human Beings; Nucleotides; Polymorphism; Tissues (Biology); Genes; Detection

20040035673 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering, Volume 16, No. 4

Wei, Jin-He, Editor; Su, Shuang-Ning, Editor; Jiang, Shi-Zhong, Editor; Wang, Xian-Min, Editor; Liu, Xin-Min, Editor; Su, Hong-Yu, Editor; Bai, Jing, Editor; Sun, Xi-Qing, Editor; Xiao, Zhi-Jun, Editor; Liu, Yong, Editor, et al.; August 2003; ISSN 1002-0837; 84 pp.; In English; In Chinese; See also 20040035674 - 20040035693

Report No.(s): CN-11-2774/R; Copyright; Avail: Other Sources

Reports presented include:Effects of Simulated Weightlessness on Myosin Heavy Chain Expression of Soleus Intrafusal Muscle Fibers in Rats (in English) Changes of Cardiac Catecholamines in Rats after Repeated + Gz Exposures and Protective Effects of Low-G Preconditioning and Tea Polyphenols (in English) Volume Rendering Based on Sorted Volumetric Data (in English) The following articles are presented:Changes of Dentin, Dental Pulp and Periodontium Tissue in Tail-suspended Rats; Changes of Potassium Channel Activity of Hindlimb Arterial Smooth Muscle Cells in Tail-suspended Rats; Effects of Simulated Weightlessness and Bone Mechanical Loading on Bone Interstitial Fluid Flow in Rats; Changes of Osteocalcin in Bone and Bone Marrow in Tail Suspended Rats; Effects of Exercise Training during 21 d -6 deg. Head Down Bed Rest on Dynamic Posture Equilibrium and Motor Coordination; 21 d Tail-suspended Rats Changes of Bone Morphogenesis Proteins and Transforming Growth Factor+ in Hind-limb Bones of 21 d Tail-suspensded Rats; Effects of Qiang Gu Kang Wei Prescription Morphology of Bone in Rats under Simulated Weightlessness; Effects of Modafinil on Visual and Auditory Reaction Abilities and Subjective Fatigue Level during 48 h Sleep Deprivation; Development of Self-generating Lower Body Negative Pressure Device; Changes of Endocrine Hormones during -6 deg. Head Down Bed Rest in Human; Experimental

Research on the Effects of Hydrophobic Coating Porous Plates on Heat Dissipation of Water Sublimator; Effects of Field Viewing Angles on Object Judgement in Virtual Environment; Development of a Shock Response Spectrum Test Facility; Integrated Evaluation on System Reliability of a Space Metabolism Simulation Device; Spatial and Temporal Characteristic of Eye Movement in Human-Computer Interface Design; Changes of Serum IL-1, IL-2R and TNF-alpha Levels in Divers after 150 m Heliox Saturation - 182 m Excursion in the Open Sea Diving; and Progress and Application of Free Radical Determination Techniques in the Biological Domain.
CASI
Aerospace Medicine; Weightlessness Simulation; Physiological Effects; Bioastronautics

20040035674 Institute of Space Medico-Engineering, Beijing, China
Changes of Endocrine Hormones during -6 deg. Head Down Bed Rest in Human
Liang, Li-Xin; Liu, Zhen-Xiu; Wan, Yu-Min; Yang, Tang-Bin; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 284-286; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

To investigate changes of endocrine hormones during 7 d head down bed rest (HDBR) is presented. Six healthy male volunteers served as the subjects and experienced 7 d -6 degrees HDBR. Urine was collected from 6:00 - 22:00 and from 22:00 - 6:00. Serum was collected 48 h before HDBR, 48 h and 120 h during HDBR. Then the endocrine indices in urine and serum were determined. 1) The levels of serum CORT and ALD increased at 48 h during HDBR, while serum T(sub 3), T(sub 4), TP, UN decreased, but they all recovered to normal at 120 h during HDBR. 2) The level of urine CORT, ALD and NE reached its peak in 24 to 48 h, and then gradually decreased to normal level. The endocrine indices in serum and urine changed in the early period but returned to normal level gradually with the proceeding of HDBR.
Derived from text
Endocrinology; Hormones; Head Down Tilt; Aerospace Medicine; Bed Rest; Human Beings

20040035675 Fourth Military Medical Univ., Xi'an, China
Development of Self-generating Lower Body Negative Pressure Device
Yang, Chang-Bin; Sun, Xi-Qing; Wang, Yong-Chun; Yao, Yong-Jie; Wu, Bao-Min; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 281-283; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

To develop a kind of self-generating lower body negative pressure device is presented. The device consists of a flexible bellows, reinforced by several steel rings and sealed by gasproof adhesive plaster. An adjustable valve, a one-way flap valve, shoulder straps and handles are incorporated on the top of the bellows. The user's lower body was contained in the bellows. As the user's legs were extended, the bellows was elongated and the air pressure in it decreased. Negative pressures of -58, -46, -38 and -26 mm- Hg respectively was created with the adjustable inlet valve completely closed, one-quarter open, half open, or fully open. This self-generating lower body negative pressure device combines exercise and LBNP into one thing and is safe and easy to use. It might be used in preventing cardiovascular deconditioning during spaceflight or for anti-G training of pilots.
Derived from text
Lower Body Negative Pressure; Aerospace Medicine; Display Devices; Fabrication; Microgravity

20040035676 Institute of Space Medico-Engineering, Beijing, China
Development of a Shock Response Spectrum Test Facility
Ma, Ai-Jun; Feng, Xue-Mei; Lu, Lai-Jie; Liu, Hong-Ying; Fu, Chang-Hong; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 296-299; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The development of a shock response spectrum test facility for testing space products in the pyrotechnic environment is presented. The natural frequencies of the resonant plate, a key part of the facility, were calculated with finite element method. The dynamic response of the whole system was simulated when the machine was excited by a real shock generated by a dropping hammer. A shock response spectrum test facility was developed under the guide of the simulation results. The resonant plate drop machine could simulate pyrotechnic shock by adjusting the force, the natural frequencies of the plate and the damping materials above and under the plate. The agreement between the measurement and the simulation indicates that the computer simulation results are reliable. It is feasible to use the resonant plate drop machine to simulate pyrotechnic environment.
Derived from text
Shock Tests; Test Facilities; Dynamic Response; Pyrotechnics; Spectra

20040035679 Zhejiang Univ., China

Spatial and Temporal Characteristic of Eye Movement in Human-Computer Interface Design

Shen, Mo-Wei; Feng, Cheng-Zhi; Su, Hui; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 304-306; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

A method to examine the related spatial and temporal characteristics of eye movement in HCI design to provide ergonomic parameters to optimize the HCI design based on eye tracking is presented. Task time, selected error and timeout numbers were recorded automatically, when 12 participants were performing the task of target selection, with different object size, space and dwell time. It was significantly found that task time was influenced by object size and dwell time, the selected error was influenced by object space and dwell time significantly. In conclusion, the dwell time, object size and object space are all important to optimize the HCI design based on eye tracking. We recommend that the dwell time should be 500 ms, the object size and object space should be not less than 1.5 degrees and 1.0 degree respectively for the normal interactive systems.

Derived from text

Eye (Anatomy); Eye Movements; Human-Computer Interface; Aerospace Medicine; Spatial Dependencies; Temporal Resolution

20040035682 Institute of Space Medico-Engineering, Beijing, China

Effects of Qiang Gu Kang Wei Prescription Morphology of Bone in Rats under Simulated Weightlessness

Li, Yong-Zhi; Shi, Hong-Zhi; Fan, Quan-Chun; Tao, Ying; Bai, Gui-e; Duan, Yuan-Ru; Xie, Jun-Shui; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 272-276; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The objective of this research is to investigate effects of Qiang Gu Kang Wei prescription on bone morphology in tail-suspended rats. Rats were tail-suspended (-30 degrees) for 21d to simulate weightlessness. The effects of this prescription on thickness of periost and cortex at epiphyseal plate of tibial shaft and 3 mm under it were examined. The effects of this prescription on histology and ultrastructure of tibia were also observed. Compared with the normal control, cortex at both epiphyseal plate of tibial shaft and 3 mm under it in suspended rats thinned significantly (P less than 0.01 or P less than 0.05). Histological observation showed that in bone of suspended rats, uncalcific matrix was more, bone cells' number was lower and their appearance was more infantile, osteoblasts were less and smaller, while osteoclasts were more and larger, haversian system of transection also showed more irregular than in bone of normal control. Ultrastructure observation showed that the function of osteoblasts was inhabited and that of osteoclasts was active. All the three doses groups of the prescription could increase cortex at either epiphyseal plate of tibial shaft or 3 mm under it (P less than 0.01 or P less than 0.05) compared with the tail-suspended group. The appearance of bone in the three groups was improved as well under optical or electron microscope. This prescription could improve abnormal change in bone morphology resulted from being tail-suspended in rats to make it normal.

Derived from text

Morphology; Rats; Weightlessness Simulation; Bone Demineralization; Histology; Aerospace Medicine

20040035683 Fourth Military Medical Univ., Xi'an, China

Changes of Bone Morphogenesis Proteins and Transforming Growth Factor-Beta in Hind-limb Bones of 21 d Tail-suspended Rats

Cao, Xin-Sheng; Yang, Lian-Jia; Wu, Xing-Yu; Wu, Yan-Hong; Zhang, Le-Ning; Zhang, Li-Fan; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 269-271; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The objective of this research is to investigate changes of bone morphogenesis proteins (BMP), transforming growth factors-beta(TGF-beta) in tibia and the growing of femur in tail-suspensded rats after 21 d simulated weightlessness. Fourteen male SD rats were randomly divided into control group (CON) and tail-suspension group (TS). After 21 d tail-suspension, basic physical parameters of the femur were measured; changes of BMP, TGF-beta in tibia were assayed by immunohistochemical method. During 21 d tail-suspension, all rats grew well without apparent stress reaction. After 21 d weightlessness simulation, wet weight, dried weight, ash, diameter and density of femur in TS group declined significantly (P less than 0.01). Immunohistochemical results of tibia showed that both BMP and TGF-beta declined in tissues from all regions of the tibia. In conclusion, after 21 d tail-suspension, the growth of rat's weight bearing bones were suppressed, production and secretion of BMP and TGF-beta was holdback.

Derived from text

Bones; Proteins; Hindlimb Suspension; Aerospace Medicine; Rats; Immunology; Histology

20040035684 Institute of Aviation Medicine, Beijing, China

Effects of Modafinil on Visual and Auditory Reaction Abilities and Subjective Fatigue Level during 48 Hour Sleep Deprivation

Li, Yan-Feng; Zhan, Hao; Xin, Yi-Mei; Tang, Gui-Xiang; Wei, Si-Huang; Li, Tong; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 277-280; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The objective of this research is to investigate the effects of modafinil, a new central stimulant, on visual and auditory motion reaction ability and subjective fatigue level during 48 h sleep deprivation (SD). Six male healthy young volunteers were exposed to two 48 h periods of continuous wakefulness during the crossover experiment. In one period, three 200 mg doses of modafinil were given and in the other, separated by two weeks, matching placebos were administered. The SD time started from 7:00 of the first day to 7:00 of the third day. Drugs were given at 0:00, 16:00 of the second day and 0:00 of the third day. Variables, including visual and auditory motion reaction time, attention distribution, critical flicker fusion frequency (CFF), Stanford sleepiness scale (SSS) and rating of perceived exertion (RPE), were tested at 21:00 of the first day and 1, 3, 5, 7 h after each drug administration. After 2 - 3 does of modafhil ,the CFF level was obviously enhanced while the scores of Stanford sleepiness scale and RPE were markedly reduced. The visual and auditory motion reaction ability, as well as the attention distribution, showed no significant change. In conclusion, Modafinil can effectively reduce the subjective fatigue and sleepiness levels during SD.

Derived from text

Sleep Deprivation; Fatigue (Biology); Drugs; Central Nervous System Stimulants; Auditory Stimuli; Visual Acuity

20040035687 Naval Medical Research Inst., Shanghai, China

Changes of Serum IL-1, IL-2R and TNF-alpha Levels in Divers after 150 m Heliox Saturation -182 m Excursion in the Open Sea Diving

Fang, Yi-Qun; Xu, Ji; Chen, Yong; Xiao, Wei-Bing; Zhang, He-Xiang; Yu, Feng-Tao; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 307-308; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

A method to observe the change of the serum IL-1, IL-2R and TNF-alpha levels in divers after deep saturation in the open sea diving is presented. Eight divers experienced 150 m heliox saturation - 182 m excursion diving. Serum levels of IL-1, IL-2R and TNF-alpha level before and after diving were measured by ELISA. There was no significant change of serum TNF-alpha level after saturation diving, but serum levels of IL-1, IL-2R increased significantly after saturation diving. In conclusion, deep open sea saturation diving had significant effects on serum IL-6, IL-2R levels of the divers.

Derived from text

Diving (Underwater); Seas; Serums; Aerospace Medicine; Saturation; Helium-Oxygen Atmospheres

20040035690 Institute of Space Medico-Engineering, Beijing, China

Effects of Exercise Training during 21 d -6 deg. Head Down Bed Rest on Dynamic Posture Equilibrium and Motor Coordination

Liu, Yu-Sheng; Huang, Wei-Fen; Liu, Xing-Hua; Wang, Jun; Zhao, Dong-Ming; Wu, Xuan; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 264-268; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The objective of this research is to study the effects of 21 d -6 degree head down bed rest (HDBR) with exercise training on dynamic posture equilibrium and motor coordination. Ten healthy young men were randomly divided into HDBR control groups and HDBR exercise groups, with 5 in each group. The subjects in the exercise group performed exercise with a bicycle ergometer in the supine position 1 h/d during bed rest. Dynamic posture equilibrium as well as isokinetic concentric muscular strength were determined before and after 21 d HDBR. After HDBR, average dynamic proprioception score and dynamic motor coordination decreased significantly, relative peak torque (peak torque/body weights PT/BW) also decreased significantly and accompanied with increase of the peak torque ratio between hamstrings and quadriceps (H/Q) in HDBR control groups. Average dynamic proprioception score and dynamic motor coordination in the HDBR exercise groups remained above the HDBR control groups, but the H/Q ratio showed no significant change. The results showed that exercise training during 21 d -6 degree head-down tilt bed-rest do have beneficial effects on retaining the dynamic posture equilibrium and dynamic motor coordination of the subjects after bed rest.

Derived from text

Bed Rest; Physical Exercise; Head Down Tilt; Aerospace Medicine; Physiological Effects; Efferent Nervous Systems; Equilibrium

20040035691 Institute of Space Medico-Engineering, Beijing, China
Experimental Research on the Effects of Hydrophobic Coating Porous Plates on Heat Dissipation of Water Sublimator
Wu, Zhi-Qiang; Shen, Li-Ping; Han, Li-Jun; Zhao, Pi-Sheng; Feng, Hong-Qi; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 287-291; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

To investigate the development method of hydrophobic coating porous plates for water sublimator and carry out an experimental study on hydrophobic coating porous plates is presented. Porous plates were coated with Teflon coating solution and a kind of special hydrophobic coating solution. Physical characteristic tests for hydrophobic coating porous plates were conducted. An upgrading breadboard of sublimator was redesigned. Effects of hydrophobic coating porous plates on heat rejection of water sublimator were studied. Hydrophobic coating porous plate could evidently increase the water retention pressure, but also increase pressure drop of gas permeability in varying degrees. Heat rejection performance of two kinds of coating plates was different. Performance of coating plate with the special hydrophobic coating solution was better. Hydrophobic coating porous plate could improve performance of water sublimator by optimizing coating parameters and technics of Teflon coating solution and the special hydrophobic coating solution.
Derived from text
Coating; Hydrophobicity; Porous Plates; Dissipation; Sublimation; Water Pressure

20040035692 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Integrated Evaluation on System Reliability of a Space Metabolism Simulation Device
Du, Zhen-Hua; Chen, Jin-Dun; Zhao, Yu; Wang, Li-Dong; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 300-303; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

The objective of this research is to define the lower confidence limit of the system reliability of the space metabolism simulation device by using the test data of the comprising units in their development phases. A new method for defining the environmental conversion factors of failure times has been given based on the AMSAA model, and the MTBF point evaluated values and lower confidence limits of the units were defined, at last, the lower confidence limit of the system reliability was obtained using the L-M method. The results indicate that the lower confidence limit of the system reliability under confidence level of 0.8 is 0.9281, which is consistent with the result obtained by the classic system reliability evaluation method. In conclusion, the integrated system reliability evaluation using the proposed method can well satisfy the need in engineering.
Derived from text
Systems Integration; Metabolism; Computerized Simulation; Reliability Engineering; Aerospace Medicine

20040035693 Academy of Military Medical Sciences, Beijing, China
Progress and Application of Free Radical Determination Techniques in the Biological Domain
Zhang, Qing-Jun; Wu, Ke; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 309-312; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

Seeking for convenient, rapid and highly effective techniques of free radical determination is a key point for studying the biologic mechanism of free radicals. This paper reviewed the progress of these techniques in biological domain and described the electron spin resonance imagine (ESRI) technique development since the 1990s.
Author
Electron Paramagnetic Resonance; Imaging Techniques; Aerospace Medicine; Hydroxyl Radicals

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040034070 Colorado Univ., Boulder, CO, USA
Stress and Cognition: A Cognitive Psychological Perspective
Bourne, Lyle E., Jr.; Yaroush, Rita A.; September 2003; 161 pp.; In English
Contract(s)/Grant(s): NAG2-1561; RTOP 728-20-30
Report No.(s): NASA/CR-2003-212282; IH-045; No Copyright; Avail: CASI; A08, Hardcopy

Research in cognitive psychology has made a significant contribution to our understanding of how acute and chronic stress affect performance. It has done so by identifying some of the factors that contribute to operator error and by suggesting how operators might be trained to respond more effectively in a variety of circumstances. The major purpose of this paper was to review the literature of cognitive psychology as it relates to these questions and issues. Based on the existence of earlier

reviews (e.g., Hamilton, & Warburton, 1979; Hockey, 1983) the following investigation was limited to the last 15 years (1988-2002) and restricted to a review of the primary peer-reviewed literature. The results of this examination revealed that while cognitive psychology has contributed in a substantive way to our understanding of stress impact on various cognitive processes, it has also left many questions unanswered. Concerns about how we define and use the term stress and the gaps that remain in our knowledge about the specific effects of stressors on cognitive processes are discussed in the text.
Author
Cognition; Memory; Cognitive Psychology; Stress (Psychology)

20040035546 Civil Aerospace Medical Inst., Oklahoma City, OK, USA, University of Northern Colorado, Greeley, CO, USA
Use of Personality Assessment Measures in the Selection of Air Traffic Control Specialists
King, Raymond E.; Retzlaff, Paul D.; Detwiler, Cristy A.; Schroeder, David J.; Broach, Dana; December 2003; 15 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-03-HRR-523
Report No.(s): DOT/FAA/AM-03/20; No Copyright; Avail: CASI; A03, Hardcopy

Three studies illustrate the uses of personality assessment methods for selection of Federal Aviation Administration (FAA) air traffic control specialists (ATCSs). Study 1, using a select-out approach to the problems of screening, compared the Sixteen Personality Factor Questionnaire (16 PF) results with NEO Personality Inventory-Revised (NEO PI-R) results from 122 student ATCS participants. Results suggest that the current approach to personality assessment during the initial medical examination focuses primarily on the extent to which the applicant reports symptoms consistent with neurotic, inefficient, and perhaps argumentative characteristics. The remaining two studies consider select-in strategies looking at the psychometric issues of reliability, specificity, and validity. Study 2 examined the NEO PI-R along with the Experiences Questionnaire (EQ) subtests of the Air Traffic-Selection and Training (AT-SAT) battery scores. Participants included 142 students in the ATCS training program at the Mike Monroney Aeronautical Center, Oklahoma City, OK. That sample, in combination with an additional 99 participants who took only AT-SAT, allowed for the examination of the characteristics of the EQ itself. Scores on the eight subtests of the EQ were found to be moderately to highly intercorrelated, ranging from .53 to .81. A principal component analysis revealed only one major underlying factor for the EQ, accounting for 69.22 % of the variance. The overall EQ correlated most notably with the NEO PI-R domains of Neuroticism and Conscientiousness. Finally, Study 3 examined one of the more recent personality measures to be used for personnel research, the Armstrong Laboratory Aviation Personality Survey (ALAPS). A total of 121 students at the FAA Academy completed both the ALAPS and AT-SAT. Scores on the ALAPS Depression scale were negatively correlated with scores on the composite AT-SAT, and scores on the Organization scale were positively correlated with scores on the AT-SAT, suggesting that there may be dimensions of the ALAPS that are related to the overall skills and abilities required for individuals to achieve success as ATCSs. This review affords the reader an appreciation of the uses and history of personality assessment, both select-out and select-in, in FAA ATCS selection. The FAA is continually evaluating cognitive, as well as personality, measures as part of its selection procedures.
Author
Air Traffic Controllers (Personnel); Personality Tests; Personnel Selection

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*.

20040031680 Defence Science and Technology Organisation, Fishermans Bend, Australia
A Review of Critical Human Factors Issues for Aviation Team Training
Lenne, Michael G.; July 2003; 88 pp.; In English
Report No.(s): DSTO-TR-1466; DODA-AR-012-832; Copyright; Avail: Other Sources

This report reviews literature relevant to team training in complex environments. While technological developments allow for the training of higher-order cognitive skills in complex simulated environments, in the absence of sound learning methodologies, training systems may not fully achieve their desired objectives. There are relatively few attempts in the literature that focus on how best to use technology to support effective training, and little research effort has involved the use of technology in the development of effective training programs for teams rather than individuals. The effectiveness of team training systems, and specifically, the measures of team outcomes and team processes that could be used to measure team

performance in distributed training, are also reviewed. Some areas for future research relevant to distributed team training are identified.
Author
Teams; Education; Human Factors Engineering

20040031681 National Defence Research Establishment, Linkoeping, Sweden
Knowledge Representation of Doctrines and Tactical Behaviour
Suzic, R.; 2003; In Swedish
Report No.(s): PB2004-101831; FOI-R-0865-SE; No Copyright; Avail: National Technical Information Service (NTIS)

As a first step towards the development of methodologies for doctrine modeling a study and knowledge representation of doctrines at operational, tactical and armor technical level has been performed. The aim has been to supply information fusion processes with a priori knowledge, which in this case is knowledge about the enemy's tactical behavior. There are many unpredictable factors that can play a decisive role in warfare. An important observation made during the study is that uncertainty increases dramatically as soon as the first shot is fired. Therefore it will be difficult to make battle models which give a good prediction of the enemy's course of action that is most likely. When modeling doctrines for information fusion processes, the first step should be to make models for tactical behavior before and after the battle. This report describes how doctrines can be represented in terms of classes and their interrelationships using Unified Modeling Language (UML). Additionally we describe in an example how the doctrine models and information fusion process are coped with.
NTIS
Knowledge Representation; Information Systems

20040031835 NASA Langley Research Center, Hampton, VA, USA
The H-Metaphor as a Guideline for Vehicle Automation and Interaction
Flemisch, Frank O.; Adams, Catherine A.; Conway, Sheila R.; Goodrich, Ken H.; Palmer, Michael T.; Schutte, Paul C.; January 12, 2003; 35 pp.; In English
Contract(s)/Grant(s): WU 23-786-10-10
Report No.(s): NASA/TM-2003-212672; L-18448; No Copyright; Avail: CASI; A03, Hardcopy

Good design is not free of form. It does not necessarily happen through a mere sampling of technologies packaged together, through pure analysis, or just by following procedures. Good design begins with inspiration and a vision, a mental image of the end product, which can sometimes be described with a design metaphor. A successful example from the 20th century is the desktop metaphor, which took a real desktop as an orientation for the manipulation of electronic documents on a computer. Initially defined by Xerox, then refined by Apple and others, it could be found on almost every computer by the turn of the 20th century. This paper sketches a specific metaphor for the emerging field of highly automated vehicles, their interactions with human users and with other vehicles. In the introduction, general questions on vehicle automation are raised and related to the physical control of conventional vehicles and to the automation of some late 20th century vehicles. After some words on design metaphors, the H-Metaphor is introduced. More details of the metaphor's source are described and their application to human-machine interaction, automation and management of intelligent vehicles sketched. Finally, risks and opportunities to apply the metaphor to technical applications are discussed.
Author
Automation; Robotics; Automobiles; Human-Computer Interface; Artificial Intelligence

20040033986 Naval Medical Research Inst., Shanghai, China
Observation on Protective Effect of Hearing Protectors on Infrasound
Liang, Zhen-Fu; Huang, Feng; Tang, Zhi-Wen; Yu, Hao; Niu, Cong-Min; Liu, Gang; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 110-114; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this research was to observe the sound-attenuation effect of several kinds of hearing protectors (earplugs and earmuffs) in an infrasound generator sound field. An artificial head was utilized in the experiments. Using a real time analyzer, linear sound pressure level, sound level, infrasound level, and one-third octave-band sound pressure level were measured, with or without hearing protectors.
Author (revised)
Ear Protectors; Sound Intensity

20040033988 Institute of Space Medico-Engineering, Beijing, China

Physical Simulation of Human Body Metabolism in Sealed Module on the Ground

Tu, Bo; Lin, Gui-Ping; Rui, Jia-Bai; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 128-132; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this investigation was to provide a test platform for experimental verification of environmental control and life support systems of manned spacecraft on the ground. Simulation of human body metabolism was divided into different units, and a ground simulator was designed.

Author (revised)

Life Support Systems; Simulators; Metabolism

20040034004 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Shared Knowledge for Decision-making on Environment and Health Issues in the Arctic

Maynard, Nancy G.; [2003]; 1 pp.; In English; 2003 SEARCH Open Science Meeting, 25-30 Oct. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper will describe a remote sensing and GIs-based system to bring indigenous traditional knowledge together with contemporary scientific knowledge to address impacts resulting from changes in climate, environment, weather and pollution in the Arctic. As scientists and policy-makers from both indigenous and non-indigenous communities continue to build closer partnerships to address common sustainability issues such as the health impacts of climate change and anthropogenic activities, it becomes increasingly important to create shared information management systems which integrate all relevant factors for optimal information sharing and decision-making. This system is being designed to bring together remotely sensed, indigenous and other data and observations for analysis, measuring, and monitoring parameters of interest (e.g., snow cover, rainfall, temperature, ice conditions, vegetation, infrastructure, fires). A description of the system and its components as well as a preliminary application of the system in the Arctic will be presented.

Author

Arctic Regions; Decision Making; Health; Management Systems; Climate Change; Environment Pollution

20040034725 Westinghouse Savannah River Co., Aiken, SC, USA

Use of DAC-Hours for Radiation Work Permit Suspension Guides and Validation of Respiratory Equipment Selection at the Savannah River Site

Hadlock, D. J.; Epperson, S. A.; 2003; 16 pp.; In English

Report No.(s): DE2003-817233; WSRC-MS-2003-00660; No Copyright; Avail: Department of Energy Information Bridge

Historically, the Savannah River Site, like many Department of Energy sites, has used some multiple of the expected Derived Air Concentration (DAC) of a radionuclide as a suspension guide for Radiological Work Permits (RWP) or validation of selected respiratory protection equipment. Even though the term DAC is derived from an intake of radioactivity (Annual Limit on Intake) that would result in defined estimated dose to a worker, knowing only the DAC value does not allow a workers potential dose to be determined. Recently, the Savannah Rive Site has converted to the use of DAC-hours for RWP suspension guides and respiratory equipment validation. The term DAC-hr takes into account not only the concentration of the radionuclide in air (DAC) but also the time the individual was exposed allowing an estimate of a workers dose to be determined. The conversion to DAC-hrs resulted in four benefits to the radiation protection program without increasing the risk to workers; (1) consistency with the constant air monitor (CAM) alarm setpoint protocol; (2) consistency with Internal Dosimetry terminology; (3) an a priori determination of the potential risk to a worker; and (4) reduced complexity/error in field calculations. This paper outlines the justification for the conversion to DAC-hrs, the protocols used for field and count room calculations, and the implementation process utilized at the Savannah River Site.

NTIS

Radiation Protection; Dosimeters; Radioactive Isotopes

20040035698 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan

Biological Information Interface Technology

Ninjouji, Takashi; Manabe, Hiroyuki; Mashiko, Takunori; Suzuki, Shin; Sugimura, Toshiaki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 67-71; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

We are studying biological information interfaces to enable people to interact with information via enhanced senses and limbs. In this article, we discuss the future possibilities of this interface technology and introduce our current research on the

measurement, analysis, and application of biological signals in nerves and muscles. We are starting to use such biological signals as control signals for input operations.
Author
Man Machine Systems; Interfaces

20040035700 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Revolutionizing Mobile Communications through New Interface Technologies
Nalano, Hirotaka; Sugimura, Toshiaki; Kurakake, Shoji; Takeshita, Atsushi; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 60-66; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

NTT DoCoMo Multimedia Laboratories are researching user interfaces that will enable you to use devices, objects, and information naturally and with ease as if they were part of your body. This article describes associated technical issues and introduces the concept of Human Centered Communication and Computing (HC(sup 3)) based on the technologies described.
Author
Mobile Communication Systems; Interfaces; Man Machine Systems

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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*.

20040035654 Geoscience Australia, Canberra, Australia
AusGeo News, No. 72
Wissman, Julie, Editor; December 2003; ISSN 1035-9338; 32 pp.; In English; Copyright; Avail: Other Sources

In many Australian coastal waterways plant growth is stimulated by nutrients that come from the catchment. Large increases in plant growth can cause clogged waterways and algal blooms. But some estuaries and coastal lakes remain 'clean' despite lots of nutrient or sediment. Something is happening at the bottom of these lakes or in their water that allows them to handle big sediment-nutrient loads without threatening ecosystem health. These factors are discussed in this issue of AusGeo News.
Author
Algae; Ecosystems; Estuaries; Vegetation Growth; Waterways

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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*.

20040031672
Evaluation of Rescue Services Preparendess for Chemical Accidents. Users Manual for the Evaluation Instrument VIK. Second Edition
Eriksson, H.; Ritchey, T.; Stenstroem, M.; Sep. 2003; In Swedish
Report No.(s): PB2004-101820; FOI-R-0861-SE; No Copyright; Avail: National Technical Information Service (NTIS)

FOI have developed a computer-based instrument for evaluation of Rescue Services preparedness for chemical accidents. The instrument is intended for studying the rescue services preparedness for accidents involving hazardous materials. The results can be used for discussions in order to improve that preparedness. The document is a manual for users of the instrument, which is based on the method Morphological Analysis together with the program CASPER (Computer Aided Scenario and Problem Evaluation Routine).
NTIS
Hazardous Materials; Rescue Operations

20040031684 Swedish Defence Research Establishment, Stockholm, Sweden
Cyberterrorism: Does IT Open New Possibilities for Terrorism
Grennert, J.; Lindell, M. T.; 2003; 48 pp.; In Swedish
Report No.(s): PB2004-102710; FOI-R-0626-SE; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of the report is to clarify what cyber terrorism is and to determine if there is such a threat against our society or if one could develop over time. A definition of cyber terrorism is suggested. The connection between 'cyber' and 'terrorism' suggests that the word implies a new means for terrorism and also that it is separated from other forms of computer crime that can not be classified as terrorism.
NTIS
Threat Evaluation; Terrorism; Crime; Data Processing

20040031689 Arkansas Univ., Fayetteville, AR, USA
Simple Approach to Linehaul-Backhaul Problems: A Guided Local Search Approach for the Vehicle Routing Problem
Zhong, Y.; Cole, M. H.; 2003; 46 pp.
Report No.(s): PB2004-103189; No Copyright; Avail: CASI; A03, Hardcopy

This report develops a heuristic algorithm and prototype software for solving the Vehicle Routing Problem with Backhauls and Time Windows (VRPBTW). The problem differs from the well-known VRP in that customers can demand either delivery (linehaul) or pickup (backhaul), and each customer has a service time window.
NTIS
Algorithms; Heuristic Methods; Scheduling; Computer Programs

20040031786 NASA Ames Research Center, Moffett Field, CA, USA
Evaluation of Genetic Algorithm Concepts Using Model Problems, Part 2, Multi-Objective Optimization
Holst, Terry L.; Pulliam, Thomas H.; December 2003; 44 pp.; In English
Contract(s)/Grant(s): 302-15-31
Report No.(s): NASA/TM-2003-212813/PT2; A-0311046/PT2; No Copyright; Avail: CASI; A03, Hardcopy

A genetic algorithm approach suitable for solving multi-objective optimization problems is described and evaluated using a series of simple model problems. Several new features including a binning selection algorithm and a gene-space transformation procedure are included. The genetic algorithm is suitable for finding pareto optimal solutions in search spaces that are defined by any number of genes and that contain any number of local extrema. Results indicate that the genetic algorithm optimization approach is flexible in application and extremely reliable, providing optimal results for all optimization problems attempted. The binning algorithm generally provides pareto front quality enhancements and moderate convergence efficiency improvements for most of the model problems. The gene-space transformation procedure provides a large convergence efficiency enhancement for problems with non-convoluted pareto fronts and a degradation in efficiency for problems with convoluted pareto fronts. The most difficult problems --multi-mode search spaces with a large number of genes and convoluted pareto fronts-- require a large number of function evaluations for GA convergence, but always converge.
Author
Genetic Algorithms; Mathematical Models; Optimization; Operators (Mathematics)

20040031802
Relaxation and Preconditioning for High Order Discontinuous Galerkin Methods with Applications to Aeroacoustics and High Speed Flows
Shu, Chi-Wang; [2004]; 7 pp.; In English
Contract(s)/Grant(s): NCC1-01035; No Copyright; Avail: CASI; A02, Hardcopy

This project is about the investigation of the development of the discontinuous Galerkin finite element methods, for general geometry and triangulations, for solving convection dominated problems, with applications to aeroacoustics. Other related issues in high order WENO finite difference and finite volume methods have also been investigated. methods are two classes of high order, high resolution methods suitable for convection dominated simulations with possible discontinuous or sharp gradient solutions. In [18], we first review these two classes of methods, pointing out their similarities and differences in algorithm formulation, theoretical properties, implementation issues, applicability, and relative advantages. We then present some quantitative comparisons of the third order finite volume WENO methods and discontinuous Galerkin methods for a series of test problems to assess their relative merits in accuracy and CPU timing. In [3], we review the development of the Runge-Kutta discontinuous Galerkin (RKDG) methods for non-linear convection-dominated problems. These robust and

accurate methods have made their way into the main stream of computational fluid dynamics and are quickly finding use in a wide variety of applications. They combine a special class of Runge-Kutta time discretizations, that allows the method to be non-linearly stable regardless of its accuracy, with a finite element space discretization by discontinuous approximations, that incorporates the ideas of numerical fluxes and slope limiters coined during the remarkable development of the high-resolution finite difference and finite volume schemes. The resulting RKDG methods are stable, high-order accurate, and highly parallelizable schemes that can easily handle complicated geometries and boundary conditions. We review the theoretical and algorithmic aspects of these methods and show several applications including nonlinear conservation laws, the compressible and incompressible Navier-Stokes equations, and Hamilton-Jacobi-like equations.
Derived from text
Aeroacoustics; High Speed; Incompressible Flow; Computational Fluid Dynamics; Runge-Kutta Method; Galerkin Method; Finite Element Method; Triangulation; Convection

20040031844 Maryland Univ. Baltimore County, Catonsville, MD, USA
Representativeness Uncertainty in Chemical Data Assimilation Highlight Mixing Barriers
Lary, David John; [2003]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy
When performing chemical data assimilation the observational, representativeness, and theoretical uncertainties have very different characteristics. In this study we have accurately characterized the representativeness uncertainty by studying the probability distribution function (PDF) of the observations. The average deviation has been used as a measure of the width of the PDF and of the variability (representativeness uncertainty) for the grid cell. It turns out that for long-lived tracers such as N2O and CH4 the representativeness uncertainty is markedly different from the observational uncertainty and clearly delineates mixing barriers such as the polar vortex edge, the tropical pipe and the tropopause.
Author
Assimilation; Distribution Functions; Methane; Pipes (Tubes); Probability Theory; Variability; Vortices; Uncertain Systems

20040034229 Lawrence Livermore National Lab., Livermore, CA
Topology of the Level Sets of Scalar Field
Pascucci, V.; Dec. 12, 2000; 16 pp.; In English
Report No.(s): DE2003-15005458; UCRL-JC-142262; No Copyright; Avail: Department of Energy Information Bridge
This paper introduces a new simple algorithm for the construction of the Contour Tree of a 3D scalar field augmented with the Betti numbers of each contour component. The algorithm has O(n log n) time complexity and O(n) auxiliary storage, where n is the number of vertices in the domain of the field. The algorithm can be applied to fields of any dimension in which case it computes the Contour Tree augmented onlj, with the Euler characteristic of each con- tour. The complexity in any dimension remains O(n logn). This is the same complexity as in (4) but with correct computation of the tree for fields with bounded domains.
NTIS
Algorithms; Topology; Trees (Mathematics); Set Theory

20040034724 Lawrence Livermore National Lab., Livermore, CA
High Performance Diskless Linux Workstation in AX-Division
Councell, E.; Bushy, L.; Sep. 30, 2003; 12 pp.; In English
Report No.(s): DE2003-15004944; UCRL-TR-155566; No Copyright; Avail: Department of Energy Information Bridge
AX Division has recently installed a number of diskless Linux workstations to meet the needs of its scientific staff for classified processing. Results so far are quite positive, although problems do remain. Some unusual requirements were met using a novel, but simple, design: Each diskless client has a dedicated partition on a server disk that contains a complete Linux distribution.
NTIS
Workstations; Unix (Operating System)

20040034739 Lawrence Livermore National Lab., Livermore, CA
Are Multiple Runs Better than One?
Cantu-Paz, E.; Jan. 2001; 14 pp.; In English
Report No.(s): DE2003-15005318; UCRL-JC-142172; No Copyright; Avail: Department of Energy Information Bridge
This paper investigates whether it is better to use a certain constant amount of computational resources in a single run

with a large population, or in multiple runs with smaller populations. The paper presents the primary tradeoffs involved in this problem and identifies the conditions under which there is an advantage to use multiple small runs. The paper uses an existing model that relates the quality of the solutions reached by a genetic algorithm (GA) with its population size. The results suggest that in most cases a single run with the largest population possible reaches a better solution than multiple isolated runs. The findings are validated with experiments on functions of varying difficulty.
NTIS
Populations; Genetic Algorithms; Tradeoffs

20040035616 Lawrence Livermore National Lab., Livermore, CA
Object-Oriented NeuroSys: Parallel Programs for Simulating Large Networks of Biologically Accurate Neurons
Pacheco, P.; Miller, P.; Kim, J.; Leese, T.; Zabiyaka, Y.; May 07, 2003; 16 pp.; In English
Report No.(s): DE2003-15005007; UCRL-JC-153186; No Copyright; Avail: Department of Energy Information Bridge
Object-oriented NeuroSys is a collection of programs for simulating very large networks of biologically accurate neurons on distributed memory parallel computers. It includes two principle programs: ooNeuroSys, a parallel program for solving the large systems of ordinary differential equations arising from the interconnected neurons, and Neurondiz, a parallel program for visualizing the results of ooNeuroSys. Both programs are designed to be run on clusters and use the MPI library to obtain parallelism. ooNeuroSys also includes an easy-to-use Python interface. This interface allows neuroscientists to quickly develop and test complex neuron models. Both ooNeuroSys and Neurondiz have a design that allows for both high performance and relative ease of maintenance.
NTIS
Computer Programs; Computer Networks; Parallel Processing (Computers); Object-Oriented Programming

20040035618 Lawrence Livermore National Lab., Livermore, CA
Performance of Parallel Disk Write Methods for Linux Multiprocessor Nodes
Benson, G. D.; Long, K.; Pacheco, P. S.; May 07, 2003; 18 pp.; In English
Report No.(s): DE2003-15005008; UCRL-JC-153187; No Copyright; Avail: Department of Energy Information Bridge
Despite increasing attention paid to parallel I/O and the introduction of MPI-IO, there is limited, practical data to help guide a programmer in the choice of a good parallel write strategy in the absence of a parallel file system. In this study we experimentally evaluate several methods for implementing parallel computations that interleave a significant number of contiguous or strided writes to a local disk on Linux-based multiprocessor nodes. Using synthetic benchmark programs written with MPI and Pthreads, we have acquired detailed performance data for different application characteristics of programs running on dual processor nodes. In general, our results show that programs that perform a significant amount of I/O relative to pure computation benefit greatly from the use of threads, while programs that perform relatively little I/O obtain excellent results using only MPI. For a pure MPI approach, we have found that it is best to use two writing processes with mmap(). For Pthreads it is usually best to use write() for contiguous data and writev() for strided data. Codes that use mmap() tend to benefit from periodic syncs of the data of the data to the disk, while codes that use write() or writev() tend to have better performance with few syncs. A straightforward use of ROMIO usually does not perform as well as these direct approaches for writing to the local disk.
NTIS
Computer Programming; Data Management; Multiprocessing (Computers); Unix (Operating System)

20040035642 Lawrence Livermore National Lab., Livermore, CA
ROSETTA: The Compile-Time Recognition of Object-Oriented Library Abstractions and Their use within User Applications
Quinlan, D.; Philip, B.; Jan. 08, 2001; 12 pp.; In English
Report No.(s): DE2003-15005481; UCRL-JC-141943; No Copyright; Avail: Department of Energy Information Bridge
Libraries arise naturally from the increasing complexity of developing scientific applications, the optimization of libraries is just one type of high-performance optimization. Many complex applications areas can today be addressed by domain-specific object-oriented frameworks. Such object-oriented frameworks provide an effective compliment to an object-oriented language and effectively permit the design of what amount to essentially domain-specific languages. The optimization of such a domain-specific library/language combination however is particularly complicated due to the inability

of the compiler to optimize the use of the libraries abstractions of specialization in the recognition of complex use of user defined abstractions.
NTIS
Libraries; Object-Oriented Programming; Compilers; Human-Computer Interface

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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*.

20040034720 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Requirements UML Tool (RUT) Expanded for Extreme Programming (CI02)
McCoy, James R.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): CSIP2002-29; No Copyright; Avail: Other Sources; Abstract Only

A procedure for capturing and managing system requirements that incorporates XP user stories. Because costs associated with identifying problems in requirements increase dramatically over the lifecycle of a project, a method for identifying sources of software risks in user stories is urgently needed. This initiative aims to determine a set of guide-lines for user stories that will result in high-quality requirement. To further this initiative, a tool is needed to analyze user stories that can assess the quality of individual user stories, detect sources cf software risk's, produce software metrics, and identify areas in user stories that can be improved.
Author
Costs; Risk; Computer Programs

20040035544 Southern Taiwan Univ. of Technology, Tainan, Taiwan, Province of China
Successive Bit-Vector Search Algorithm for CELP Vocoders
Lin, Rong-San; Yang, Jar-Ferr; Ho, David; Journal of the Chinese Institute of Engineers; May 2003; ISSN 0253-3839; Volume 26, No. 3, pp. 261-270; In English
Contract(s)/Grant(s): NSC-87-NSPO-A-006; Copyright; Avail: Other Sources

In this paper, we propose a successive bit-vector search approach to reduce the computational complexity of coded excited linear predictive coding (CELP) speech coders. By decomposing each code-vector into several bit-vectors, the convolution process of the linear predictive coding model can be simplified. With a suggested matching criterion, the proposed method removes a portion of unlikely code-vectors in a bit-vector by bit-vector fashion. Theoretical analyses and simulation results show that the proposed search method reduces a lot of the computational load for general codebook searches and maintains nearly the same speech quality as the traditional search approach. The proposed method, which reduces the complexity of the CELP speech coders in VLSI realization, can be flexibly embedded with a simple RISC processor to achieve a low-cost speech coder. Key Words: speech coding, fast codebook search, CELP.
Author
Algorithms; Coders; Computation; Speech Recognition; Vocoders

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040031635 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Power Management for AES
vanderBurgt, J. J. A.; May 2003; 66 pp.; In English
Contract(s)/Grant(s): A99/KM/492; TNO Proj. 014.12975
Report No.(s): TD-2002-0207; PML-2003-A33; Copyright; Avail: Other Sources

This report describes a power management simulation tool to analyse power management systems in a stationary situation. The model is a set of switching rules that depend on the state of the network. The main components of the power management system are the generator load sharing controller and the switch-over units. The tool has been implemented in the

TNO-developed program GES. This has been described in the report Power management for AES by TNO-CMC. The testing of the power management module has been done in fault scenarios that are caused by a warhead detonation in the ship. This is done in combination with the ship vulnerability simulation tool PROGRESS. This analysis has been described in the report Vulnerability of the All-Electric Ship of TNO-PML.
Author
Electric Propulsion; Management Systems

20040031780 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Computational Aspects of Data Assimilation and the ESMF
daSilva, A.; [2003]; 1 pp.; In English; National Center for Atmospheric Research, 7-11 Jul. 2003, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The scientific challenge of developing advanced data assimilation applications is a daunting task. Independently developed components may have incompatible interfaces or may be written in different computer languages. The high-performance computer (HPC) platforms required by numerically intensive Earth system applications are complex, varied, rapidly evolving and multi-part systems themselves. Since the market for high-end platforms is relatively small, there is little robust middleware available to buffer the modeler from the difficulties of HPC programming. To complicate matters further, the collaborations required to develop large Earth system applications often span initiatives, institutions and agencies, involve geoscience, software engineering, and computer science communities, and cross national borders.The Earth System Modeling Framework (ESMF) project is a concerted response to these challenges. Its goal is to increase software reuse, interoperability, ease of use and performance in Earth system models through the use of a common software framework, developed in an open manner by leaders in the modeling community. The ESMF addresses the technical and to some extent the cultural - aspects of Earth system modeling, laying the groundwork for addressing the more difficult scientific aspects, such as the physical compatibility of components, in the future. In this talk we will discuss the general philosophy and architecture of the ESMF, focussing on those capabilities useful for developing advanced data assimilation applications.
Author
Geophysics; Assimilation; Computer Programming; Software Engineering

20040031800 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Data Access Tools And Services At The Goddard Distributed Active Archive Center (GDAAC)
Pham, Long; Eng, Eunice; Sweatman, Paul; [2003]; 1 pp.; In English; American Geophysical Union Fall Meeting, December 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

As one of the largest providers of Earth Science data from the Earth Observing System, GDAAC provides the latest data from the Moderate Resolution Imaging Spectroradiometer (MODIS), Atmospheric Infrared Sounder (AIRS), Solar Radiation and Climate Experiment (SORCE) data products via GDAAC's data pool (50TB of disk cache). In order to make this huge volume of data more accessible to the public and science communities, the GDAAC offers multiple data access tools and services: Open Source Project for Network Data Access Protocol (OPeNDAP), Grid Analysis and Display System (GrADS/DODS) (GDS), Live Access Server (LAS), OpenGlS Web Map Server (WMS) and Near Archive Data Mining (NADM). The objective is to assist users in retrieving electronically a smaller, usable portion of data for further analysis. The OPeNDAP server, formerly known as the Distributed Oceanographic Data System (DODS), allows the user to retrieve data without worrying about the data format. OPeNDAP is capable of server-side subsetting of HDF, HDF-EOS, netCDF, JGOFS, ASCII, DSP, FITS and binary data formats. The GrADS/DODS server is capable of serving the same data formats as OPeNDAP. GDS has an additional feature of server-side analysis. Users can analyze the data on the server there by decreasing the computational load on their client's system. The LAS is a flexible server that allows user to graphically visualize data on the fly, to request different file formats and to compare variables from distributed locations. Users of LAS have options to use other available graphics viewers such as IDL, Matlab or GrADS. WMS is based on the OPeNDAP for serving geospatial information. WMS supports OpenGlS protocol to provide data in GIs-friendly formats for analysis and visualization. NADM is another access to the GDAAC's data pool. NADM gives users the capability to use a browser to upload their C, FORTRAN or IDL algorithms, test the algorithms, and mine data in the data pool. With NADM, the GDAAC provides an environment physically close to the data source. NADM will benefit users with mining or offer data reduction algorithms by reducing large volumes of data before transmission over the network to the user.
Author
Earth Observing System (Eos); MODIS (Radiometry); Data Systems; Data Transmission; Multiple Access; Oceanographic Parameters

20040031824 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Parallel Signal Processing and System Simulation using aCe
Dorband, John E.; Aburdene, Maurice F.; [2003]; 7 pp.; In English; 37th Annual Conference on Information Sciences and Systems, 12-14 Mar. 2003, Baltimore, MD, USA; Copyright; Avail: CASI; A02, Hardcopy

Recently, networked and cluster computation have become very popular for both signal processing and system simulation. A new language is ideally suited for parallel signal processing applications and system simulation since it allows the programmer to explicitly express the computations that can be performed concurrently. In addition, the new C based parallel language (ace C) for architecture-adaptive programming allows programmers to implement algorithms and system simulation applications on parallel architectures by providing them with the assurance that future parallel architectures will be able to run their applications with a minimum of modification. In this paper, we will focus on some fundamental features of ace C and present a signal processing application (FFT).
Author
Parallel Processing (Computers); Simulation; C (Programming Language); Signal Processing

20040033998 NASA Goddard Space Flight Center, Greenbelt, MD, USA
13RC and and 3DRT Working Group of IRC: Status and Plans
Cahalan, Robert; [2003]; 1 pp.; In English; GEWEX GRP, 10-15 Nov. 2003, Victoria, Canada; No Copyright; Avail: Other Sources; Abstract Only

We summarize recent activities of the International Intercomparison of 3D Radiation Codes (DRC), including development of an open source code, approximation methods for use in cloud dynamical models, and cloud reconstructions from multiple satellite platforms such as MODIS, MISR and ICESat. We also discuss the charter of the newly formed 3DRT Working Group of the International Radiation Commission, which hopes to coordinate and integrate efforts in various 3D application areas, including clouds, sea ice, and vegetation. Finally we describe plans for a special 3D session at the next International Radiation Symposium in Busan Korea, during 23-30 August 2004.
Author
Approximation; Ice, Cloud and Land Elevation Satellite; Imaging Spectrometers

20040034049 Nelson Consulting, Moffett Field, CA, USA
Product-oriented Software Certification Process for Software Synthesis
Nelson, Stacy; Fischer, Bernd; Denney, Ewen; Schumann, Johann; Richardson, Julian; Oh, Phil; February 2004; 48 pp.; In English
Contract(s)/Grant(s): NAS2-00065
Report No.(s): NASA/CR-2004-212819; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this document is to propose a product-oriented software certification process to facilitate use of software synthesis and formal methods. Why is such a process needed? Currently, software is tested until deemed bug-free rather than proving that certain software properties exist. This approach has worked well in most cases, but unfortunately, deaths still occur due to software failure. Using formal methods (techniques from logic and discrete mathematics like set theory, automata theory and formal logic as opposed to continuous mathematics like calculus) and software synthesis, it is possible to reduce this risk by proving certain software properties. Additionally, software synthesis makes it possible to automate some phases of the traditional software development life cycle resulting in a more streamlined and accurate development process.
Author
Software Engineering; Architecture (Computers); Program Verification (Computers); Software Development Tools; Certification

20040034080 Physics and Electronics Lab. TNO, The Hague, Netherlands
Feasibility Test Bed Country Mines
Koole, J.; May 2003; 48 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 015.31757
Report No.(s): TD-2003-0016; FEL-02-A313; Copyright; Avail: Other Sources

The requirements are formulated for a mine testbed (simulation model). It must be possible to analyze the effectiveness from minefiedls in an operational context. Also, an engineering exchange proposal has been made for implementing these requirements in Future Combat System.
Author
Simulation; Mines (Ordnance)

20040034131 Akron Univ., Akron, OH, USA
Enhancements to NURBS-Based FEA Airfoil Modeler: SABER
Saleeb, A. F.; Trowbridge, D. A.; January 1, 2003; 2 pp.; In English
Contract(s)/Grant(s): NCC3-578; No Copyright; Avail: Other Sources; Abstract Only

NURBS (Non-Uniform Rational B-Splines) have become a common way for CAD programs to fit a smooth surface to discrete geometric data. This concept has been extended to allow for the fitting of analysis data in a similar manner and 'attaching' the analysis data to the geometric definition of the structure. The 'attaching' of analysis data to the geometric definition allows for a more seamless sharing of data between analysis disciplines. NURBS have become a useful tool in the modeling of airfoils. The use of NURBS has allowed for the development of software that easily and consistently generates plate finite element models of the midcamber surface of a given airfoil. The resulting displacements can then be applied to the original airfoil surface and the deformed shape calculated.
Author
Computer Aided Design; Airfoils; Surface Properties; Displacement; Computer Programming

20040034178 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Transferring Knowledge from Observations and Models to Decision Makers: An Overview and Challenges
Habib, Shahid; Nokra, Nada Abu; [2003]; 1 pp.; In English; SPIE Remote Sensing 2003 Conference, 8-12 Sep. 2003, Barcelona, Spain; No Copyright; Avail: Other Sources; Abstract Only

Over the last 25 years, a tremendous progress has been made in the Earth science space-based remote sensing observations, technologies and algorithms. Such advancements have improved the predictability by providing lead-time and accuracy of forecast in weather, climate, natural hazards, and natural resources. It has further reduced or bounded the overall uncertainties by partially improving our understanding of planet Earth as an integrated system that is governed by non-linear and chaotic behavior. Many countries such US, European Community, Japan, China and others have invested billions of dollars in developing and launching space-based assets in the low earth (LEO) and geostationary (GEO) orbits. However, the wealth of this scientific knowledge that has potential of extracting monumental socio-economic benefits from such large investments have been slow in reaching to public and decision makers. For instance, there are a number of areas such as energy forecasting, aviation safety, agricultural competitiveness, disaster management, security, air quality and public health can directly take advantage. Nevertheless, we all live in a global economy that depends on access to the best available Earth Science information for all inhabitants of this planet. This paper surveys and examines a number such applications in terms of their architecture, maturity and economic applicability as they apply to the societal needs. A detailed analysis is also presented of various challenges and issues that pertain to a number of areas such as: (1) difficulties in making a speedy transition of data and information from observations and models to relevant Decision Support Systems (DSS) or tools, (2) data and models inter-operability issues, (3) limitations of spatial, spectral and temporal resolution, (4) communication limitations as dictated by the availability of image processing and data compression techniques. Additionally, the most critical element amongst all is the organizational and management boundaries that must be resolved at local, state, national and international levels to implement and realize free flow of such vital information. This paper also makes attempts to address this topic and discuss possible approaches to deal with this quandary.
Author
Algorithms; Data Compression; Decision Support Systems; Earth Resources; Earth Sciences; Forecasting; Remote Sensing

20040034185 Nelson Consulting, Moffett Field, CA, USA
Survey of Software Assurance Techniques for Highly Reliable Systems
Nelson, Stacy; February 2004; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS2-00065
Report No.(s): NASA/CR-2004-212805; No Copyright; Avail: CASI; A04, Hardcopy

This document provides a survey of software assurance techniques for highly reliable systems including a discussion of relevant safety standards for various industries in the USA and Europe, as well as examples of methods used during software development projects. It contains one section for each industry surveyed: Aerospace, Defense, Nuclear Power, Medical Devices and Transportation. Each section provides an overview of applicable standards and examples of a mission or software development project, software assurance techniques used and reliability achieved.
Author
Software Engineering; Reliability; Safety; Program Verification (Computers); Standards

20040034186 Minnesota Univ., MN, USA
A Spectrum of IV and V Modeling Techniques
Heimdahl, Mats; Owen, David; January 2004; 1 pp.; In English
Contract(s)/Grant(s): CI-452; No Copyright; Avail: Other Sources; Abstract Only

The aerospace industry in general and NASA in particular is using more (semi-formal) model-based software development. Model-based development produces a collection of artifacts, for example, state diagrams, module diagrams (such as class diagrams), control-block diagrams, etc. These artifacts may than be used as a basis for auto code generation for production use. Therefore, these models must be properly evaluated in the IV and V process. IV and V practitioners know how assess standard procedural systems. But what can we du about IV and V of model-based systems? The goal of the work outlined in this proposal is to use cost effective automated techniques to the largest extent possible during the IV and V process. Our working hypotheses are: 1. There exists a range of validation techniques that can assess models built using a range of modeling techniques of increasing cost and complexity. Specifically, we hypotesize that the 'cheaper' techniques can find faults cheaply and early in a project. These early results are then used to predict if this is a problem system and if a more elaborate and expensive IV and V effort is justified. 2. There exists a set of migration procedures that let us seamlessly move from simple models using cheaper techniques into more elaborate models suitable for a more expensive and detailed analysis. 3. We further hypothesize that this migration process is much cheaper than simply remodeling the system under investigation from scratch when moving to models needed for the more detailed and expensive IV and V assessments.
Author
Block Diagrams; Computer Programming; Hypotheses; Phase Diagrams

20040034831 Lawrence Livermore National Lab., Livermore, CA
Comparison of AMOS Computer Code Wakefield Real Part Impedances with Analytic Results
Mayhall, D. J.; Nelson, S. D.; Nov. 30, 2000; 18 pp.; In English
Report No.(s): DE2003-15005385; UCRL-ID-141698; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Impedance; Computer Programs

20040035598 Texas Univ., El Paso, TX, USA
A Predictive Safety Management System Software Package Based on the Continuous Hazard Tracking and Failure Prediction Methodology
Quintana, Rolando; November 30, 2003; 217 pp.; In English
Contract(s)/Grant(s): NAG10-331; No Copyright; Avail: CASI; A10, Hardcopy

The goal of this research was to integrate a previously validated and reliable safety model, called Continuous Hazard Tracking and Failure Prediction Methodology (CHTFPM), into a software application. This led to the development of a safety management information system (PSMIS). This means that the theory or principles of the CHTFPM were incorporated in a software package; hence, the PSMIS is referred to as CHTFPM management information system (CHTFPM MIS). The purpose of the PSMIS is to reduce the time and manpower required to perform predictive studies as well as to facilitate the handling of enormous quantities of information in this type of studies. The CHTFPM theory encompasses the philosophy of looking at the concept of safety engineering from a new perspective: from a proactive, than a reactive, viewpoint. That is, corrective measures are taken before a problem instead of after it happened. That is why the CHTFPM is a predictive safety because it foresees or anticipates accidents, system failures and unacceptable risks; therefore, corrective action can be taken in order to prevent all these unwanted issues. Consequently, safety and reliability of systems or processes can be further improved by taking proactive and timely corrective actions.
Author
Applications Programs (Computers); Management Information Systems; Failure Analysis; Safety Management; Prediction Analysis Techniques

20040035633 Defence Science and Technology Organisation, Edinburgh, Australia
Simulation of Voice over IP for the Battlespace Communications System (Land)
Grivell, Ian; Chau, Raymee; August 2003; 28 pp.; In English; Original contains black and white illustrations
Report No.(s): DSTO-TR-1486; DODA-AR-012-882; No Copyright; Avail: Other Sources

Project JP2072 aims to enhance communications in the land environment, providing more capacity for computer data traffic. One potential option is an Internet Protocol-based network carrying both voice and data. An important consideration

for a converged network is whether or not acceptable voice services can be supported given the additional data traffic load. This report describes a method to estimate the quality of Voice over IP calls in the presence of other network traffic, based on the ITU E-Model. Required inputs to the E-Model are determined from a computer simulation of the network. We illustrate the application of the model to a reference Parakeet network. Two companion reports present corresponding simulations of ATM-based solutions, which, together with the simulation described in this report, will enable an evaluation of the options proposed for project Jr2072.
Author
Computerized Simulation; Voice; Telecommunication

20040035637 NASA Marshall Space Flight Center, Huntsville, AL, USA
Automated Code Standard Checker 2002
Trevino, Luis; [2002]; 1 pp.; In English; Office of Safety and Mission Assurance Software Assurance Symposium, 4-6 Sep. 2002, Berkeley Springs, WV, USA
Contract(s)/Grant(s): CSIP02-05; No Copyright; Avail: Other Sources; Abstract Only

Coding standards are typically levied on flight software in order to help ensure that the code is testable, maintainable, and modifiable. Visually checking software source against a set of coding standards is time consuming and may be prone to error. Software inspection is typically costly and may require large amounts of highly skilled labor. The objective of this center initiative is to develop an automated method to ensure that mission critical software follows the required coding practices and standards.
Author
Applications Programs (Computers); Coding; Inspection

20040035648 Turboinstitut, Ljubljana, Slovenia
Evaluation of a Computer Vision System for Process Control and Monitoring by Simultaneous Measurements of Velocity Fluctuations and Smoke Tracer Fluctuations of a Bluff Body Wake
Novak, M.; Sirok, B.; Philpott, D. R.; Hocevar, M.; Bullen, P. R.; International Journal of COMADEM; April 2003; Volume 6, No. 2, pp. 19-26; In English
Contract(s)/Grant(s): CEC-IC15-CT96-0700
Report No.(s): ISSN 1363-7681; Copyright; Avail: Other Sources

A computer-aided visualization method that enables simultaneous quantitative analysis of visual processes was evaluated against hot-film velocity measureiiicnts in the wake of a bluff body.Cross correlation between the two methods at different wake positions showed the expected oscillatory form and correlation was deteriorated near the wake centre line. This corresponded with a poorer performance in the visualisation method in the prediction of the espected power law relationship in the inertial sub range of the turbulent power spectnini. This is not fully understood but may be connected with light attenuation caused by smoke tracer particles situated between the illuminated section of the flow and the camera.
Derived from text
Wakes; Computer Vision; Bluff Bodies

20040035671 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evolution of the Systems Engineering Education Development (SEED) Program at NASA Goddard Space Flight Center
Bagg, Thomas C., III; Brumfield, Mark D.; Jamison, Donald E.; Granata, Raymond L.; Casey, Carolyn A.; Heller, Stuart; [2003]; 11 pp.; In English; Fourteenth Annual International Symposium of the International Council on Systems Engineering, 20-24 Jun. 2004; Copyright; Avail: CASI; A03, Hardcopy

The Systems Engineering Education Development (SEED) Program at NASA Goddard Space Flight Center develops systems engineers from existing discipline engineers. The program has evolved significantly since the report to INCOSE in 2003. This paper describes the SEED Program as it is now, outlines the changes over the last year, discusses current status and results, and shows the value of human systems and leadership skills for practicing systems engineers.
Author
Product Development; Systems Engineering; Computer Programs

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040035696 Nippon Telegraph and Telephone Public Corp., Japan
Technical Improvements in Photonic Networks for Constructing Next-generation Networks
Shimano, Katsuhiro; Takahashi, Tetsuo; Koga, Masafumi; Takigawa, Yoshihiro; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 12-23; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

A massive infrastructure for IP networks should be developed to handle the rapid increase in Internet traffic. This requires interworking technologies between IP routers and the underlying transport equipment, so photonic networking technologies urgently need to be improved. This paper describes optical switching technologies for flexibly changing optical connections, control technologies for photonic networks such as ASON (automatic switched optical network) and GMPLS (generalized multi protocol label switching) to improve connection control, and new restoration techniques to enhance network robustness. It also introduces research on optical burst switching to enable fast connection control for dynamic traffic engineering.
Author
Optical Switching; Internets; Control Systems Design; Optical Control

20040035702 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Fulltime-wear Interface Technology
Fukumoto, Masaaki; Sugimura, Toshiaki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 77-81; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

'Wearable interface devices' are the key to realizing a wearable computer. However, it is difficult to achieve both usability (ease of use) and wearability by simply miniaturizing conventional interface devices such as the keyboard and mouse. We reconsider interface mechanisms on the premise of 'worn on the body for constant availability (= fulltime-wear)' and introduce a few examples of implementations that we have been working on.
Author
Interfaces; Miniaturization; Wear; Computers

20040035703 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Ubiquitous Interface Technologies
Ohta, Ken; Isoda, Yoshinori; Kurakake, Shoji; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 89-94; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

This article introduces a mobile adaptive terminal architecture as an interface for flexible use of various network resources, such as devices and wireless access measures in ubiquitous environments, without troublesome settings or operations by users or applications. It aims to provide seamless services that adapt autonomously to the user's movements and changes in the state of resources.
Author
Architecture (Computers); Interfaces; Computer Networks; Applications Programs (Computers)

20040035705 Nippon Telegraph and Telephone Public Corp., Tsukuba Science City, Japan
Trend of Standardizing xDSL Technologies in ITU-T
Fujikawa, Shuichi; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 101-103; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

Various digital subscriber line (xDSL) technologies that allow high-speed data transmission over metallic pair cable are being discussed for standardization in International Telecommunication Union Telecommunication Standardization Sector (ITU-T) Study Group 15 (SG15) Working Party 1 (WP1) Question 4 (Q4). This article reports the results and future issues for ADSL and VDSL, upon which NTT's FLET'S-ADSL and B-FLET'S services are based, from among items on the agenda of the January 2003 meeting.
Author
Data Transmission; High Speed; Telecommunication

20040035706 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Platform Technology for Ubiquitous Services
Iso, Toshiki; Isoda, Yoshinori; Otsuji, Kiyotaka; Suzuki, Hiroki; Kurakake, Shoji; Sugimura, Toshiaki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 82-88; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

This article introduces platform technology that i) makes it easy for users to access the services they want among numerous services available everywhere in a ubiquitous environment and ii) uses a sensor network to ascertain a user's context when the user accesses a service and allows the service to be used in the most convenient way.
Author
Technology Utilization; Human-Computer Interface

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20040031674 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Introduction to Modeling and Simulation of Dynamic Systems
daCunhaTrivelato, Gilberto; 2003; 23 pp.; In Portuguese
Report No.(s): INPE-9665-NTC/358; Copyright; Avail: Other Sources

This technical note presents an introduction to modeling and simulation of dynamic systems, with their basic concepts and definitions. It presents breiefly: 1) an introduction to modeling and simulation; 2) physical models using similarity, scaling and dimensional analysis; 3) mathematical models of known systems classifieds by the types: linear or nonlinear, lumped or distributed; stationary (time invariant) or nonstationary (time variant); deterministic or random; driven by events or by time; continuous in time or sampled/discrete in time; and by representation forms; equations, tables or graphics, 4) logical models with Boolean algebras, tables, graphics and state flows; 5) computational models; 6) model of real and unknown systems; 7) simulation methodology including physical simulation, analog simulation or digital simulation; 8) HLA architecture and military simulation models including live simulation, virtual simulation and constructive model or simulation.
Author
Dynamical Systems; Mathematical Models; Architecture (Computers); Digital Simulation

20040031757 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Determination of Mercury Content in a Shallow Firn Core from Summit, Greenland by Isotope Dilution Inductively Coupled Plasma Mass Spectrometry
Mann, Jacqueline L.; Long, Stephen E.; Shuman, Christopher A.; Kelly, W. Robert; [2003]; 25 pp.; In English
Contract(s)/Grant(s): EPA-U915356; WBS 51-622-83-72; No Copyright; Avail: CASI; A03, Hardcopy

The total mercury Hg content was determined in 6 cm sections of a near-surface 7 m firn core and in surrounding surface snow from Summit, Greenland (elevation: 3238 m, 72.58 N, 38.53 W) in May 2001 by isotope dilution cold-vapor inductively coupled plasma mass spectrometry (ID-CV-ICP-MS). The focus of this research was to evaluate the capability of the ID-CV-ICPMS technique for measuring trace levels of Hg typical of polar snow and firn. Highly enriched Hg-201 isotopic spike is added to approximately 10 ml melted core and thoroughly mixed. The Hg(+2) in the sample is reduced on line with tin (II) chloride (SnCl2) and the elemental Hg (Hg(0)) vapor pre-concentrated on to gold gauze using a commercial amalgam system. The Hg is then thermally desorbed and introduced into a quadrupole ICP-MS. The blank corrected Hg concentrations determined for all samples ranged from 0.25 ng/L to 1.74 ng/L (ppt) (average 0.59 ng/L plus or minus 0.28 ng/L) and fall within the range of those previously determined by Boutron et al., 1998 (less than or equal to 0.05 ng/L to 2.0 ng/L) for the Summit site. The average blank value was 0.19 ng/L plus or minus 0.045 ng/L (n=6). The Hg values specifically for the firn core range from 0.25 ng/L to 0.87 ng/L (average 0.51 ng/L plus or minus 0.13 ng/L) and show both values declining with time and larger variability in concentration in the top 1.8 m.
Author
Inductively Coupled Plasma Mass Spectrometry; Mercury (Metal); Trace Elements; Mercury Isotopes; Greenland; Dilution

20040031851 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Using Neural Networks to Describe Tracer Correlations
Lary, D. J.; Mueller, M. D.; Mussa, H. Y.; Atmospheric Chemistry and Physics Discussions; [2003]; Volume 3, pp. 1-14; In English; Copyright; Avail: CASI; A02, Hardcopy

Neural networks are ideally suited to describe the spatial and temporal dependence of tracer-tracer correlations. The neural network performs well even in regions where the correlations are less compact and normally a family of correlation curves would be required. For example, the CH4-N2O correlation can be well described using a neural network trained with the latitude, pressure, time of year, and CH4 volume mixing ratio (v.m.r.). In this study a neural network using Quickprop learning and one hidden layer with eight nodes was able to reproduce the CH4-N2O correlation with a correlation co- efficient of 0.9995. Such an accurate representation of tracer-tracer correlations allows more use to be made of long-term datasets to constrain chemical models. Such as the dataset from the Halogen Occultation Experiment (HALOE) which has continuously observed CH4, (but not N2O) from 1991 till the present. The neural network Fortran code used is available for download.
Author
Neural Nets; Atmospheric Chemistry

20040035649 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Software Requirements Analysis as Fault Predictor
Wallace, Dolores; [2003]; 1 pp.; In English
Contract(s)/Grant(s): CI2003-577; No Copyright; Avail: Other Sources; Abstract Only

Waiting until the integration and system test phase to discover errors leads to more costly rework than resolving those same errors earlier in the lifecycle. Costs increase even more significantly once a software system has become operational. WE can assess the quality of system requirements, but do little to correlate this information either to system assurance activities or long-term reliability projections - both of which remain unclear and anecdotal. Extending earlier work on requirements accomplished by the ARM tool, measuring requirements quality information against code complexity and test data for the same system may be used to predict specific software modules containing high impact or deeply embedded faults now escaping in operational systems. Such knowledge would lead to more effective and efficient test programs. It may enable insight into whether a program should be maintained or started over.
Author
Computer Programming; Software Engineering; Reliability Engineering; System Failures

20040035686 Institute of Space Medico-Engineering, Beijing, China
Effects of Field Viewing Angles on Object Judgement in Virtual Environment
Zhou, Qian-Xiang; Jiang, Guo-Hua; Qu, Zhan-Shen; Zhu, Yan-Jun; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 292-295; In Chinese; See also 20040035673; Copyright; Avail: Other Sources

To investigate the effect of viewing angle on human judgement reliability for objects in virtual environment is presented. Firstly, pre-tests were done with the PC virtual reality ergonomic system to determine difference among observed object and valus of viewing angle. Then, one factor, 4-levels full random experiments were done with 45 health human subjects (male and female nearly 1:1). It was shown that the reliability of human judgement was significantly influenced by the setting of the viewing angle of virtual environment, and the object judgement including size and angle judgement was the best when the viewing angle virtual environment was 60 degrees. When virtual reality was used in ergonomic design, operation training and other related research, the effect of field viewing angle should be taken into consideration, and 60 degrees recommended to be optimal for human judgment task.
Derived from text
Virtual Reality; Field of View; Human Factors Engineering; Artificial Intelligence

20040035701 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Alter-Ego Interface Technology
Hiraiwa, Akira; Hayashi, Kouki; Manabe, Hiroyuki; Sugimura, Toshiaki; NTT Technical Review, Volume 1, No. 8; November 2003, pp. 72-76; In English; See also 20040035694; Original contains black and white illustrations; Copyright; Avail: Other Sources

A communication style in which robots serve as alter egos to represent our own bodies in distant locations is being considered for future wireless network services. As a step in that direction, research is under way on telerobots that execute commands sent from an operating interface such as cell phones and humanoid robots that convey human gestures and facial

expression according to signals from human bodies. Here we describe a human interface for these alter-ego robots and a new communication style that is made possible by such humanoid robot mediators.
Author
Robots; Telecommunication; Interfaces; Wireless Communication

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040031727 Stanford Univ., Stanford, CA, USA
Testing of RANS Turbulence Models for Stratified Flows Based on DNS Data
Venayagamoorthy, S. K.; Koseff, J. R.; Ferziger, J. H.; Shih, L. H.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 127-138; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

In most geophysical flows, turbulence occurs at the smallest scales and one of the two most important additional physical phenomena to account for is strati cation (the other being rotation). In this paper, the main objective is to investigate proposed changes to RANS turbulence models which include the effects of stratifi- cation more explicitly. These proposed changes were developed using a DNS database on strati ed and sheared homogenous turbulence developed by Shih et al. (2000) and are described more fully in Ferziger et al. (2003). The data generated by Shih, et al. (2000) (hereinafter referred to as SKFR) are used to study the parameters in the k- model as a function of the turbulent Froude number, Frk. A modified version of the standard k- model based on the local turbulent Froude number is proposed. The proposed model is applied to a stratified open channel flow, a test case that differs significantly from the flows from which the modified parameters were derived. The turbulence modeling and results are discussed in the next two sections followed by suggestions for future work.
Author
Turbulence Models; Stratified Flow

20040033380 Mississippi State Univ., Mississippi State, MS, USA
Unstructured Unsteady Flow Solver Applicable to MSU TURBO and Computational Design
Newman, James C., III; Sheng, Chun-Hua; February 2004; 22 pp.; In English
Contract(s)/Grant(s): NAG3-2829; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents numerical simulations for a high-speed transonic compressor rotor, NASA Rotor 35, using an unstructured grid flow solver U2NCLE. It solves Reynolds averaged Navier-Stokes equations using an arbitrary Mach number solution algorithm. Experiments were conducted at the NASA Glen Research Center to investigate compressor stability enhancement using steady and discrete tip injections. The mass injection upstream of the tip of a high- speed axial compressor rotor has shown effectiveness in suppressing stall in tip-critical rotors. This work presents numerical simulations of a high-speed compressor rotor with and without tip injections. Methods to model the flow injection are described. Numerical simulations are conducted at 80 and 100 percent of the design speed. Results show that numerical solutions are consistent with the experimental trends.
Author
Numerical Analysis; Rotors; Injection; Unstructured Grids (Mathematics); Turbocompressors

20040034016 NASA Marshall Space Flight Center, Huntsville, AL, USA
Comparison of Structural Optimization Techniques for a Nuclear Electric Space Vehicle
Benford, Andrew; [2003]; 7 pp.; In English; Space Technoloy and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA
Contract(s)/Grant(s): 090-50-EB; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this paper is to utilize the optimization method of genetic algorithms (GA) for truss design on a nuclear propulsion vehicle. Genetic Algorithms are a guided, random search that mirrors Darwin s theory of natural selection and survival of the fittest. To verify the GA s capabilities, other traditional optimization methods were used to compare the results obtained by the GA's, first on simple 2-D structures, and eventually on full-scale 3-D truss designs.
Author
Nuclear Propulsion; Genetic Algorithms; Electric Motor Vehicles; Structural Analysis

20040034029 NASA Marshall Space Flight Center, Huntsville, AL, USA

Numerical Modeling of Pulse Detonation Rocket Engine Gasdynamics And Performance

Morris, Christopher I.; January 21, 2004; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Pulse detonation rocket engines (PDREs) offer potential performance improvements over conventional designs, but represent a challenging modeling task. A quasi-1-D, finite-rate chemistry computational fluid dynamics model for PDREs is described and implemented. Four different PDRE geometries are evaluated in this work: a baseline detonation tube, a detonation tube with a straight extension, and a detonation tube with two types of converging-diverging (C-D) nozzles. The effect of extension length and C-D nozzle area ratio on the single-shot gasdynamics and performance of a PDRE is studied over a wide range of blowdown pressure ratios (1-1000). The results indicate that a C-D nozzle is generally more effective than a straight extension in improving PDRE performance, particularly at higher pressure ratios. Additionally, the results show that the blowdown process of the C-D nozzle systems could be beneficially cut off well before the pressure at the end-wall reaches the ambient value. The performance results are also compared to a steady-state rocket system using similar modeling assumptions.

Author

Mathematical Models; Pulse Detonation Engines; Computational Fluid Dynamics; Gas Dynamics

20040034198 NASA Glenn Research Center, Cleveland, OH, USA

Control of Initialized Fractional-Order Systems

Hartley, Tom T.; Lorenzo, Carl F.; March 04, 2004; 1 pp.; In English

Contract(s)/Grant(s): NCC3-526; No Copyright; Avail: Other Sources; Abstract Only

Fractional-Order systems, or systems containing fractional derivatives and integrals, have been studied by many in the engineering area. Additionally, very readable discussions, devoted specifically to the subject, are presented by Oldham and Spanier, Miller and Ross, and Pudlubny (1999a). It should be noted that there are a growing number of physical systems whose behavior can be compactly described using fractional system theory. Of specific interest to electrical engineers are long lines, electrochemical processes, dielectric polarization, colored noise, viscoelastic materials, and chaos. With the growing number of applications, it is important to establish a theory of control for these fractional-order systems, and for the potential use of fractional-order systems as feedback compensators. This topic is addressed in this paper. The first section discusses the control of fractional-order systems using a vector space representation, where initialization is included in the discussion. It should be noted that Bagley and Calico and Padovan and Sawicki both present a fractional state-space representation, which do not include the important historic effects. Incorporation of these effects based on the initialized fractional calculus is presented . The control methods presented in this paper are based on the initialized fractional order system theory. The second section presents an input-output approach. Some of the problems encountered in these sections are: a) the need to introduce a new complex plane to study the dynamics of fractional-order systems, b) the need to properly define the Laplace transform of the fractional derivative, and c) the proper inclusion of the initialization response in the system and control formulation. Following this, the next section generalizes the proportional-plus-integral-control (PI-control) and PID-control (PI-plus- derivative) concepts using fractional integrals. This is then further generalized using general fractional- order compensators. Finally the compensator concept is generalized by the use of a continuum of fractions in the compensator via the concept of order-distributions. The last section introduces fractional feedback in discrete-time.

Derived from text

Calculus; Derivation; Dielectric Polarization; Integrals; Proportional Control; Systems Analysis

20040035685 University of Science and Technology, Hefei, China

Volume Rendering Based on Sorted Volumetric Data

Zhuge, Bin; Feng, Huan-Qing; Zhou, He-Qin; Space Medicine and Medical Engineering, Volume 16, No. 4; August 2003, pp. 243-247; In English; See also 20040035673

Contract(s)/Grant(s): ANSF-01042202; Copyright; Avail: Other Sources

Objective: To describe a spatial structure which speeds up the volume rendering and will not affect image quality. Method: Before volume rendering we transfer each slice of volume into an array indexed by the value of voxels, element in which stores the position of each vox- el. According to the opacity transfer function, we can affirm the value ranges of voxels that are non-transpar- ent. Therefore we translate, resample and composite only the voxels in the value ranges. By marching through the sorted arrays, we locate the non-transparent voxels rapidly and skip all voxels that are transparent. The sorted data structures need not recompute whenever the opacity transfer function changes and are not restricted on the opacity transfer function. Result The method presented in this paper has been implemented in a stand- ard personal computer. The rendering time for CT head volume data is less than 1 s that is satisfied with the diagnostic purpose. Conclusion The concept of proposed

algorithm is simple, easy to realize and it is not re- computed whenever the opacity transfer function changes. By using the sorted volumetric data structure, we speed up the volume rendering without affecting image quality.
Author
Data Structures; Computer Aided Tomography; Algorithms

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040031720 Stanford Univ., Stanford, CA, USA
Stochastic Mixing Model with Power Law Decay of Variance
Fedotov, S.; Ihme, M.; Pitsch, H.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 285-296; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

Here we present a simple stochastic mixing model based on the law of large numbers (LLN). The reason why the LLN is involved in our formulation of the mixing problem is that the random conserved scalar c = c(t,x(t)) appears to behave as a sample mean. It converges to the mean value mu, while the variance sigma(sup 2)(sub c) (t) decays approximately as t(exp -1). Since the variance of the scalar decays faster than a sample mean (typically is greater than unity), we will introduce some non-linear modifications into the corresponding PDF-equation. The main idea is to develop a robust model which is independent from restrictive assumptions about the shape of the PDF. The remainder of this paper is organized as follows. In Section 2 we derive the integral equation from a stochastic difference equation describing the evolution of the PDF of a passive scalar in time. The stochastic difference equation introduces an exchange rate gamma(sub n) which we model in a first step as a deterministic function. In a second step, we generalize gamma(sub n) as a stochastic variable taking fluctuations in the inhomogeneous environment into account. In Section 3 we solve the non-linear integral equation numerically and analyze the influence of the different parameters on the decay rate. The paper finishes with a conclusion.
Author (revised)
Stochastic Processes; Mixing; Decay; Variance (Statistics)

20040031803 Hampton Univ., VA, USA
Statistical Methods for Rapid Aerothermal Analysis and Design Technology: Validation
DePriest, Douglas; Morgan, Carolyn; December 31, 2003; 13 pp.; In English
Contract(s)/Grant(s): NAG1-02030; No Copyright; Avail: CASI; A03, Hardcopy

The cost and safety goals for NASA s next generation of reusable launch vehicle (RLV) will require that rapid high-fidelity aerothermodynamic design tools be used early in the design cycle. To meet these requirements, it is desirable to identify adequate statistical models that quantify and improve the accuracy, extend the applicability, and enable combined analyses using existing prediction tools. The initial research work focused on establishing suitable candidate models for these purposes. The second phase is focused on assessing the performance of these models to accurately predict the heat rate for a given candidate data set. This validation work compared models and methods that may be useful in predicting the heat rate.
Author
Aerothermodynamics; Design to Cost; Predictions; Thermal Analysis; Statistical Analysis

20040034041 NASA Goddard Inst. for Space Studies, New York, NY, USA
Vector Radiative Transfer Equation for Arbitrarily Shaped and Arbitrarily Oriented Particles: A Microphysical Derivation from Statistical Electromagnetics
Mishchenko, Michael I.; [2003]; 1 pp.; In English; 7th Conference on Electromagnetic and Light Scattering by Nonspherical Particles, 8-12 Sep. 2003, Bremen, Germany; No Copyright; Avail: Other Sources; Abstract Only

We use the concepts of statistical electromagnetics to derive the general radiative transfer equation (RTE) describing multiple scattering of polarized light by sparse discrete random media consisting of arbitrarily shaped and arbitrarily oriented particles. The derivation starts from the volume integral and Lippmann-Schwinger equations for the electric field scattered by a fixed N-particle system and proceeds to the vector form of the Foldy-Lax equations and their approximate far-field version. We then assume that particle positions are completely random and derive the vector RTE by applying the Twersky approximation to the coherent electric field and the Twersky and ladder approximations to the coherency dyad of the diffuse

field in the limit N -> infinity. The concluding section discusses the physical meaning of the quantities entering the general vector RTE and the assumptions made in its derivation.
Author
Electromagnetism; Radiative Transfer; Particles; Statistical Analysis; Vectors (Mathematics)

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040031647 Physics and Electronics Lab. TNO, The Hague, Netherlands
Report Study (V)SHORADS JPG 28/30 on Modularity in Air Defence
vanderVeen, E. M.; Bardelmeijer, C. J.; October 2002; 52 pp.; In English
Contract(s)/Grant(s): A98/KL/683; TNO Proj. 015.27331
Report No.(s): TD-2001-0291; FEL-02-A261; Copyright; Avail: Other Sources

The report provides a description of the concept of modularity, applied to short-range ground based air defence systems. The report contains an analysis of advantages and disadvantages, and includes cost issues.
Author
Air Defense; Modularity

20040031682 Defence Science and Technology Organisation, Edinburgh, Australia
Optimal Search, Location and Tracking of Surface Maritime Targets by a Constellation of Surveillance Satellites
Berry, Paul E.; Pontecorvo, Carmine; Fogg, David A. B.; August 2003; 62 pp.; In English
Report No.(s): DSTO-TR-1480; DODA-AR-012-869; Copyright; Avail: Other Sources

The issues associated with the maximal exploitation of space-based surveillance resources are unique due to the nature of the platforms, their sensors and intermittent communications links to the ground station for target information processing and sensor tasking. This report applies the GAMBIT formalism to the networked sensor decision problem of determining the optimal allocation of space-based surveillance resources for the purpose of detecting, locating and tracking surface maritime targets. As well as being an issue of interest in its own right, this application is an instance of the more general surveillance asset allocation problem.
Author
Space Surveillance (Spaceborne); Systems Integration; Optimization; Decision Making; Resource Allocation

20040034200 Ohio Aerospace Inst., Cleveland, OH, USA
Environment of Space Interactions with Space Systems
[2004]; 4 pp.; In English
Contract(s)/Grant(s): NCC3-801; No Copyright; Avail: CASI; A01, Hardcopy

The primary product of this research project was a computer program named SAVANT. This program uses the Displacement Damage Dose (DDD) method of calculating radiation damage to solar cells. This calculation method was developed at the Naval Research Laboratory, and uses fundamental physical properties of the solar cell materials to predict radiation damage to the solar cells. This means that fewer experimental measurements are required to characterize the radiation damage to the cells, which results in a substantial cost savings to qualify solar cells for orbital missions. In addition, the DDD method makes it easier to characterize cells that are already being used, but have not been fully tested using the older technique of characterizing radiation damage. The computer program combines an orbit generator with NASA's AP-8 and AE-8 models of trapped protons and electrons. This allows the user to specify an orbit, and the program will calculate how the spacecraft moves during the mission, and the radiation environment that it encounters. With the spectrum of the particles, the program calculates how they would slow down while traversing the coverglass, and provides a slowed-down spectrum.
Derived from text
Computer Programs; Radiation Damage; Solar Cells; Aerospace Systems

20040034228 Lawrence Livermore National Lab., Livermore, CA
Creating Ensembles of Decision Trees through Sampling
Kamath, C.; Cantu-Paz, E.; Feb. 02, 2001; 12 pp.; In English
Report No.(s): DE2003-15005459; UCRL-JC-142268; No Copyright; Avail: Department of Energy Information Bridge

Recent work in classification indicates that significant improvements in accuracy can be obtained by growing an ensemble of classifiers and having them vote for the most popular class. This paper focuses on ensembles of decision trees that are created with a randomized procedure based on sampling. Randomization can be introduced by using random samples of the training data (as in bagging or arcing) and running a conventional tree-building algorithm, or by randomizing the induction algorithm itself. The objective of this paper is to describe our first experiences with a novel randomized tree induction method that uses a subset of samples at a node to determine the split. Our empirical results show that ensembles generated using this approach yield results that are competitive in accuracy and superior in computational cost.
NTIS
Decision Theory; Random Sampling; Trees (Mathematics); Algorithms

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040031651 Syracuse Univ., NY, USA
Infinitely Many Asymptotic Values of Locally Univalent Meromorphic Functions
Barth, Karl F.; Rippon, Philip J.; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 303-314; In English; Copyright; Avail: Other Sources

McMillan and Pommerenke showed that a locally univalent meromorphic function f in the disc, without Koebe arcs, has at least three asymptotic values in each boundary arc. The modular function shows that the number three is best possible. We show that if f satisfies certain further conditions, each of which narrowly excludes the modular function, then the number of asymptotic values in each boundary arc must be infinite.
Author
Meromorphic Functions; Theorem Proving

20040031655 Tokyo Inst. of Tech., Tokyo, Japan
On a Distance Defined By the Length Spectrum on Teichmueller Space
Shiga, Hiroshige; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 315-326; In English; Copyright; Avail: Other Sources

We consider a distance dL on the Teichmiiller space T(So) of a hyperbolic Riemann surface So. The distance is defined by the length spectrum of Riemann surfaces in ’(So) and we call it the length spectrum metric on T(So). It is known that the distance dL determines the same topology as that of the Teichmiiller metric if So is a topologically finite Riemann surface. In this paper we show that there exists a Riemann surface So of infinite type such that the length spectrum distance d L on ‘(So) does not define the same topology as that of the Teichmiiller distance. Also, we give a sufficient condition for these distances to have the same topology on T(So).
Author
Topology; Riemann Manifold

20040031656 International Univ. Bremen, Bremen, Germany
Periodic Points and Dynamic Rays of Exponential Maps
Schleicher, Dierk; Zimmer, Johannes; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 327-354; In English; Copyright; Avail: Other Sources

We investigate the dynamics of exponential maps; the goal is a description by means of dynamic rays. We discuss landing properties of dynamic rays and show that in many important cases, repelling and parabolic periodic points are landing points of periodic dynamic rays. For postsingularly finite exponential maps, we use spider theory to show that a dynamic ray lands at the singular value.
Author
Iterative Solution; Theorems

20040034137 Volgograd State Univ., USSR

Geometric Structure of Tubes and Bands of Zero Mean Curvature in Minkowski Space

Klyachin, V. A.; Miklyukov, V. M.; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 239-270; In English; Copyright; Avail: Other Sources

Spacelike and timelike tubes and bands of zero mean curvature in Minkowski space are investigated in a neighborhood of finite or infinite singularities. We also study the correlation between the branching of surfaces and their exterior amounts, and questions of the smooth pasting of spacelike and timelike tubes and bands. We give an asymptotic representation of the surfaces in the neighborhood of the singular point.

Author

Minkowski Space; Curvature

20040034167 Helsinki Univ., Helsinki, Finland

The Apollonian Metric: Uniformity and Quasiconvexity

Hasto, Peter A.; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 385-414; In English; Copyright; Avail: Other Sources

In this paper we examine implications of a mapping being bilipschitz with re- spect to the Apollonian metric. The main results are improvements of results by Gehring and Hag which aim at describing Apollonian isometries. We also derive results on quasi-isotropy and quasiconvexity of the Apollonian metric.

Author

Theorem Proving; Spheres

20040034172 Scuola Normale Superiore, Pisa, Italy

A Generalised Conical Density Theorem for Unrectifiable Sets

Lorent, Andrew; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 415-431; In English; Copyright; Avail: Other Sources

We provide a strengthening of an elementary technique in geometric measure theory. Given an s-set S C R , in the language of tangent measures, this technique establishes the existence of tangent measures to the measure His on one side of an (n - 1)-plane. If S is purely unrectifiable or of dimension less than n - 1, our strengthening consists of being able to find tangent measures on one side of an (n - 1)-plane containing a vector of our choice. We give an application of this result to the problem of characterising removable sets for harmonic functions.

Author

Tangents; Theorem Proving; Cones

20040034173 Helsinki Univ. of Technology, Helsinki, Finland

Potential Theory of Quasiminimizers

Kinnunen, Juha; Martio, Olli; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 459-490; In English; Copyright; Avail: Other Sources

We study nonlinear potential theory related to quasiminimizers on a metric measure space equipped with a doubling measure and supporting a Poincare inequality. Our objective is to show that quasiminimizers create an interesting potential theory with new features although from the potential theoretic point of view they have several drawbacks: They do not provide a unique solution to the Dirichlet problem, they do not obey the comparison principle and they do not form a sheaf. However, many potential theoretic concepts such as harmonic functions, superharmonic functions and the Poisson modification have their counterparts in the theory of quasiminimizers and, in particular, we are interested in questions related to regularity, convergence and polar sets.

Author

Metric Space; Potential Theory

20040034175 Copenhagen Univ., Denmark

Finite Energy Maps from Riemannian Polyhedra to Metric Spaces

Fuglede, Bent; Annales Academiae Scientiarum Fennicae: Mathematica; 2003; ISSN 1239-629X; Volume 28, No. 2, pp. 433-458; In English; Copyright; Avail: Other Sources

It is shown that every map of finite energy in the sense of Korevaar and Schoen into a complete metric space Y (not necessarily locally compact) is quasicontinuous, the domain space being an admissible Riemannian polyhedron. Assuming that

Y is a geodesic space of up- per bounded Alexandrov curvature, two inequalities are obtained for the energy of certain maps associated with a given pair of maps. One of these inequalities is due to T. Serbinowski (unpublished) and applied to establish existence and uniqueness of the solution to the variational Dirichlet problem for harmonic maps into Y.
Author
Inequalities; Metric Space; Polyhedrons

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20040031604 Lawrence Livermore National Lab., Livermore, CA
Contribution of Neutron Beta Decay to Radiation Belt Pumping from High Altitude Nuclear Explosions
Mars, R. E.; Nov. 13, 2002; 30 pp.; In English
Report No.(s): DE2003-15004871; UCRL-ID-151402; No Copyright; Avail: Department of Energy Information Bridge
This report presents the results of a calculation of the contribution of neutron beta decay to artificial belt pumping.
NTIS
Nuclear Explosions; Radiation Belts; Neutrons; Radioactive Decay; Beta Particles

20040031614 Lawrence Livermore National Lab., Livermore, CA
RIA Fragmentation Line Beam Dumps
Stein, W.; Aug. 08, 2003; 12 pp.; In English
Report No.(s): DE2003-15004880; UCRL-JC-153085-R1; No Copyright; Avail: Department of Energy Information Bridge
The Rare Isotope Accelerator project involves generating heavy-element ion beams for use in a fragmentation target line to produce beams for physics research. The main beam, after passing through the fragmentation target, may be dumped into a beam dump located in the vacuum cavity of the first dipole magnet. For a dump beam power of 100 kW, cooling is required to avoid excessive high temperatures. The proposed dump design involves rotating cylinders to spread out the energy deposition and turbulent subcooled water flow through internal water cooling passages to obtain high, nonboiling, cooling rates.
NTIS
Fragmentation; Ion Beams; Heavy Elements; Energy Transfer

20040031617 Lawrence Livermore National Lab., Livermore, CA
Fast Tuner R&D for RIA
Rusnak, B.; Shen, S.; Aug. 19, 2003; 12 pp.; In English
Report No.(s): DE2003-15004884; UCRL-JC-155119; No Copyright; Avail: Department of Energy Information Bridge
The limited cavity beam loading conditions anticipated for the Rare Isotope Accelerator (RIA) create a situation where microphonic-induced cavity detuning dominates radio frequency (RF) coupling and RF system architecture choices in the linac design process. Where most superconducting electron and proton linacs have beam-loaded bandwidths that are comparable to or greater than typical microphonic detuning bandwidths on the cavities, the beam-loaded bandwidths for many heavy-ion species in the RIA driver linac can be as much as a factor of 10 less than the projected 80-150 Hz microphonic control window for the RF structures along the driver, making RF control problematic. System studies indicate that for the low-(beta) driver linac alone, running the cavities with no fast tuner may cost 50% or more than an RF system employing a voltage controlled reactance (VCX) or other type of fast tuner. An update of these system cost studies, along with the status of the VCX work being done at Lawrence Livermore National Lab is presented.
NTIS
Linear Accelerators; Electromagnetic Coupling; Superconductivity; Radio Frequencies

20040031664 Lawrence Livermore National Lab., Livermore, CA
Positronium in SOlids: Computer Simulation of Pick-Off and Self-Annihilation
Bug, A. L. R.; Muluneh, M.; Waldman, J.; Sterne, P. A.; Aug. 01, 2003; 12 pp.; In English
Report No.(s): DE2003-15005180; UCRL-CONF-155634; No Copyright; Avail: Department of Energy Information Bridge

Positronium (Ps) is simulated using Path Integral Monte Carlo (PIMC). This method can reproduce the results of previous simple theories in which a single quantum particle is used to represent Ps within an idealized pore. In addition, our calculations treat the elementary charge minus and elementary charge plus of Ps exactly and realistically model interactions with solid atoms, thereby correcting and extending the simpler theory. We study the pick-off lifetime of ortho-positroniums and the internal contact density density, which controls the self-annihilation behavior, for Ps in model voids (spherical pores), defects in a solid (argon), and microporous solids (zeolites).
NTIS
Positronium; Monte Carlo Method; Annihilation Reactions; Computerized Simulation

20040031677 Swedish Defence Research Establishment, Stockholm
Comparison of Spectral Element and Finite Difference Methods for Electromagnetic Wave Propagation over a Material Discontinuity
Sjoegren, M.; 2003; In English
Report No.(s): PB2004-101817; FOI-R-0489-SE; No Copyright; Avail: National Technical Information Service (NTIS)
In this report, Maxwell's equations are solved for the case of an electromagnetic wave propagating over a material discontinuity. The numerical calculation of the solution to the problem is performed with a high-order spectral element method on an unstructured grid as well as with a high-order finite difference method on a structured grid. The results and errors of the two computations are compared, and efficiency, long-time stability and the order of accuracy are analyzed.
NTIS
Electromagnetic Wave Transmission; Finite Difference Theory; Structured Grids (Mathematics); Unstructured Grids (Mathematics)

20040034096 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Some Experiences Regarding the Nonlinearity of Hot Wires
Betchov, R.; Welling, W.; Proceedings; June 1952; Volume LIII, No. 4, pp. 432-439; In English
Report No.(s): NACA-TM-1223; No Copyright; Avail: CASI; A03, Hardcopy
We compare here the results of some experiences with the formulas established in our preceding report 'Nonlinear Theory of a Hot-Wire Anemometer.' We shall show that the nonlinear term plays a role as important as the thermal conduction in the calculation of the thermal inertia of the hot wire.
Author
Nonlinearity; Conductive Heat Transfer; Wire; High Temperature

20040034251 Lawrence Livermore National Lab., Livermore, CA
High-Order Boundary Condition Perturbation Theory for the Neutron Transport Equation
McKinley, M. S.; Rahnema, F.; Sep. 19, 2001; 38 pp.; In English
Report No.(s): DE2003-15005373; UCRL-ID-155132; No Copyright; Avail: Department of Energy Information Bridge
First-order boundary condition perturbation theory is extended to nth-order in transport theory for eigenvalue problems. In particular, using an unperturbed (known) solution, formalisms are developed to determine the solution to the neutron transport equation when the boundary condition of the system is perturbed. The new method requires the computation of an adjoint Green's function. The numerical solution of this function is discussed. Finally, four numerical examples are provided to verify the validity of the formalisms presented.
NTIS
Boundary Conditions; Neutrons; Perturbation Theory; Transport Theory; Eigenvalues

20040034255 Lawrence Livermore National Lab., Livermore, CA
Critical Current Measurements of Large Conductors of Niobium-Titanium/Copper Cable Embedded in an Aluminum Stabilizer
Walsh, R. P.; Miller, J. R.; OConner, T. G.; Jun. 01, 1999; 10 pp.; In English
Report No.(s): DE2003-15005460; UCRL-JC-142284; No Copyright; Avail: Department of Energy Information Bridge
Insertion of a flat, Rutherford type, cable of NbTi/Cu composite strands into a rectangular profile of high purity aluminum is an established method of superconductor fabrication for certain applications. Although this processing scheme has numerous advantages it produces a composite material whose properties are difficult to predict with precision. The BABAR detector magnet currently being tested at the Stanford Linear Accelerator Center, uses high-purity aluminum stabilized superconducting

cable. The performance of the superconductor is dependent on the quality of the fabrication of the composite conductor. Here we present measurements of the critical transport current of BABAR production grade conductors up to 10 kA, and at fields up to 10 T. Data are related to production variables, compared to estimates from simple models, and evaluated with respect to design specifications.
NTIS
Aluminum; Copper; Niobium; Titanium; Stabilizers (Agents); Fabrication; Critical Current; Cables; Superconductors (Materials)

20040034258 Lawrence Livermore National Lab., Livermore, CA
Science and Technology Review: Livermore Wins Six R&D 100 Awards
Oct. 2003; 36 pp.; In English
Report No.(s): DE2003-15005461; No Copyright; Avail: Department of Energy Information Bridge
The October 2003 issue of Science & Technology Review consists of the following articles: (1) Award-Winning Technologies from Collaborative Efforts--Commentary by Hal Graboske; (2) BASIS Counters Airborne Bioterrorism--The Biological Aerosol Sentry and Information System is the first integrated biodefense system; (3) In the Chips for the Coming Decade--A new system is the first full-field lithography tool for use at extreme ultraviolet wavelengths; (4) Smoothing the Way to Print the Next Generation of Computer Chips--With ion-beam thin-film planarization, the reticles and projection optics made for extreme ultraviolet lithography are nearly defect-free; (5) Eyes Can See Clearly Now--The MEMS-based adaptive optics phoropter improves the process of measuring and correcting eyesight aberrations; (6) This Switch Takes the Heat--A thermally compensated Q-switch reduces the light leakage on high-average-power lasers; (7) Laser Process Forms Thick, Curved Metal Parts--A new process shapes parts to exact specifications, improving their resistance to fatigue and corrosion cracking; and (8) Characterizing Tiny Objects without Damaging Them--Livermore researchers are developing nondestructive techniques to probe the Lilliputian world of mesoscale objects.
NTIS
Research and Development; Technologies; Adaptive Optics; High Power Lasers

20040034261 Lawrence Livermore National Lab., Livermore, CA
Improving Tritium Exposure Reconstructions Using Accelerator Mass Spectrometry
Love, A. H.; Hunt, J. R.; Knezovich, J. P.; Jun. 2003; 22 pp.; In English
Report No.(s): DE2003-15004909; UCRL-JC-151957; No Copyright; Avail: Department of Energy Information Bridge
Exposure reconstructions for radionuclides are inherently difficult. As a result, most reconstructions are based primarily on mathematical models of environmental fate and transport. These models can have large uncertainties, as important site-specific information is unknown, missing, or crudely estimated. Alternatively, surrogate environmental measurements of exposure can be used for site-specific reconstructions. In cases where environmental transport processes are complex, well-chosen environmental surrogates can have smaller exposure uncertainty than mathematical models. Because existing methodologies have significant limitations, the development or improvement of methodologies for reconstructing exposure from environmental measurements would provide important additional tools in assessing the health effects of chronic exposure. As an example, the direct measurement of tritium atoms by accelerator mass spectrometry (AMS) enables rapid low-activity tritium measurements from milligram-sized samples, which permit greater ease of sample collection, faster throughput, and increased spatial and/or temporal resolution. Tritium AMS was previously demonstrated for a tree growing on known levels of tritiated water and for trees exposed to atmospheric releases of tritiated water vapor. In these analyses, tritium levels were measured from milligram-sized samples with sample preparation times of a few days. Hundreds of samples were analyzed within a few months of sample collection and resulted in the reconstruction of spatial and temporal exposure from tritium releases.
NTIS
Exposure; Mass Spectroscopy; Mathematical Models; Spatial Resolution

20040034271 Lawrence Livermore National Lab., Livermore, CA
Measurement of Heat Propagation in a Laser Produced Plasma
Gregori, G.; Glenzer, S. H.; Knight, J.; Niemann, C.; Price, D.; Aug. 22, 2003; 10 pp.; In English
Report No.(s): DE2003-15005091; UCRL-JC-155168; No Copyright; Avail: Department of Energy Information Bridge
Heat transport is a fundamental process for the laser plasma interaction in inertial confinement fusion (ICF) experiments, as well as for the correct design of ICF igni- tion targets. Controlled energy deposition by intense lasers into a radiation cavity

(hohlraum) must be properly modelled to achieve the desired symmetric convergence of implosion ICF capsules. Key issues that need to be ad- dressed are the degree of heat transport inhibition by both nonlocal electrons and magnetic fields together with a validation of the predictive capability of plasma conditions in gas filled hohlraums. In this paper, we report the observation of nonlo- cal heat wave propagation. We have experimentally ob- tained spatially and temporally resolved electron tem- perature profiles of the heat wave evolution and used them to test radiation-hydrodynamics, Fokker-Planck, and reduced nonlinear, nonlocal transport modeling.
NTIS
Laser Heating; Heat Transfer; Energy Transfer; Prediction Analysis Techniques; Inertial Confinement Fusion

20040034294 Lawrence Livermore National Lab., Livermore, CA
Employing Thin HPGe Detectors for Gamma-Ray Imaging
Vetter, K.; Mihailescu, L.; Ziock, K.; Burks, M.; Hull, E.; 2001; 14 pp.; In English
Report No.(s): DE2003-15005341; No Copyright; Avail: Department of Energy Information Bridge

We have evaluated a collimator-less gamma-ray imaging system, which is based on thin layers of double-sided strip HPGe detectors. The position of individual gamma-ray interactions will be deduced by the strip addresses and the Ge layers which fired. Therefore, high bandwidth pulse processing is not required as in thick Ge detectors. While the drawback of such a device is the increased number of electronics channels to be read out and processed, there are several advantages, which are particularly important for remote applications: the operational voltage can be greatly reduced to fully deplete the detector and no high bandwidth signal processing electronics is required to determine positions. Only a charge sensitive preamplifier, a slow pulse shaping amplifier, and a fast discriminator are required on a per channel basis in order to determine photon energy and interaction position in three dimensions. Therefore, the power consumption and circuit board real estate can be minimized. More importantly, since the high bandwidth signal shapes are not used to determine the depth position, lower energy signals can be processed. The processing of these lower energy signals increases the efficiency for the recovery of small angle scattering. Currently, we are studying systems consisting of up to ten 2mm thick Ge layers with 2mm pitch size. The required electronics of the few hundred channels can be integrated to reduce space and power. We envision applications in nuclear non-proliferation and gamma-ray astronomy where ease of operation and low power consumption, and reliability, are crucial.
NTIS
Imaging Techniques; Gamma Rays; Electric Potential; Collimators

20040034297 Lawrence Livermore National Lab., Livermore, CA
Novel Synthesis of Silicon and Germanium Nanocrystallites
Kauzlarich, S. M.; Liu, Q.; Yin, S. C.; Lee, H. W. H.; Taylor, B.; Apr. 02, 2001; 12 pp.; In English
Report No.(s): DE2003-15005441; UCRL-JC-143296; No Copyright; Avail: Department of Energy Information Bridge

Interest in the synthesis of semiconductor nanoparticles has been generated by their unusual optical and electronic properties arising from quantum confinement effects. We have synthesized silicon and germanium nanoclusters by reacting Zintl phase precursors with either silicon or germanium tetrachloride in various solvents. Strategies have been investigated to stabilize the surface, including reactions with RLi and MgBrR (R = alkyl). This synthetic method produces group IV nanocrystals with passivated surfaces. These nanoparticle emit over a very large range in the visible region. These particles have been characterized using HRTEM, FTIR, UV-Vis, solid state NMR, and fluorescence. The synthesis and characterization of these nanoclusters will be presented.
Author
Silicon; Germanium; Electrical Properties

20040034722 Lawrence Livermore National Lab., Livermore, CA
Analytic ICF Hohlraum Energetics
Rosen, M.; Hammer, J.; Aug. 27, 2003; 10 pp.; In English
Report No.(s): DE2003-15004941; UCRL-JC-155214; No Copyright; Avail: Department of Energy Information Bridge

We apply recent analytic solutions to the radiation diffusion equation to problems of interest for ICF hohlraums. The solutions provide quantitative values for absorbed energy which are of use for generating a desired radiation temperature vs. time within the hohlraum. Comparison of supersonic and subsonic solutions (heat front velocity faster or slower, respectively, than the speed of sound in the x-ray heated material) suggests that there may be some advantage in using high Z metallic foams as hohlraum wall material to reduce hydrodynamic losses, and hence, net absorbed energy by the walls. Analytic and numerical calculations suggest that the loss per unit area might be reduced approximately 20% through use of foam hohlraum

walls. Reduced hydrodynamic motion of the wall material may also reduce symmetry swings, as found for heavy ion targets.
NTIS
Energy; Solutions; Analysis (Mathematics); Acoustic Velocity; Hohlraums; Metal Foams

20040034824 Lawrence Livermore National Lab., Livermore, CA
Process Development for Cladding APT Tungsten Targets
Homer, M. H.; Barber, R.; Dalder, E.; Nov. 27, 2000; 16 pp.; In English
Report No.(s): DE2003-15005487; UCRL-JC-142436; No Copyright; Avail: Department of Energy Information Bridge
This report describes development of processes for cladding APT Target tungsten components with a thin layer (0.127-mm) of Alloy 718, Alloy 600 or 316L stainless steel alloy. The application requires that the cladding be thermally bonded to the tungsten in order to transfer heat generated in the tungsten volume to a surrounding coolant. High temperature diffusion bonding using the hot isostatic processing (HIP) technique was selected as the method for creating a metallurgical bond between pure tungsten tubes and rods and the cladding materials. Bonding studies using a uniaxially loaded vacuum hot press were conducted in preliminary experiments to determine acceptable time-temperature conditions for diffusion bonding. The results were successfully applied in cladding tungsten rods and tubes with these alloys. Temperatures 800-810 C were suitable for cladding tungsten with Alloy 600 and 316L stainless steel alloy, whereas tungsten was clad with Alloy 718 at 1020 C.
NTIS
Cladding; Tritium; Targets; Diffusion Welding

20040034832 Lawrence Livermore National Lab., Livermore, CA
Moment Condensed History Algorithm for Monte Carlo Electron Transport Simulations
Tolar, D. R.; Larsen, E. W.; Feb. 27, 2001; 22 pp.; In English
Report No.(s): DE2003-15005488; UCRL-JC-142907; No Copyright; Avail: Department of Energy Information Bridge
We introduce a new Condensed History algorithm for the Monte Carlo simulation of electron transport. To obtain more accurate simulations, the new algorithm preserves the mean position and the variance in the mean position exactly for electrons that have traveled a given path length and are traveling in a given direction. This is accomplished by deriving the zeroth-, first-, and second-order spatial moments of the Spencer-Lewis equation and employing this information directly in the Condensed History process. Numerical calculations demonstrate the advantages of our method over standard Condensed History methods.
NTIS
Electron Transfer; Monte Carlo Method; Variance (Statistics)

20040034833 Lawrence Livermore National Lab., Livermore, CA
Calculation of (sup 239) Pu(n,n') to 5 MeV
Chen, H.; Ross, M. A.; Reffo, G.; White, R. M.; Apr. 01, 2000; 32 pp.; In English
Report No.(s): DE2003-15005558; UCRL-ID-139407; No Copyright; Avail: Department of Energy Information Bridge
Calculations of the(sup 239)Pu(n,n') cross section and other relevant cross sections for incident neutron energies of up to 5 MeV are presented. Two components of the(sup 239)Pu(n,n') cross section are included. The direct contribution to the (sup 239)Pu(n,n') cross section is computed by the coupled-channel optical model. The compound component is calculated by a Hauser-Feshbach statistical treatment. Fission and(gamma)-cascade processes are considered as competing channels in the compound-decay process. Whenever possible, calculations are compared with experimental data and evaluations.
NTIS
Cross Sections; Neutrons

20040034836 Lawrence Livermore National Lab., Livermore, CA
Sub-Millimeter Solenoid Device for Trapping Paramagnetic Microbeads
Garcia, L. D.; Cheung, L. C.; Mikkelsen, J. C.; Santiago, J. G.; Aug. 01, 2001; 14 pp.; In English
Report No.(s): DE2003-15005473; UCRL-JC-144904; No Copyright; Avail: Department of Energy Information Bridge
We present the design and preliminary evaluation of a paramagnetic microsphere trapping and separation device consisting of a copper solenoid wrapped around a 1.3 mm diameter glass capillary. The magnetization and subsequent dipole-dipole interaction of paramagnetic spheres under an applied magnetic field results in the formation of bead chains that persist and grow under the applied field, but quickly disperse upon field removal. The chaining of paramagnetic spheres is

important to the design of magnetic-based separation devices because the viscous-drag-limited velocities of chains are typically several times larger than that of individual particles. We have performed a set of experiments designed to evaluate the performance of a sub-millimeter solenoid device including measurements of the temperature versus field strength of the device, observations of the controlled chain formation process, and preliminary observations regarding the maximum flow mte over which the bead chains can be held in place by magnetic forces. These results are applicable to the design and characterization of magnetically induced microsphere trapping and separation systems which use pressure driven flow.
NTIS
Solenoids; Paramagnetism

20040035549 Fermi National Accelerator Lab., Batavia, IL, Batavia, IL, USA
CDF Data Handling System
Litvintsev, D. O.; Mar. 2003; 12 pp.; In English
Report No.(s): DE2003-816952; FERMILAB-CONF-03/271; No Copyright; Avail: Department of Energy Information Bridge

The Collider Detector at Fermilab (CDF) records proton-antiproton collisions at center of mass energy of 2.0 TeV at the Tevatron collider. A new collider run, Run II, of the Tevatron started in April 2001. Increased luminosity will result in about 1 PB of data recorded on tapes in the next two years. Currently the CDF experiment has about 260 TB of data stored on tapes. This amount includes raw and reconstructed data and their derivatives. The data storage and retrieval are managed by the CDF Data Handling (DH) system. This system has been designed to accommodate the increased demands of the Run II environment and has proven robust and reliable in providing reliable flow of data from the detector to the end user. This paper gives an overview of the CDF Run II Data Handling system which has evolved significantly over the course of this year. An outline of the future direction of the system is given.
NTIS
Luminosity; Particle Accelerators; Proton-Antiproton Interactions; Data Systems

20040035552 Fermi National Accelerator Lab., Batavia, IL, Batavia, IL, USA
Field Flatness Tuning of TM(110) Mode Cavities with Closely Spaced Modes
Bellantoni, L.; Edwards, H.; Khabibouline, T.; Rowe, A.; Oct. 2003; 8 pp.; In English
Report No.(s): DE2003-816713; FERMILAB-CONF-03/353; No Copyright; Avail: Department of Energy Information Bridge

Superconducting cavities for the CKM RF separated kaon beamline at Fermilab have modes that are closely spaced compared to the resonance bandwidths when warm, and this complicates the field flatness (warm) tuning process. Additionally, it is necessary to maintain the azimuthal orientation of the mode during the tuning deformations. the authors present two analytic techniques to warm-tune cavities with overlapping modes, a finite-element analysis of the tuning process, the design of a warm tuner which maintains mode polarization, and the results of tuning a cavity in which initial manufacturing variations caused the desired (pi) and nearby (pi)-1 modes to be indistinguishable before field flatness tuning.
NTIS
Cavities; Tuners; Tuning

20040035553 California Univ., Davis, Davis, CA, USA, Texas A and M Coll., College Station, College Station, TX, USA, Waseda Univ., Tokyo (Japan), Tokyo, Japan, Rutgers - The State Univ., Piscataway, NJ, Piscataway, NJ, USA
CDF-II Tau Physics Program. Trigger, pi ID and Preliminary Results
Baroiant, S.; Chertok, M.; Goncharov, M.; Kamon, T.; Khotilovich, V.; Oct. 2003; 16 pp.; In English
Report No.(s): DE2003-816827; FERMILAB-CONF-03/322-E; No Copyright; Avail: Department of Energy Information Bridge

The study of processes containing(tau) leptons in the final state will play an important role at Tevatron Run II. Such final states will be relevant both for electroweak studies and measurements as well as in searches for physics beyond the Standard Model. The present paper discusses the physics opportunities and challenges related to the implementation of new set of triggers able to select events containing tau candidates in the final state. They illustrate, in particular, the physics capabilities for a variety of new physics scenarios such as supersymmetry (SUSY), SUSY with Rp-parity violation, with Bilinear parity violation or models with the violation of lepton flavor. Finally, they present the first Run II results obtained using some of the described tau triggers.
NTIS
Supersymmetry; Electroweak Interactions (Field Theory); Particle Accelerators

20040035620 Lawrence Livermore National Lab., Livermore, CA
Self-Consistent Simulation of Turbulence and Transport in Tokamak Edge Plasmas
Rognlien, T. D.; Umansky, M. V.; Xu, X. Q.; Cohen, R. H.; Sep. 03, 2003; 12 pp.; In English
Report No.(s): DE2003-15005009; UCRL-JC-153197; No Copyright; Avail: Department of Energy Information Bridge

The status of coupling the fluid 3D turbulence code BOUT and the fluid plasma/neutral 2D transport code UEDGE is reported, where both codes simulate the edge region of diverted tokamaks from several cm inside the magnetic separatrix to the far scrape-off layer (SOL), thereby including the magnetic X-point. Because the characteristic time scale of the turbulence is short and the profile evolution time scale can be long an iterative scheme is used that relaxes the turbulent fluxes passed from BOUT to UEDGE and the profiles from UEDGE to BOUT over many coupling steps. Each code is run on its own characteristic time scale, yielding a statistically averaged steady state. For this initial study, the ion and neutral densities and parallel velocities are evolved, while the temperature profiles are stationary. Here the turbulence code is run in the electrostatic approximation. For this example of self-consistent coupling with strong L-mode-like turbulence, the ion flux to the main-chamber exceeds that to the divertor plates.
NTIS
Tokamak Devices; Simulation; Turbulence; Plasmas (Physics); Flux (Rate)

20040035645 Lawrence Livermore National Lab., Livermore, CA
178m2(sup)Hf Controversy
Becker, J. A.; Gemmell, D. S.; Schiffer, J. P.; Wilmelmy, J. B.; Jul. 24, 2003; 10 pp.; In English
Report No.(s): DE2003-15005468; UCRL-ID-155489; No Copyright; Avail: Department of Energy Information Bridge

Since its discovery in the 1960's the(sup 178m2)Hf isomer has garnered high attention from both the basic and applied communities in nuclear science. It's combination of high spin (16+), long half life (31 yrs), and high excitation energy (2.446 MeV) offer unique possibilities as an energy storage medium. Interest in the isomer was rekindled beginning in 1999 when a series of publications began to appear from a group (referred to here as the 'Texas collaboration') primarily based at the University of Texas, Dallas. They reported observations that some of the stored energy could be released ('triggered') when the isomer was exposed to a fluence of photons in the energy range (approx) 10 to (approx) 60 keV. The implications of this observation are profound. At this point an outsider has difficulty determining whether there is indeed a triggering effect that should be pursued energetically with substantial resources, or whether the phenomenon consists of overly optimistic interpretation of data. The report explores the controversy.
NTIS
Hafnium Isotopes; Cross Sections; Isomers; Hafnium

20040035709 Lawrence Livermore National Lab., Livermore, CA
NIF Power Conditioning System Testing at LLNL
Fulkerson, E. S.; Newton, M.; Hulsey, S.; Hammon, J.; Moore, W. B. S.; Jun. 2001; 12 pp.; In English
Report No.(s): DE2003-15005976; UCRL-JC-142111; No Copyright; Avail: Department of Energy Information Bridge

The National Ignition Facility (NIF) is now under construction at the Lawrence Livermore National Laboratory (LLNL). The Power Conditioning System (PCS) for NIF, when completed will consist of a 192 nearly identical 2 megajoule capacitor storage banks driving 7680 two meter long flashlamps. A fully integrated single-module test facility was completed in August of 2000 at LLNL. The purpose to the Test Facility is to conduct Reliability and Maintainability (RAM) testing of a true 'First Article' system (built to the final drawing package as opposed to a prototype). The test facility can be fired once every ten minutes with a total peak output current of 580kA with a pulse width of 400us. Procedures for producing, activating and integrating the full 192-module system are also being developed. To date over 4,000 full systems shots have been conducted on the system. The first 402 shots were conducted with a mix of prototype and production pulse power hardware.
NTIS
Ignition; Power Conditioning; Test Facilities

20040035710 Lawrence Livermore National Lab., Livermore, CA
Laser Driven High Pressure, High Strain-Rate Materials Experiments
Kalantar, D. H.; Allen, A. M.; Gregori, F.; Kad, B.; Kumar, M.; Jun. 2001; 12 pp.; In English
Report No.(s): DE2003-15005974; UCRL-JC-141824; No Copyright; Avail: Department of Energy Information Bridge

Laser-based experiments are being developed to study the response of solids under high pressure loading. Diagnostic techniques that have been applied include dynamic x-ray diffraction, VISAR wave profile measurements, and post-shock

recovery and analysis. These techniques are presented with some results from shocked Si, Al, and Cu experiments.
NTIS
High Pressure; Laser Applications; Strain Rate; Mechanical Properties; Compression Loads

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040031669
Localization of Broadband Noise with Hydrophone Array
Oeberg, D.; Jun. 2003; In Swedish
Report No.(s): PB2004-101818; FOI-R-0881-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Localization of noise sources is important when assessing the possible threats for a naval platform. Traditional beam forming focuses on finding and tracking the bearings to noise radiators. In this report a method for estimating the curvature of the soundfield, rendering passive ranging possible, is used. Data from a field experiment carried out at FOI's research site at Djupviken were used in order to test the localization method. In the experiment a speaker emitted broadband noise from different positions, up to one kilometer from the hydrophone array. The array consisted of 22 sensors, with an aperture of around 20 meters. The analysis of the field experiment shows that passive ranging is a difficult task for a sonar. The range estimates are quite rough. At the distance of one kilometer the error is a couple of hundred meters.
NTIS
Hydrophones; Broadband; Sonar; Position (Location)

20040031761 Institute TNO of Applied Physics, Delft, Netherlands
The Influence of Baffle Size on the Sound Radiation from a Simple Vibrating Disk
Petersson, B. A. T.; December 2002; 19 pp.; In English
Contract(s)/Grant(s): A02/KM/124; TNO Proj. 008.03456
Report No.(s): TD-0235; DGT-RPT-020147; Copyright; Avail: Other Sources

In the work on underwater radiation from stiffened plates, a simple statistically formulated model has been developed. This model assumes that the stiffened plate consists of numerous independently vibrating plate fields of varying sizes and shapes of which one is resonantly radiating, while the others act like an infinite baffle. This assumption needs validation. Herein, the influence of the size of a finite baffle on the power radiated by a dipole source is studied. An approximate model with a rigid sphere substituted for the baffle is resurrected and analyzed numerically. The results are compared with those obtained from a direct FE-analysis. In addition, experiments have been made in the anechoic laboratory using a small loudspeaker element inserted in a circular baffle. From the two numerical analyses as well as the experiments a qualitative agreement is found. Quantitatively, the approximate spherical model overall yields a somewhat lower radiated power than the FE-model. The quantitative comparison with the experimental results is hampered by the unavoidable resonant vibration of the membrane. Nonetheless, the investigation unambiguously reveals that the finite baffle practically acts as were it infinite for frequencies above that where half a wavelength is equal to the smallest dimension of the baffle.
Author
Underwater Acoustics; Baffles; Plates (Structural Members); Disks (Shapes)

20040031763 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands
Implementation of the Acoustic Analysis of Box-Like Machinery Foundation Structures into BATSOFT: Supplement
Liang, J.; Petersson, B. A. T.; deJong, C. A. F.; December 2002; 22 pp.; In English
Contract(s)/Grant(s): A02/KM/124; TNO Proj. 008.03456/01.01
Report No.(s): TD-0239; DGT-RPT-030007; Copyright; Avail: Other Sources

This report describes the final update of the module for box-like structures in the BATSOFT calculation software for the structural acoustic analysis of machinery foundation structures. The model implementation has been extended with analytical expressions for the local deformation of the top plate for lateral force and moment excitation. A comparison of the results of

the updated model with the results of laboratory experiments shows that the model now provides satisfactory predictions for all relevant mobility components.
Author
Underwater Acoustics; Ships; Boxes (Containers); Computer Programs

20040033976 Tsinghua Univ., Bejing, China
Signal Detection and Analysis of the Transient-evoked Otoacoustic Emissions and Its Application
Gong, Qin; Ye, Da-Tian; Dig, Hai-Yan; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 147-151; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

A detailed review is given in this paper on signal characteristics, signal detection and analysis of Transient-evoked Otoacoustic Emissions (TEOAE), as well as its recent status of research and clinical application. Research aspects and perspective of clinical application of TEOAE was also proposed.
Author
Signal Detection; Otology; Clinical Medicine; Acoustic Emission

20040033983 Xidian Univ., Xian, China
An Adaptive Algorithm for Reducing Reverberation
Wu, Wei; Chang, Yi-Lin; Gao, Hui; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 138-141; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

This paper presents a modified algorithm for reducing reverberation. The reverberation is an improtant factor influencing the performance of an adaptive noise canceller (ANC). Since the excess mean-squared error increases with desired signal power, a modified algorithm was proposed on the basis of S.Ikeda algorithm. The results of the output SNRs compared with those of S.Ikeda algorithm are presented.
Derived from text
Algorithms; Reverberation; Adaptive Control; Noise Reduction

20040033994 NASA Langley Research Center, Hampton, VA, USA
Supersonic Jet Exhaust Noise at High Subsonic Flight Speed
Norum, Thomas D.; Garber, Donald P.; Golub, Robert A.; Santa Maria, Odilyn L.; Orme, John S.; January 2004; 90 pp.; In English
Contract(s)/Grant(s): WU 23-781-30-12
Report No.(s): NASA/TP-2004-212686; L-18319; No Copyright; Avail: CASI; A05, Hardcopy

An empirical model to predict the effects of flight on the noise from a supersonic transport is developed. This model is based on an analysis of the exhaust jet noise from high subsonic flights of the F-15 ACTIVE Aircraft. Acoustic comparisons previously attainable only in a wind tunnel were accomplished through the control of both flight operations and exhaust nozzle exit diameter. Independent parametric variations of both flight and exhaust jet Mach numbers at given supersonic nozzle pressure ratios enabled excellent correlations to be made for both jet broadband shock noise and jet mixing noise at flight speeds up to Mach 0.8. Shock noise correlated with flight speed and emission angle through a Doppler factor exponent of about 2.6. Mixing noise at all downstream angles was found to correlate well with a jet relative velocity exponent of about 7.3, with deviations from this behavior only at supersonic eddy convection speeds and at very high flight Mach numbers. The acoustic database from the flight test is also provided.
Author
Jet Aircraft Noise; Jet Exhaust; Subsonic Speed; Supersonic Speed; Mathematical Models; Aeroacoustics; Flight Tests

20040034092 Physics and Electronics Lab. TNO, The Hague, Netherlands
HF Reverberation Modelling: Analysis of Bottom Reverberation Data
Saanen, A. M.; Janmaat, J.; March 2003; 30 pp.; In English
Contract(s)/Grant(s): A01/KM/687; TNO Proj. 015.30632
Report No.(s): TD-2002-0217; FEL-02-A290; Copyright; Avail: Other Sources

Within the framework of the projects Validation ALMOST HF2 and HF Reverberation Modelling a bottom reverberation trial with the DUBM-2 1B mine hunting sonar was carried out in 2001 on board L M S Willemstad [1,2]. This trial was more or less a replica of the Bottomclassification -trial executed in 2000 with an identical sonar and in the same area, but as has been stated in [3] the data from that trial could not be used for analysis for the projects under consideration due to inappropriate

setting of the sonar system. The area of the Bottomclassification -trial was chosen as the most suitable, not only because the various bottom characteristics of this area as depth, type and composition are well-known, but also because of the large variation in bottom type ~41. During the 2001-trial 100 kHz data was recorded with the detection sonar adjusted to a tilt angle of 30 (range setting 400 m), respectively 7 (range setting 900 m). At 30 -tilt data was collected of six sonar beams with the automatic gain control (CAG-control) set to a fixed value, at 7 -tilt only one sonar beam was recorded with the CAG-control set in an operational mode. Moreover, some noise recordings were made and three sound speed profiles were recorded over the trial period of about 20 hours. This report describes the analysis procedure (chapter 2) and examines the analysis results (chapter 3). The analysis itself is limited to specific parts of the various tracks, viz tracks for which the bottom properties show relatively small variations. In the analysis attention is paid to the environmental data, measurements with the DUBM-sonar and ALMOST-calculations for 30 - and 7 -tilt angles and the comparison between measurements and calculations.
Author
Sonar; Mines (Ordnance)

20040034183 National Advisory Committee for Aeronautics. Langley Aeronautical Lab., Langley Field, VA, USA
Reflection and Refraction of Acoustic Waves by a Shock Wave
Brillouin, J.; Reflexion et Refraction d'ondes Acoustiques Par Une Onde de Choc; July 1957; Volume 5, No. 3, pp. 149-163; In English
Report No.(s): NACA-TM-1409; No Copyright; Avail: CASI; A03, Hardcopy

The presence of sound waves in one or the other of the fluid regions on either side of a shock wave is made apparent, in the region under superpressure, by acoustic waves (reflected or refracted according to whether the incident waves lie in the region of superpressure or of subpressure) and by thermal waves. The characteristics of these waves are calculated for a plane, progressive, and uniform incident wave. In the case of refraction, the refracted acoustic wave can, according to the incidence, be plane, progressive, and uniform or take the form of an 'accompanying wave' which remains attached to the front of the shock while sliding parallel to it. In all cases, geometrical constructions permit determination of the kinematic characteristics of the reflected or refractive acoustic waves. The dynamic relationships show that the amplitude of the reflected wave is always less than that of the incident wave. The amplitude of the refracted wave, whatever its type, may in certain cases be greater than that of the incident wave.
Author
Reflected Waves; Refracted Waves; Sound Waves; Shock Waves

20040034212 NASA Langley Research Center, Hampton, VA, USA
Multiplexing Technology for Acoustic Emission Monitoring of Aerospace Vehicles
Prosser, William; Percy, Daniel; [2003]; 8 pp.; In English; 4th International Workshop on Structural Health Monitoring, 15-17 Sep. 2003, Stanford, CA, USA
Contract(s)/Grant(s): RTA 721-21-55-05; No Copyright; Avail: CASI; A02, Hardcopy

The initiation and propagation of damage mechanisms such as cracks and delaminations generate acoustic waves, which propagate through a structure. These waves can be detected and analyzed to provide the location and severity of damage as part of a structural health monitoring (SHM) system. This methodology of damage detection is commonly known as acoustic emission (AE) monitoring, and is widely used on a variety of applications on civil structures. AE has been widely considered for SHM of aerospace vehicles. Numerous successful ground and flight test demonstrations have been performed, which show the viability of the technology for damage monitoring in aerospace structures. However, one significant current limitation for application of AE techniques on aerospace vehicles is the large size, mass, and power requirements for the necessary monitoring instrumentation. To address this issue, a prototype multiplexing approach has been developed and demonstrated in this study, which reduces the amount of AE monitoring instrumentation required. Typical time division multiplexing techniques that are commonly used to monitor strain, pressure and temperature sensors are not applicable to AE monitoring because of the asynchronous and widely varying rates of AE signal occurrence. Thus, an event based multiplexing technique was developed. In the initial prototype circuit, inputs from eight sensors in a linear array were multiplexed into two data acquisition channels. The multiplexer rapidly switches, in less than one microsecond, allowing the signals from two sensors to be acquired by a digitizer. The two acquired signals are from the sensors on either side of the trigger sensor. This enables the capture of the first arrival of the waves, which cannot be accomplished with the signal from the trigger sensor. The propagation delay to the slightly more distant neighboring sensors makes this possible. The arrival time from this first arrival provides a more accurate source location determination. The multiplexer also identifies which channels are acquired by encoding TTL logic pulses onto the latter portion of the signals. This prototype system was demonstrated using pencil lead break (Hsu-Neilsen) sources on an aluminum plate. It performed as designed providing rapid low noise trigger based switching

with encoded channel identification. this multiplexing approach is not limited to linear arrays, but can be easily extended to monitor sensors in planar ot three dimensional arrays. A 32 channel multiplexing system is under development that will allow arbitrary sensor placement. Another benefit of this multiplexing system is the reduction in the expense of data acquisition hardware. In addition, the reduced weight and power requirements are of extreme importance for proposed AE systems on aerospace vehicles.
Author
Acoustic Emission; Aerospace Vehicles; Technology Utilization; Systems Health Monitoring; Detection; Time Division Multiplexing

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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*.

20040031798 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Positron Physics
Drachman, Richard J.; [2003]; 1 pp.; In English; 2003 UK Workshop on Positron Physics; No Copyright; Avail: Other Sources; Abstract Only

I will give a review of the history of low-energy positron physics, experimental and theoretical, concentrating on the type of work pioneered by John Humberston and the positronics group at University College. This subject became a legitimate subfield of atomic physics under the enthusiastic direction of the late Sir Harrie Massey, and it attracted a diverse following throughout the world. At first purely theoretical, the subject has now expanded to include high brightness beams of low-energy positrons, positronium beams, and, lately, experiments involving anti-hydrogen atoms. The theory requires a certain type of persistence in its practitioners, as well as an eagerness to try new mathematical and numerical techniques. I will conclude with a short summary of some of the most interesting recent advances.
Author
Atomic Physics; Positrons; Positronium; Theoretical Physics

20040031804 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Re-Examination of a Simplified Model for Positronium-Helium Scattering
Drachman, Richard J.; DiRienzi, Joseph; [2003]; 1 pp.; In English; 12th International Workshop on Low Energy Posifron and Positronium Physics, 19-21 Jul. 2003, Sonderborg, Denmark; No Copyright; Avail: Other Sources; Abstract Only

Using a local effective potential to account for electron exchange, R J Drachman and S K Houston analyzed the zero-energy scattering of ortho-positronium by helium atoms in 1970. The idea was to use the existing static-exchange results to fit the parameters of the local potential and then to use the potential in a variational target-elastic calculation. The results were remarkably good, both for the scattering length and the annihilation parameter. Recently, however, a rigorous target-elastic calculation by Blackwood et al disagreed so strongly with these old results that we have undertaken a re-examination. We find that the assumption made in the earlier work, that the direct potential is negligible compared with the exchange potential, is not quantitatively correct. But the original idea that omission of the direct potential might compensate approximately for the omission of the van der Waals potential still seems reasonable.
Author
Positronium; Mathematical Models; Helium Atoms; Scattering

20040033374 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Proton Nonionizing Energy Loss (NIEL) for Device Applications
Jun, Insoo; Xapsos, Michael A.; Messenger, Scott R.; Burke, Edward A.; Walters, Robert J.; Summers, Geoff; Jordan, Thomas; [2003]; 5 pp.; In English; Nuclear and Space Readiation Effects Conference, 21-25 Jul. 2003, Monterey, CA, USA; Copyright; Avail: CASI; A01, Hardcopy

Nonionizing energy loss (NIEL) is a quantity that describes the rate of energy loss due to atomic displacements as a particle traverses a material. The product of the NIEL and the particle fluence (time integrated flux) gives the displacement damage energy deposition per unit mass of material. NIEL plays the same role to the displacement damage energy deposition as the stopping power to the total ionizing dose (TID). The concept of NIEL has been very useful for correlating particle induced displacement damage effects in semiconductor and optical devices. Many studies have successfully demonstrated that

the degradation of semiconductor devices or optical sensors in a radiation field can be linearly correlated to the displacement damage energy, and subsequently to the NIEL deposited in the semiconductor devices or optical sensors. In addition, the NIEL concept was also useful in the study of both Si and GaAs solar cells and of high temperature superconductors, and at predicting the survivability of detectors used at the LHC at CERN. On the other hand, there are some instances where discrepancies are observed in the application of NIEL, most notably in GaAs semiconductor devices. However, NIEL is still a valuable tool, and can be used to scale damages produced by different particles and in different environments, even though this is not understood at the microscopic level.
Derived from text
Proton Energy; Ionization; Energy Dissipation; Losses

20040034240 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Electron-Hydrogen Elastic Scattering
Bhatia, A. K.; [2004]; 1 pp.; In English; XXII International Conference on Photonic, Electronic, and Atomic Collisions, 23-29 Jul. 2003, Stockholm, Sweden; No Copyright; Avail: Other Sources; Abstract Only

Scattering by single-electron systems is always of interest because the wave function of the target is known exactly. Various approximations have been employed to take into account distortion produced in the target. Among them are the method of polarized orbitals and the close coupling approximation. Recently, e-H and e-He+ S-wave scattering in the elastic region has been studied using the Feshbach projection operator formalism. In this approach, the usual Hartree-Fock and exchange potentials are augmented by an optical potential and the resulting phase shifts have rigorous lower bounds. Now this method is being applied to the e-H P-wave scattering in the elastic region. The number of terms in the Hylleraas-type wave function for the 1,3 P phase shifts is 84 and the resulting phase shifts (preliminary) are given. The results have been given up to five digits because to that accuracy they are rigorous lower bounds. They are in general agreement with the variational (VAR) results of Armstead, and those obtained from the intermediate energy R-matrix method (RM) of Scholz et al., and the finite element method (FEM) of Botero and Shertzer. The later two methods do not provide any bounds on phase shifts.
Author
Electron Scattering; Elastic Scattering; Hydrogen; Wave Scattering

20040035538 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The -145 km/S Absorption System of Eta Carinae
Vieira, G.; Gull, T. R.; Danks, A.; Johansson, S.; [2002]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

With the STIS E230H mode (R-118,000) , we have identified about twenty absorption components in line of sight from Eta Carinae. Two components, one at -513 km/s and another at -145 W s , are quite different in character from the others, mostly at intermediate velocities. The -145 km/s component is significantly wider in fwhm, is seen in many more species, and the lower level can be above 20,000/cm, well above the 2000/cm noted in the -513 km/s component. In the spectral region from 2400 to 3160A, approximately 500 absorption lines have been identified. In this poster, we will present line identifications and atomic parameters of the measured lines, hopefully providing insight as to what levels are being excited and by what processes.
Author
Line Spectra; Line of Sight; Atoms

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*.

20040034010 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Scintillation Counter System Design To Detect Antiproton Annihilation using the High Performance Antiproton Trap(HiPAT)
Martin, James J.; Lewis, Raymond A.; Stanojev, Boris; [2003]; 1 pp.; In English; STAIF 2004 Conference, 8-12 Feb. 2004, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

The High Performance Antiproton Trap (HiPAT), a system designed to hold up to l0(exp 12) charge particles with a

storage half-life of approximately 18 days, is a tool to support basic antimatter research. NASA's interest stems from the energy density represented by the annihilation of matter with antimatter, 10(exp 2)MJ/g. The HiPAT is configured with a Penning-Malmberg style electromagnetic confinement region with field strengths up to 4 Tesla, and 20kV. To date a series of normal matter experiments, using positive and negative ions, have been performed evaluating the designs performance prior to operations with antiprotons. The primary methods of detecting and monitoring stored normal matter ions and antiprotons within the trap includes a destructive extraction technique that makes use of a micro channel plate (MCP) device and a non-destractive radio frequency scheme tuned to key particle frequencies. However, an independent means of detecting stored antiprotons is possible by making use of the actual annihilation products as a unique indicator. The immediate yield of the annihilation event includes photons and pie mesons, emanating spherically from the point of annihilation. To 'count' these events, a hardware system of scintillators, discriminators, coincident meters and multi channel scalars (MCS) have been configured to surround much of the HiPAT. Signal coincidence with voting logic is an essential part of this system, necessary to weed out the single cosmic ray events from the multi-particle annihilation shower. This system can be operated in a variety of modes accommodating various conditions. The first is a low-speed sampling interval that monitors the background loss or 'evaporation' rate of antiprotons held in the trap during long storage periods; provides an independent method of validating particle lifetimes. The second is a high-speed sample rate accumulating information on a microseconds time-scale; useful when trapped antiparticles are extracted against a target, providing an indication of quantity. This paper details the layout of this system, setup of the hardware components around HiPAT, and applicable checkouts using normal matter radioactive sources.
Author
Annihilation Reactions; Design Analysis; Charged Particles; Antiprotons; Antimatter

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20040031631 Lawrence Livermore National Lab., Livermore, CA
Crossed Beam Energy Transfer in the NIF ICF Target Design
Williams, E. A.; Hinkel, D. E.; Hittinger, J. A.; Aug. 27, 2003; 18 pp.; In English
Report No.(s): DE2003-15004921; UCRL-JC-152016; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Laser Targets; Optical Measuring Instruments

20040031649 Lawrence Livermore National Lab., Livermore, CA
Development of Short Pulse Laser Pumped X-ray Lasers
Dunn, J.; Osterheld, A. L.; Hunter, J. R.; Shlyaptsev, V. N.; Feb. 22, 2000; 22 pp.; In English
Report No.(s): DE2003-15005094; UCRL-ID-138114; No Copyright; Avail: Department of Energy Information Bridge
X-ray lasers have been extensively studied around the world since the first laboratory demonstration on the Novette laser at LLNL in 1984. The characteristic properties of short wavelength, high monochromaticity, collimation and coherence make x-ray lasers useful for various applications. These include demonstrations of biological imaging within the water window, interferometry of laser plasmas and radiography of laser-heated surfaces. The objective of the project was to develop a soft x-ray laser (XRL) pumped by a short pulse laser of a few joules. In effect to demonstrate a robust, working tabletop x-ray laser at LLNL for the first time.
NTIS
Laser Plasmas; X Ray Lasers; Interferometry; Pulsed Lasers

20040031725 NASA Goddard Inst. for Space Studies, New York, NY, USA
Fundamentals of Polarized Light
Mishchenko, Michael; [2003]; 1 pp.; In English; NATO Advanced Study Institute/Lecture Course, 20 Sep. - 3 Oct. 2003, Yalta, Ukraine; No Copyright; Avail: Other Sources; Abstract Only
The analytical and numerical basis for describing scattering properties of media composed of small discrete particles is formed by the classical electromagnetic theory. Although there are several excellent textbooks outlining the fundamentals of this theory, it is convenient for our purposes to begin with a summary of those concepts and equations that are central to the

subject of this book and will be used extensively in the following chapters. We start by formulating Maxwell's equations and constitutive relations for time- harmonic macroscopic electromagnetic fields and derive the simplest plane-wave solution that underlies the basic optical idea of a monochromatic parallel beam of light. This solution naturally leads to the introduction of such fundamental quantities as the refractive index and the Stokes parameters. Finally, we define the concept of a quasi-monochromatic beam of light and discuss its implications.
Author
Electromagnetic Fields; Polarized Light; Numerical Analysis; Light Scattering

20040031731 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GLAST's GBM Burst Trigger
Band, D.; Briggs, M.; Connaughton, V.; Kippen, M.; Preece, R.; [2003]; 4 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The GLAST Burst Monitor (GBM) will detect and localize bursts for the GLAST mission, and provide the spectral and temporal context in the traditional 10 keV to 25 MeV band for the high energy observations by the Large Area Telescope (LAT). The GBM will use traditional rate triggers in up to three energy bands, and on a variety of timescales between 16 ms and 16 s.
Author
Bursts; Telescopes; Gamma Ray Telescopes

20040031737 NASA Goddard Space Flight Center, Greenbelt, MD, USA
James Webb Space Telescope (JWST) Optical Telescope Element (OTE) Architecture and Technology
Feinberg, Lee D.; [2003]; 3 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004; No Copyright; Avail: CASI; A01, Hardcopy

The James Webb Space Telescope (JWST) Optical Telescope Element (OTE) is the first NASA segmented space telescope and is planned for launch in 201 1. The telescope architecture was recently finalized with the selection of the primary mirror material. This presentation reviews the telescope architecture and discusses the remaining key technological challenges of this element.
Author
James Webb Space Telescope; Architecture (Computers); Technology Assessment

20040031744 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SWIFT BAT Loop Heat Pipe Thermal System Characteristics and Ground/Flight Operation Procedure
Choi, Michael K.; [2003]; 8 pp.; In English; 1st International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Report No.(s): AIAA Paper 2003-6077; No Copyright; Avail: CASI; A02, Hardcopy

The SWIFT Burst Alert Telescope (BAT) Detector Array has a total power dissipation of 208 W. To meet the stringent temperature gradient and thermal stability requirements in the normal operational mode, and heater power budget in both the normal operational and safehold modes, the Detector Array is thermally well coupled to eight constant conductance heat pipes (CCHPs) embedded in the Detector Array Plate (DAP), and two loop heat pipes (LHPs) transport heat fiom the CCHPs to a radiator. The CCHPs have ammonia as the working fluid and the LHPs have propylene as the working fluid. Precision heater controllers, which have adjustable set points in flight, are used to control the LHP compensation chamber and Detector Array XA1 ASIC temperatures. The radiator has the AZ-Tek AZW-LA-II low-alpha white paint as the thermal coating and is located on the anti-sun side of the spacecraft. This paper presents the characteristics, ground operation and flight operation procedures of the LHP thermal system.
Author
Application Specific Integrated Circuits; Conductive Heat Transfer; Heat Pipes; Telescopes; Thermal Stability

20040031754 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Fizeau Interferometer Testbed (FIT) for Stellar Imager
Carpenter, Kenneth G.; Lyon, Richard G.; Mazzuca, Lisa M.; Solyar, Gregory; Mundy, Lee G.; Armstrong, J. T.; Zhang, Xiaolei; Marzouk, Joe; [2003]; 1 pp.; In English; IAUXXV Joint Assembly Meeting 'Stars as Sins: Activity, Evolution, and Planets', 13-26 Jul. 2003, Sydney, Australia; No Copyright; Avail: Other Sources; Abstract Only

Goddard Space Flight Center is pursuing the development of space-based, long-baseline (less than 0.5km) UV-optical

Fizeau imaging interferometers to enable the next major stride toward very high angular resolution astronomical observations. This effort includes the development and operation of the Fizeau Interferometer Testbed (FIT), in collaboration with the Naval Research Lab/NPOI, Univ. of MD, and Sigma Space Corporation. The FIT will be used to explore the principles of and requirements for the Stellar Imager (SI) mission concept (http://hires.gsfc.nasa.gov/-si) and other such Fizeau Interferometers/ Sparse Aperture Telescope missions. The primary FIT goal is to demonstrate closed-loop control of a many-element (7 - 30) system which keeps the optical beams in phase and thus enables high quality imaging. The FIT will also be used to assess various wavefront reconstruction and sensing and image reconstruction algorithms for utility and accuracy by application to real data generated by the Testbed. In this paper, we describe the design and goals of the system, provide a status report on its construction, and note our future plans. The FIT development is supported by NASA-ROSS/SARA grants to GSFC, UMD, and NRL and by internal GSFC R&D funds.
Author
Performance Tests; Interferometers; Imaging Techniques; Optical Measurement; Image Reconstruction

20040031827 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Steps Toward a Large Space-Based UV/Optical Fizeau Interferometer: The GSFC Fizeau Interferometer Testbed (FIT)
Carpenter, K. G.; Lyon, R. G.; Mazzuca, L. M.; Solyar, G.; Marzouk, J.; Mundy, L. G.; Armstrong, J. T.; Zhang, X.; [2003]; 1 pp.; In English; 201st Meeting of the American Astronomical Society, 5-9 Jan. 2003, Seattle, WA, USA; No Copyright; Avail: CASI; A01, Hardcopy

Goddard Space Flight Center is pursuing the development of space-based, long-baseline (0.5km) UV-optical Fizeau imaging interferometers to enable the next major stride toward very high angular resolution astronomical observations. This effort includes the development and operation of the Fizeau Interferometry Testbed (FIT), in collaboration with the Naval Research Lab/NPOI, Univ. of MD, and Sigma Space Corporation. The FIT will be used to explore the principles of and requirements for the Stellar Imager (SI) mission concept (http://hires.gsfc.nasa.gov/~si) and other such Fizeau Interferometers/ Sparse Aperture Telescope missions, leading in the end to the Planet Imager (PI), which is the ultimate goal of the current Origins Program. The primary goal of the FIT program is to demonstrate closed-loop control of mirrors (tip, tilt, piston, translation of array elements) and the overall system to keep the optical beams in phase and enable high quality imaging by a many-element (7-30) Fizeau Interferometric System. The FIT will also be used to assess various wave-front reconstruction and sensing and image reconstruction algorithms for utility and accuracy by application to real data generated by the Testbed. In this paper, we describe the design and goals of the system, provide a status report on its construction, and note our future plans.
Author
Angular Resolution; Interferometers; High Resolution; Imaging Techniques; Optical Measurement

20040033925 Akron Univ., Akron, OH, USA
Development of an Optical-Real Time Polarimetric Imaging System for Aerospace Applications
Giakos, George C.; January 2004; 1 pp.; In English
Contract(s)/Grant(s): NAG3-2632; No Copyright; Avail: CASI; A01, Hardcopy

The design of an optical polarimetric imaging system, aimed to detect cracks or structural defects on the surface of rotating aircraft engine shafts, is presented. The experimental results have been processed by a real time wavelet denouncing system implemented by a Filed Programmable Gate Arrays (FPGA), which has been designed for this purpose. The experimental results clearly indicate that high signal-to-noise ratio signals can be obtained.
Author
Fabrication; Optical Equipment; Polarimetry; Imaging Techniques; Real Time Operation

20040033934 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Submillimeter and Far Infrared Experiment for SOFIA (SAFIRE): Progress and Prospects
Shafer, R. A.; Moseley, S. H.; Benford, D. J.; Chervenak, J. A.; Dwek, E.; Staguhn, J. G.; Irwin, K. D.; Pajot, F.; Stacey, G. J.; [2002]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

SAFIRE/SOFIA is a versatile imaging Fabry-Perot spectrograph covering 100 less than lambda less than 655 microns, with spectral resolving power of approx. l0(exp 3). Selected as a 'PI' instrument for the airborne Stratospheric Observatory for Infrared Astronomy (SOFIA), SAFIRE will apply two dimensional pop-up bolometer arrays to provide background limited imaging spectrometry. We describe the instrument design, its application to a range of astro- physical investigations, and

current progress and results in the innovative detector and instrument design. SAFIRE/SOFIA is on track for availability in 2006.
Author
Sofia (Airborne Observatory); Spectrometers; Submillimeter Waves; Imaging Techniques

20040033960 Nippon Telegraph and Telephone Public Corp., Tsukuba Science City, Japan
Development of a Road Disaster Monitoring System Using Optical Fiber Sensing Technology
Fujihashi, Kazuhiko; Uehara, Hideki; Okutsu, Masaru; Komatsu, Koji; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 48-52; In English; See also 20040033955; Copyright; Avail: Other Sources

NTT Access Network Service Systems Laboratories has developed a system for monitoring road disasters by using optical fiber sensing technology. This technology allows linear measurement over long distances, which is advantageous when the length to manage is long and risk locations are difficult to determine in advance. This article describes various sensors developed for monitoring road disasters and software for controlling the measuring devices, processing data, and performing other tasks.
Author
Fiber Optics; Brillouin Effect; Fault Detection; Systems Health Monitoring

20040033965 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mid-Infrared Imaging of Orion BN/KL With Keck I Telescope
Gezari, Daniel Y.; Danchi, William C.; Greenhill, Lincoln J.; Varosi, Frank; [2003]; 2 pp.; In English; Presenation to the International Astronomical Union Conference, 13-26 Jul. 2003, Sydney, Australia; No Copyright; Avail: Other Sources; Abstract Only

We present new images of the Orion BN/KL infrared complex at 4.8, 8.0, 8.9,9.9, 10.4, 11.7, 12.5, 17.6, 18.1,20.0 and 22.0 um obtained with the 10-meter Keck I telescope, with typically 0.3 arcsec resolution at 12.5 um. The multi-wavelength observational image data is registered in a stack and a dust emission/extinction model is fitted to the resulting spectrum of each pixel to create a diffraction-limited 'image' of the temperature, opacity and luminosity of the emitting dust, as well as the circumstellar and line-of-sight dust extinction. New source structure, temperature, opacity and luminosity detail is seen in the vicinity of IRc2-IRc7. The model results are used to develop a more complete picture of the structure and energetics of the BN/KL, infrared complex.
Author
Infrared Radiation; Imaging Techniques; Data Acquisition; Star Formation

20040034079 Physics and Electronics Lab. TNO, The Hague, Netherlands
Key Components for Photonic Phased-Array Receivers (SKAI)
vanDijk, Raymond; June 2003; 27 pp.; In English
Contract(s)/Grant(s): A99/KM/645; TNO Proj. 015.27776
Report No.(s): TD-2001-0322; FEL-02-A001; Copyright; Avail: Other Sources

The overall goal of the project is to study the feasibility of the use of photonic components in phased-array receivers. For this purpose an analysis of photonic architectures for phased-array receivers has to be made. The photonic key parts have to be identified for the architecture of choice. Some of these integrated photonic subsystems were designed and developed. Measurements of RF characteristics as well as with the beam former embedded in a electronically steered receive antenna have been conducted; they showed good performance of the system.
Author
Phased Arrays; Photonics; Receivers

20040034088 Hawaii Univ., Honolulu, HI, USA
Search for Near-Earth Objects with Small Aphelion Distances
Tholen, David J.; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-12406; No Copyright; Avail: CASI; A01, Hardcopy

An essential component of our ability to efficiently find NEOs at small solar elongation is a focal reducer, whose construction is being separately funded by a grant from NSF. This focal reducer will increase the field of view of the 8k CCD mosaic camera from 19 arc min to about 32 arc min at the Cassegrain focus of the University of Hawaii 2.24-m telescope. As of January, all but one of the lenses for the focal reducer were in hand. The final lens had been delayed due to problems

with the availability of the rather exotic material out of which the manufacturer was to fabricate the lens. Perhaps as a result of their rush to deliver that final lens, it developed a crack during the annealing process at the manufacturer, thus they had to start over. The total delay in delivery of that last lens was nearly ten months, and therefore the focal reducer was not completed on schedule and could not be used on the telescope this semester. A postdoctoral research associate was recruited to handle the day-to-day operations. The closing date for applications was 2002 December 3 1, and seven were received. One applicant was not qualified, and two were marginal. Of the four qualified candidates, Fabrizio Bernardi stood out as being best qualified. He was a student of Andrea Carusi and had worked on the CINEOS project in Italy, which includes a component of searching for NEOs at small solar elongations.
Derived from text
Near Earth Objects; Aphelions; Construction; Fabrication; Lenses

20040034108 NASA Goddard Inst. for Space Studies, New York, NY, USA
Remote Sensing of Aerosol Optical and Microphysical Properties using Polarization and Lidar Techniques
Mishchenko, Michael; [2003]; 1 pp.; In English; NATO Advanced Study Institute on Photopolarimetry in Remote Sensing, 20 Sep. - 3 Oct. 2003, Yalta, Ukraine; No Copyright; Avail: Other Sources; Abstract Only

Tropospheric aerosols cause a substantial forcing of the terrestrial climate, but the magnitude of this forcing remains largely unknown. This explains the significant interest of the climate community to the prospect of measuring key aerosol properties from space using advanced remote sensing techniques. It has been known for a long time that polarization of the scattered light is much more sensitive to the aerosol microphysics than the scattered intensity. It is, therefore, not surprising that the most recent addition to the New Polar Orbiting Operational Environmental Satellite System (NPOESS) payload is the so-called Aerosol Polarimetry Sensor (APS). The main objective of this instrument is to measure the aerosol and cloud properties with accuracy and coverage sufficient for a reliable estimate of the direct and indirect aerosol forcings of climate. Accordingly, the first part of this lecture course will focus on describing the basic concept of the APS, the physical principles of polarization data analyses, and the results already obtained with an aircraft version of the APS. Polar stratospheric clouds (PSCs) represent another poorly understood aerosol component of the terrestrial atmosphere which affects the climate by supporting chemical reactions destroying the ozone layer. The high altitude of the PSCs and their predominant occurrence in high latitude and polar regions make it very difficult to study PSCs using conventional in situ techniques. Most of the information that we have about this type of clouds has been gathered using ground-based polarization lidars. The second part of the course will focus on explaining the physical principles of the polarization lidar technique and describing retrievals of PSC particle microphysical characteristics by converting I multispectral lidar measurements of the backscattered intensity and depolarization.
Author
Remote Sensing; Aerosols; Optical Properties; Troposphere; Ozonosphere

20040034171 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Alignment of the Grating Wheel Mechanism for a Ground-Based, Cryogenic, Near-Infrared Astronomy Instrument
Gutkowski, Sharon M.; Ohl, Raymond G.; Hylan, Jason E.; Hagopian, John G.; Kraft, Stephen E.; Mentzell, J. Eric; Connelly, Joseph A.; Schepis, Joseph P.; Sparr, Leroy M.; Greenhouse, Matthew A., et al.; [2003]; 12 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: CASI; A03, Hardcopy

We describe the population, optomechanical alignment, and alignment verification of near-infrared gratings on the grating wheel mechanism (GWM) for the Infrared Multi-Object Spectrometer (IRMOS). IRMOS is a cryogenic (80 K), principle investigator-class instrument for the 2.1 m and Mayall 3.8 m telescopes at Kitt Peak National Observatory, and a MEMS spectrometer concept demonstrator for the James Webb Space Telescope. The GWM consists of 13 planar diffraction gratings and one flat imaging mirror (58 x 57 mm), each mounted at a unique compound angle on a 32 cm diameter gear. The mechanism is predominantly made of Al 6061. The grating substrates are stress relieved for enhanced cryogenic performance. The optical surfaces are replicated from off-the-shelf masters. The imaging mirror is diamond turned. The GWM spans a projected diameter of approx. 48 cm when fully assembled, utilizes several flexure designs to accommodate potential thermal gradients, and is controlled using custom software with an off-the-shelf controller. Under ambient conditions, each grating is aligned in six degrees of freedom relative to a coordinate system that is referenced to an optical alignment cube mounted at the center of the gear. The local tip/tilt (Rx/Ry) orientation of a given grating is measured using the zero-order return from an autocollimating theodolite. The other degrees of freedom are measured using a two-axis cathetometer and rotary table. Each grating's mount includes a one-piece shim located between the optic and the gear. The shim is machined to fine align each

grating. We verify ambient alignment by comparing grating difractive properties to model predictions.
Author
Wheels; Alignment; Cathetometers; Cryogenics; Infrared Spectrometers; Microelectromechanical Systems

20040034218 Lawrence Livermore National Lab., Livermore, CA
Combined Advanced Finishing and UV-Laser Conditioning for Producing UV Damage Resistant Fused Silica Optics
Menapace, J. A.; Penetrante, B.; Golini, D.; Slomba, A.; Miller, P. E.; Nov. 2001; 20 pp.; In English
Report No.(s): DE2003-15004634; UCRL-JC-144396; No Copyright; Avail: Department of Energy Information Bridge
Laser induced damage initiation on fused silica optics can limit the lifetime of the components when used in high power UV laser environments. For example in inertial confinement fusion research applications, the optics can be exposed to temporal laser pulses of about 3-nsec with average fluences of 8 J/cm(sup 2) and peak fluences between 12 and 15 J/cm(sup 2). During the past year, we have focused on optimizing the damage performance at a wavelength of 355-nm (3(omega)), 3-nsec pulse length, for optics in this category by examining a variety of finishing technologies with a challenge to improve the laser damage initiation density by at least two orders of magnitude. In this paper, we describe recent advances in improving the 3(omega) damage initiation performance of laboratory-scale zirconium oxide and cerium oxide conventionally finished fused silica optics via application of processes incorporating magnetorheological finishing (MRF), wet chemical etching, and UV laser conditioning. Details of the advanced finishing procedures are described and comparisons are made between the procedures based upon large area 3(omega) damage performance, polishing layer contamination, and optical subsurface damage.
NTIS
Optics; Silica Glass

20040034241 NASA Marshall Space Flight Center, Huntsville, AL, USA
X-Ray Scattering Polarimeters: An Overview
Weisskopf, Martin C.; Elsner, Ronald F.; Ramsey, Brian D.; ODell, Steven L.; [2004]; 1 pp.; In English; X-Ray Polarimetry Workshop, 9-11 Feb. 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only
X-Ray polarimeters that exploit the polarization-dependence of Thompson scattering were among the first utilized to detect the linear polarization from an X-Ray source. We review the basic principals, survey and compare different approaches and contrast these with other techniques.
Author
X Ray Scattering; Polarimeters

20040034269 Lawrence Livermore National Lab., Livermore, CA
Blue and Green Light. Wavelength Scaling for NIF
Suter, L.; Miller, M.; Moody, J.; Kruer, W.; Aug. 21, 2003; 14 pp.; In English
Report No.(s): DE2003-15004916; UCRL-JC-151308; No Copyright; Avail: Department of Energy Information Bridge
Use of the National Ignition Facility to also output frequency-doubled (.53pm) laser light would allow significantly more energy to be delivered to targets as well as significantly greater bandwidth for beam smoothing This green light option could provide access to new ICF target designs and a wider range of plasma conditions for other applications. The wavelength scaling of the interaction physics is a key issue in assessing this green light option. Wavelength scaling theory based on the collisionless plasma approximation is explored, and some limitations associated with plasma collisionality are examined. Important features of the wavelength scaling are tested using the current data base, which is growing. It appears that, with modest restrictions, S3pm light couples with targets as well as .35pm light does. A more quantitative understanding of the beneficial effects of SSD on the interaction physics is needed for both S3pm and .35pm light.
NTIS
Plasmas (Physics); Collisionless Plasmas; Data Bases; Mathematical Models

20040034270 Lawrence Livermore National Lab., Livermore, CA
Core Temperature and Density Profiles from Multispectral Imaging of ICF Plasmas
Koch, J. A.; Barbee, T. W.; Dalhed, S.; Haan, S.; Izumi, N.; Aug. 26, 2003; 12 pp.; In English
Report No.(s): DE2003-15005089; UCRL-JC-155163; No Copyright; Avail: Department of Energy Information Bridge
We have developed a multiple monochromatic x-ray imaging diagnostic using an array of pinholes coupled to a multilayer Bragg mirror, and we have used this diagnostic to obtain unique multispectral imaging data of inertial- confinement fusion

implosion plasmas. Argon dopants in the fuel allow emission images to be obtained in the Ar He-b and Ly-b spectral regions, and these images provide data on core temperature and density profiles. We have analyzed these data to obtain quasi-three-dimensional maps of electron temperature and scaled electron density within the core for several cases of drive symmetry, and we observed a two-lobed structure evolving for increasingly prol2te-asymmetric drive. This structure is invisible in broad-band x-ray images. Future work will concentrate on hydrodynamics simulations for comparison with the data.
NTIS
Electron Energy; Mirrors; Electron Density (Concentration); Hydrodynamics; Plasmas (Physics)

20040034279 Lawrence Livermore National Lab., Livermore, CA
Electric Field Enhancement by Nodular Defects in Multilayer Coatings Irradiated at Normal and 45 Degree Incidence
Stolz, C. J.; Genin, F. Y.; Pistor, T. V.; Sep. 18, 2003; 16 pp.; In English
Report No.(s): DE2003-15005172; UCRL-JC-153466; No Copyright; Avail: Department of Energy Information Bridge
Calculations by DeFord demonstrated a standing-wave electric-field (SWEF) enhancement at normal incidence due to the nodular defect. Sawicki later calculated temperature rises and thermomechanical stresses due to this SWEF enhancement to generate a model of nodular ejection. In these calculations, the SWEF code was limited to calculations of rotationally-symmetric two-dimensional cases. Such codes limited the calculation to normal incidence cases and neglected polarization effects. Improvements in computational speed, memory and in finite-element codes have recently allowed three-dimensional calculations of cases at oblique incidence with polarization effects. Experimental studies have determined that the laser-induced damage threshold (LIDT) at nodular defects decreases as the seed diameter increases.
NTIS
Electric Fields; Defects; Coatings

20040034280 Lawrence Livermore National Lab., Livermore, CA
Optical Design Using an Expert System
Lerner, S. A.; Aug. 2003; 16 pp.; In English
Report No.(s): DE2003-15005176; UCRL-JC-154627; No Copyright; Avail: Department of Energy Information Bridge
We present, as a different perspective on optimization, an expert system for optimization of optical systems that can be used in conjunction with damped least squared methods to find minima for specific design forms. Expert system optimization differs from global optimization in that it preserves the basic structure of the optical system and limits its search for a minima to a relatively small portion of the design space. In general, the high density of local minima obscures the general trend of the merit function in the region of interest for systems with a large number of variables and constraints. Surprisingly, there may be a potential decrease of an order a magnitude in the merit function for a region of solution space. While global optimization is well-suited to identifying design forms of interest, expert system optimization can be used for in-depth optimization of such forms. An expert system based upon such techniques was used to obtain the winning entry for the 2002 IODC lens design problem. The expert system used is discussed along with other design examples.
NTIS
Expert Systems; Lens Design; Optical Equipment; Optimization

20040034281 Lawrence Livermore National Lab., Livermore, CA
Design and Testof Advanced Multi-Layer Dielectric Gratings for High Energy Petawatt
Molander, W.; Komashko, A.; Britten, J.; Jones, L.; Brown, C.; 2003; 10 pp.; In English
Report No.(s): DE2003-15005177; No Copyright; Avail: Department of Energy Information Bridge
In this paper we discuss recent work on the development of high damage threshold, high efficiency MLD (multilayer dielectric) diffraction gratings for use in high energy, petawatt laser systems. This effort involves a close integration between modeling, fabrication, and testing. The modeling work is used to identify grating designs that satisfy the constraints of high efficiency and low field enhancement which is a necessary condition for high damage threshold. Subscale MLD gratings for test are being fabricated in an advanced ion-etch machine we have recently built. The testing effort is being conducted in a dedicated laboratory. The laser beam used to test the samples is based on an OPCPA (optical parametric chirped-pulse amplifier) and a compressor that can provide pulse energies up to 50mJ with pulse lengths variable from 0. 3 - 20 ps. This test station is equipped with diagnostics to fully characterize both the spatial and temporal characteristics of the test beam at the plane of the sample. Initial results have demonstrated a dependence of damage threshold on incident angle that is in good

agreement with the field enhancement calculations. We have demonstrated a grating design with a damage threshold of 3J/cm2 and are investigating manufacturability and reproducibility issues as well.
NTIS
Gratings (Spectra); Laser Beams

20040034298 Lawrence Livermore National Lab., Livermore, CA
DPAL: A New Class of Lasers for CW Power Beaming at Ideal Photovoltaic Cell Wavelengths
Krupke, W. F.; Beach, R. J.; Payne, S. A.; Kanz, V. K.; Early, J. T.; Sep. 15, 2003; 18 pp.; In English
Report No.(s): DE2003-15005470; UCRL-CONF-155610; No Copyright; Avail: Department of Energy Information Bridge

The new class of diode pumped alkali vapor lasers (DPALs) offers high efficiency cw laser beams at wavelengths which efficiently couple to photovoltaic (PV) cells: silicon cells at 895 nm (cesium), and GaAs cells at 795 nm (rubidium) and at 770 nm (potassium). DPAL electrical efficiencies of 25-30% are projected, enabling PV cell efficiencies (approx)40% (Si) and (approx)60% (GaAs). Near-diffraction-limited DPAL device power scaling into the multi-kilowatt regime from a single aperture is projected.
NTIS
Continuous Wave Lasers; Laser Beams; Photovoltaic Cells; Alkalies; Vapors; Wavelengths; Laser Power Beaming

20040034721 Lawrence Livermore National Lab., Livermore, CA
Filamentation, Deflection, Scatter, and Crossed Beam Energy Transfer in high Temperature Hohlraums
Hinkel, D. E.; Suter, L. J.; Schneider, M. B.; Springer, P. T.; Langdon, A. B.; Sep. 04, 2003; 12 pp.; In English
Report No.(s): DE2003-15004920; UCRL-JC-152004; No Copyright; Avail: Department of Energy Information Bridge

High temperature hohlraums are reduced-scale targets shot at high power. The creation of such hot environments is crucial to material science studies under extreme conditions. A key ingredient in creating hot environments is to successfully couple the laser energy into the target. Maximum coupling is limited in high temperature hohlraums by laser-plasma interactions that occur outside the target (the target fills up on the time scale of the laser pulse). High temperature hohlraums shot at the Omega laser at the Laboratory for Laser Energetics (Rochester, NY) show reduced energy coupling. Comparison between experiments and radiation- hydrodynamic simulations show that as much as 40% of the incident energy is unaccounted for in the smaller targets, Laser-plasma interaction in such targets occur in a regime of high intensity, high density, and high electron temperature. Novel saturation mechanisms such as Brillouin re-scatter of Raman forward scatter have been predicted to exist in this regime. The interplay between filamentation/deflection and laser scatter is simulated and analyzed in this regime. Crossed beam energy transfer from the inner to the outer beams will further reduce the drive and these effects are incorporated into the fluid simulations as well. Particle-in-cell simulations of Raman scatter and MPP fluid simulation results will be presented. Initial fluid simulation results show dramatic filamentation. deflection and absorption along the outermost beams of the Omega laser.
NTIS
Hohlraums; Lasers; Energy Transfer; Laser Plasma Interactions; Plasmas (Physics)

20040034731 Lawrence Livermore National Lab., Livermore, CA
Lawrence Livermore National Laboratory ULTRA-350 Test Bed
Hopkins, D. J.; Wulff, T. A.; Carisle, K.; Apr. 2001; 12 pp.; In English
Report No.(s): DE2003-15005282; UCRL-JC-142090-REV-1; No Copyright; Avail: Department of Energy Information Bridge

LLNL has many in-house designed high precision machine tools. Some of these tools include the Large Optics Diamond Turning Machine (LODTM), Diamond Turning Machine no. 3 (DTM-3) and two Precision Engineering Research Lathes (PERL-1 and PERL-11). These machines have accuracy in the sub-micron range and in most cases position resolution in the couple of nanometers range. All of these machines are built with similar underlying technologies. The machines use capstan drive technology, laser interferometer position feedback, tachometer velocity feedback, permanent magnet (PM) brush motors and analog velocity and position loop servo compensation. The machine controller does not perform any servo compensation it simply computes the differences between the commanded position and the actual position (the following error) and sends this to a D/A for the analog servo position loop.
NTIS
Machine Tools; Servomechanisms; Interferometers

20040034827 Lawrence Livermore National Lab., Livermore, CA
Minimizing Fizeau Fringes during the Contact Printing of Diffraction Gratings
Ciarlo, D.; Rushford, M.; Kuzmenko, P.; Ge, J.; Apr. 27, 2001; 14 pp.; In English
Report No.(s): DE2003-15005386; UCRL-JC-142002; No Copyright; Avail: Department of Energy Information Bridge

An index matching fluid has been used to minimize the effect of interference fringes which develop when contact printing diffraction gratings on silicon wafers. These fringes are the result of interference effects when there is a small but uneven gap between the photomask and resist surface. They are especially troublesome when printing and etching large area, coarse diffraction gratings on the surface of silicon wafers and silicon disks.
NTIS
Gratings (Spectra); Silicon

20040035551 Ralcon Development Lab., Paradise, UT, USA
SHared Aperture Diffractive Optical Elements
Rallison, Richard D.; Pearson, Elroy; January 20, 2004; 33 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS5-02018
Report No.(s): Rept-8; No Copyright; Avail: CASI; A03, Hardcopy

All prototypes that can be delivered have been delivered and the quality of the 5 plex copies is good in spot aberration and size, in Bragg angle and in crosstalk but lacks required efficiency because of excessive scatter recorded in the master. The final 4 months of this contract were performed when conditions in the lab were too harsh to complete the extremely long exposures required while maintaining sufficient thermal stability. An improved master HOE will be shot and delivered when the weather is better. It will be a post contract activity at no extra charge to NASA made necessary by bad weather.
Derived from text
Diffractive Optics; Apertures; Optical Equipment

20040035627 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Procedures To Generate A Stable Night-Time Lights Mosaic-Image From DMSP/OLS Nocturnal Images Of 2002
Amaral, Silvana; SantAna, Sidnei Joao Siqueira; 2003; 36 pp.; In Portuguese; Original contains color and black and white illustrations
Report No.(s): INPE-9917-RPQ/748; Copyright; Avail: CASI; A03, Hardcopy

DMSP/OLS night-time satellite sensor imagery was originally designed for meteorological purposes. However, the high contrast between lighted and unlighted areas in the night-time imagery and the sensor's spatial resolution makes it a useful tool to identify regions of intense human activity. An actual DMSP time series mosaic image would provide data to detect and monitor forestry fires and to continue the studies about human activity. This paper describes the procedures developed to generate a stable night light image, from nocturnal DMSP/OLS individual images obtained from January to June, 2002. First, it was implemented the standard procedure, resulting an image whose values are percentages of night-time light occurrences free of cloud for each pixel. Then, some alternative procedures to detect stable night-light, like the sample restriction and the binomial distribution threshold, were suggested and tested over the original image data set. The resulting images were compared to each other considering the ability to detect urban settlements and the presence/absence of noise (anomalous and isolated lighted pixel). Finally, it is presented the algorithms implemented and the stable night-time light DMSP image generated for 2002.
Author
Satellite Imagery; Nocturnal Variations; Human Reactions; Statistical Distributions; Forest Management; Activity (Biology); Dmsp Satellites; Time Series Analysis

20040035653 NASA Marshall Space Flight Center, Huntsville, AL, USA
Genetic Algorithm Phase Retrieval for the Systematic Image-Based Optical Alignment Testbed
Rakoczy, John; Steincamp, James; Taylor, Jaime; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A reduced surrogate, one point crossover genetic algorithm with random rank-based selection was used successfully to estimate the multiple phases of a segmented optical system modeled on the seven-mirror Systematic Image-Based Optical Alignment testbed located at NASA's Marshall Space Flight Center.
Author
Alignment; Genetic Algorithms; Adaptive Optics; Imaging Techniques; Test Stands

20040035656 NASA Marshall Space Flight Center, Huntsville, AL, USA
Coherence Effects in Coupled Optical Resonators
Smith, David D.; [2003]; 1 pp.; In English; 34th Winter Colloquium on the Physics of Quantum Electronics, 4-8 Jan. 2004, Snowbird, UT, USA; No Copyright; Avail: Other Sources; Abstract Only

The coherent coupling between optical resonators leads to an effect analogous to lasing without inversion. In addition, lasing thresholds can be substantially decreased through the use of coupled resonators provided they are properly phased.
Author
Optical Resonators; Coherence; Coupled Modes; Lasing

20040035670 NASA Goddard Space Flight Center, Greenbelt, MD, USA
James Webb Space Telescope Ka-Band Trade
Gal-Edd, Jonathan; Luers, Ed; [2004]; 6 pp.; In English; IEEE Aerospace Conference Center, 6-13 Mar. 2004, Big Sky, MT, USA
Report No.(s): IEEE Paper 1129; No Copyright; Avail: CASI; A02, Hardcopy

In August 2003 James Webb Space Telescope (JWST) had its Initial Review Confirmation Assessment Briefing with NASA HQ management. This is a major milestone as the project was approved to proceed from Phase A to B, and NASA will commit funds for the project towards meeting its science goals from the Earth-Sun s Lagrange 2 (L2) environment. At this briefing, the Project was asked, 'to take another look' into using, the JPL s Deep Space Network (DSN) as the provider of ground stations and evaluate other ground station options. The current operations concept assumes S-band and X-band communications with a daily &hour contact using the DSN with the goal of transmitting over 250 Gigabit (Gb) of data to the ground. The Project has initiated a trade study to look at this activity, and we would like to share the result of the trade in the conference. Early concept trades tends to focus on the 'normal' operation mode of supporting telemetry (science and engineering), command and radio metrics. Entering the design phase, we find that we have the unique ranging requirement for our L2 orbit using alternating ground stations located in different hemispheres. The trade must also address emergency operations (which are covered when using the DSN). This paper describes the issues confronting this Project and how the DSN and the JWST Project are working together to find an optimized approach for meeting these issues. We believe this trade is of major interest for future Code S and other L2 missions in that JWST will set the standard.
Author
James Webb Space Telescope; Extremely High Frequencies; Radio Communication; Ground Stations; Ultrahigh Frequencies

20040035707 Lawrence Livermore National Lab., Livermore, CA
Summary of Synthetic Lap Polishing Experiments at LLNL, FY 1995
Nichols, M. A.; Nov. 2001; 10 pp.; In English
Report No.(s): DE2003-15005987; UCRL-JC-146026; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this research was to support the optics finishing development work for the NIF, the National Ignition Facility. One of the major expenses for the construction of NIF is the cost of finishing of the large aperture optics. One way to significantly reduce the cost of the project is to develop processes to reduce the amount of time necessary to polish the more than 3,000 amplifier slabs. These slabs are rectangular with an aspect ratio of more than twenty to one and are made of a very temperature sensitive glass, Nd doped phosphate laser glass. As a result of this effort, we could potentially reduce the time necessary to polish each surface of an amplifier from 20-30 hours of run time to under an hour to achieve the same removal and still maintain a flatness of between one to three waves concave figure. We also feel confident that we can polish rectangular thermally sensitive glass flat by use of temperature control of the polishing platen, pad curvature, slurry concentration with temperature control, pad rotation, and pressure; although further, larger scale experiments are necessary to gain sufficient confidence that such a procedure could be successfully fielded.
NTIS
Ignition; Polishing; Amplifiers; Synthetic Apertures; Optics

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040031620 Lawrence Livermore National Lab., Livermore, CA
NIF Cryogenic Target Systems Program Fiscal Year 2003 First Half Report
Bernat, T. P.; Aug. 01, 2003; 14 pp.; In English
Report No.(s): DE2003-15004887; UCRL-ID-155333; No Copyright; Avail: Department of Energy Information Bridge

The initial NIF Cryogenic Target Systems (NCTS) major milestone for FY03 was to complete the conceptual design and a Conceptual Design Report (CDR). Due to actual FY03 NCTS funds available, this milestone has been postponed to FY2004. Some effort toward the CDR and related development activities did continue in the area of methods for fuel-filling of both beryllium and polymer ignition capsules. This work was performed mainly at General Atomics in collaboration with LANL and LLNL.

NTIS
Targets; Ignition

20040031622 Lawrence Livermore National Lab., Livermore, CA
Experimental Studies of Simultaneous 351 nm and 527 nm Laser Beam Interactions in a Long Scalelength Plasma
Moody, J. D.; Divol, J.; Glenzer, S. H.; Mackinnon, A. J.; Aug. 22, 2003; 10 pp.; In English
Report No.(s): DE2003-15004888; UCRL-JC-152367; No Copyright; Avail: Department of Energy Information Bridge

We describe experiments investigating the simultaneous backscattering from 351 nm (3w) and 527 nm (2w) interaction beams in a long scalelength laser-produced plasma for intensities less than or equal to 1 x 10(sup l5) W/cm(sup 2). Measurements show comparable scattering fractions for both color probe beams. Time resolved spectra of stimulated Raman and Brillouin scattering (SRS and SBS) indicate the effects of laser intensity and smoothing as well as plasma composition and parameters on the scattering levels.

NTIS
Laser Beams; Plasmas (Physics); Beam Interactions

20040031640 Lawrence Livermore National Lab., Livermore, CA
Characterization of Non-LTE Gold Plasmas in Controlled Conditions with Finite Tr
Heeter, R. F.; Ford, M. E.; Fournier, K. B.; Froula, D. H.; MacKinnon, A. J.; Aug. 29, 2003; 10 pp.; In English
Report No.(s): DE2003-15005043; UCRL-JC-152362; No Copyright; Avail: Department of Energy Information Bridge

Understanding the charge state distribution of gold plasmas, especially in conditions far from local thermodynamic equilibrium ('non-LTE conditions'), is among the issues in ICF hohlraum physics research. Detailed models of these plasmas have historically disagreed by several charge states under a given set of conditions; simplified models in radiation-hydrodynamics codes disagree more. This impacts the accurate prediction of radiation coupling within the hohlraum. Nova laser data for uniform gold plasmas at T(sub e)=2.2 and T(sub r) <0.05 keV and additional data from plasmas inside hohlraums have not resolved all of the issues. Here we report experiments using the Omega laser to obtain data over a wider parameter space. Gold samples embedded in Be disks expand under direct laser heating to n(sub e) approximates 10(sup 21) cm (sup -3) with T(sub e) from 1 to 3 keV.

NTIS
Hohlraums; Plasmas (Physics); Charged Particles; Hydrodynamics

20040031642 Lawrence Livermore National Lab., Livermore, CA
Reduced Model of Kinetic Effects Related to the Saturation of Stimulated Brillouin Scattering
Divol, L.; Williams, E. A.; Cohen, B. I.; Langdon, A. B.; Lasinski, B. F.; Aug. 26, 2003; 12 pp.; In English
Report No.(s): DE2003-15005092; UCRL-JC-155169; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

Brillouin Effect; Kinetic Equations

20040031646 Lawrence Livermore National Lab., Livermore, CA
Laser-Driven Hydrodynamic Experiments in the Turbulent Plasma Regime: From Omega to NIF
Robey, H. F.; Miles, A. R.; Hansen, J. F.; Blue, B. E.; Drake, R. P.; Aug. 25, 2003; 12 pp.; In English
Report No.(s): DE2003-15005093; UCRL-JC-155300; No Copyright; Avail: Department of Energy Information Bridge

There is a great deal of interest in studying the evolution of hydrodynamic phenomena in high energy density plasmas that have transitioned beyond the initial phases of instability into a fully developed turbulent state. Motivation for this study arises both is fusion plasmas as well as in numerous astrophysical applications where the understanding of turbulent mixing is essential. Double-shell ignition targets, for example, are subject to large growth of short wavelength perturbations on both surfaces of the high-Z inner shell. These perturbations, initiated by Richtmyer-Meshkov and Rayleigh-Taylor instabilities, can transition to a turbulent state and will lead to deleterious mixing of the cooler shell material with the hot burning fuel.
NTIS
Plasmas (Physics); Turbulence; Ignition

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040031636 Lawrence Livermore National Lab., Livermore, CA
Superconducting High-Resolution X-Ray Spectrometers for Chemical State Analysis of Dilute Samples
Friedrich, S.; Drury, O. B.; Funk, T.; Sherrell, D.; Yachandra, V. K.; Sep. 02, 2003; 12 pp.; In English
Report No.(s): DE2003-15005013; UCRL-JC-155314; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
X Ray Spectrometers; Chemical Analysis; Superconductivity

20040034034 NASA Marshall Space Flight Center, Huntsville, AL, USA
Accuracy Evaluation of Electron-Probe Microanalysis as Applied to Semiconductors and Silicates
Carpenter, Paul; Armstrong, John; [2003]; 1 pp.; In English; 2004 Australian Conference on Microscopy and Microanalysis 18, 1-6 Feb. 2004, Geelong, Australia; No Copyright; Avail: Other Sources; Abstract Only

An evaluation of precision and accuracy will be presented for representative semiconductor and silicate compositions. The accuracy of electron-probe analysis depends on high precision measurements and instrumental calibration, as well as correction algorithms and fundamental parameter data sets. A critical assessment of correction algorithms and mass absorption coefficient data sets can be made using the alpha factor technique. Alpha factor analysis can be used to identify systematic errors in data sets and also of microprobe standards used for calibration.
Author
Accuracy; Electron Probes; Microanalysis; Semiconductors (Materials); Silicates

20040034221 National Renewable Energy Lab., Golden, CO
Low-Temperature, High-Throughput Process for Thin, Large-Grained Poly Si. Final Technical Report 24 May 1999 25 July 2003
Atwater, H. A.; Sep. 2003; 28 pp.; In English
Report No.(s): DE2003-15004719; NREL/SR-520-34816; No Copyright; Avail: Department of Energy Information Bridge

The overall project goal is to understand the fundamental gas phase, surface and interface science issues relevant to low temperature T < 600 degrees C synthesis of polycrystalline silicon films on low-cost (e.g., glass) substrates. This understanding will be used to delineate the path to break through existing barriers to high-rate synthesis of high-quality thin films for polycrystalline silicon photovoltaics applications. In this context, high quality refers to large grain size (> film thickness) and long (> film thickness) minority carrier diffusion length.
NTIS
Semiconducting Films; Photovoltaic Conversion; Diffusion Length; Grain Size; Silicon Films

20040034222 Lawrence Livermore National Lab., Livermore, CA

Materials Science Under Extreme Conditions of Pressure and Strain Rate

Remington, B. A.; Bazan, G.; Bringa, E.; Catural, M.; Edwards, M. J.; Mar. 27, 2003; 44 pp.; In English

Report No.(s): DE2003-15005361; UCRL-JC-149205; No Copyright; Avail: Department of Energy Information Bridge

Solid state dynamics experiments at very high pressures (P>> 10 GPa) and strain rates ((epsilon >>10(sup 5) s(sup -1)) have been demonstrated on high energy laser facilities, albeit over brief intervals of time and small spatial scales. We have developed two methods for driving samples to high pressures (10-100 GPa) at high strain rate (10(sup 6)-10(sup 8) s(sup -10)) in the solid state. One method uses a shockless compression technique, and the other uses multiple staged shocks. These drives are calibrated with VISAR measurements of the resulting compression wave. Deformation mechanisms are inferred under these conditions by characterizing recovered samples. Material strength at high pressures and strain rates is deduced by measuring the reduced growth of material perturbations at a hydrodynamically unstable interface. Microscopic lattice response is determined by time-resolved Bragg diffraction and x-ray absorption spectroscopy (EXAFS). Large-scale simulations, both at the continuum level using constitutive models and at the lattice level using molecular dynamics simulation, are used to interpret these integral experiments. We will review our progress in this new area of laser-based materials science research, then present a vision for carrying these solid-state experiments to much higher pressures, P>1000 GPa, on the National Ignition Facility (NIF) laser facility.

NTIS

Mechanical Properties; Strain Rate; High Pressure; Laser Beams

20040034740 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Could Zinc Whiskers Be Impacting Your Electronic Systems? Raise Your Awareness, Revision D

Sampson, Michael; Brusse, Jay; September 25, 2003; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

During the past several decades electrical short circuits induced by 'Zinc Whiskers' have been cited as the root cause of failure for various electronic systems (e.g., apnea monitors, telecom switches). These tiny filaments of zinc that may grow from some zinc-coated items (especially those coated by electroplating processes) have the potential to induce electrical shorts in exposed circuitry. Through this article, the authors describe a particular failure scenario attributed to zinc whiskers that has affected many facilities (including some NASA facilities) that utilized zinc-coated raised 'access' floor tiles and support structures. Zinc whiskers that may be growing beneath your raised floor have the potential to wreak havoc on electronic systems operating above the floor.

Author

Circuits; Short Circuits; Zinc Coatings; Electronic Equipment

20040035556 Lawrence Livermore National Lab., Livermore, CA

Quantum-Shell Corrections to the Finite-Temperature Thomas-Fermi-Dirac Statistical Model of the Atom

Aug. 04, 2003; 20 pp.; In English

Report No.(s): DE2003-15005406; UCRL-ID-154448; No Copyright; Avail: Department of Energy Information Bridge

Quantum-shell corrections are made directly to the finite-temperature Thomas-Fermi-Dirac statistical model of the atom by a partition of the electronic density into bound and free components. The bound component is calculated using analytic basis functions whose parameters are chosen to minimize the energy. Poisson's equation is solved for the modified density, thereby avoiding the need to solve Schroedinger's equation for a self-consistent field. The shock Hugoniot is calculated for aluminum: shell effects characteristic of quantum self-consistent field models are fully captures by the present model.

NTIS

Thomas-Fermi Model; Atoms; Mathematical Models

20040035586 Rice Univ., Houston, TX, USA

Application of Terahertz Quantum-Cascade Lasers to Semiconductor Cyclotron Resonance

Larrabee, Diane C.; Khodaparast, Giti A.; Tittel, Frank K.; Kono, Jun; Scalari, Giacomo; Ajili, Lassaad; Faist, Jerome; Beere, Harvey; Davies, Giles; Linfield, Edmund, et al.; Optics Letters; January 1, 2004; ISSN 0146-9592; Volume 29, No. 1, pp. 122-124; In English; Original contains black and white illustrations

Contract(s)/Grant(s): F49620-01-1-0543; MDA972-00-1-0034; NSF DMR-01-34058; NSF INT-02-21704; Copyright; Avail: Other Sources

Quantum-cascade lasers operating at 4.7, 3.5, and 2.3 THz have been used to achieve cyclotron resonance in InAs and InSb quantum wells from liquid-helium temperatures to room temperature. This represents one of the first spectroscopic

applications of terahertz quantum-cascade lasers. Results show that these compact lasers are convenient and reliable sources with adequate power and stability for this type of far-infrared magneto-optical study of solids. Their compactness promises interesting future applications in solid-state spectroscopy.
Author
Quantum Cascade Lasers; Semiconductors (Materials); Cyclotron Resonance; Liquid Helium

20040035622 Lawrence Livermore National Lab., Livermore, CA
Sputter Deposition of Metallic Sponges
Jankowski, A. F.; Hayes, J. P.; Jan. 18, 2002; 18 pp.; In English
Report No.(s): DE2003-15005443; UCRL-JC-145843; No Copyright; Avail: Department of Energy Information Bridge

Metallic films are grown with a sponge-like morphology in the as-deposited condition using planar magnetron sputtering. The morphology of the deposit is characterized by metallic continuity in three dimensions with continuous porosity on the sub-micron scale. The stabilization of the metallic sponge is directly correlated with a limited range for the sputter deposition parameters of working gas pressure and substrate temperature. This sponge-like morphology augments the features as generally understood in the classic zone models of growth for physical vapor deposits. Nickel coatings are deposited with working gas pressures up to 4 Pa and for substrate temperatures up to 1 100 K. The morphology of the deposits is examined in plan and in cross-section with scanning electron microscopy. The parametric range of gas pressure and substrate temperature (relative to absolute melt point) for the deposition processing under which the metallic sponges are produced appear universal for many metals, as for example, including gold, silver, and aluminum.
NTIS
Sputtering; Magnetron Sputtering; Morphology; Deposition; Metals

20040035628 Argonne National Lab., IL, IL, USA
Comments on the Operation of the RHIC CNI Polarimeters
Nov. 26, 2003; 18 pp.; In English
Report No.(s): DE2003-820527; ANL-HEP-TR-03-107; No Copyright; Avail: Department of Energy Information Bridge

The RHIC polarimeter data have exhibited behavior suggesting that systematic effects are present at a level comparable to the statistical uncertainty per run, or(approx) 4 x 10(sup 4): in the physics asymmetries and somewhat larger in the luminosity asymmetries. This corresponds to an error in the polarization of approximately(delta)P(approx)(+-) 0.03. Two effects are studied that might explain some of the observations, both based on detector rates. The results may explain the systematic effects in both the physics and the luminosity asymmetries. The first effect is caused by the presence of both a background and a good p+ C elastic scattering event in the same passage of a bunch through the polarimeter target. The second effect similarly depends on the presence of multiple p+ C elastic events from the same bunch. If these rate effects become large enough (or if(delta)P(approx)(+-) 0.03 continues and the beam polarization is less than 0. 60) they could prevent determination of the beam polarization to(delta)P/P=(+-) 5% unless a correction can be determined to the measured asymmetries.
NTIS
Polarimeters; Particle Accelerators; Field Theory (Physics); Bunching

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*.

20040034053 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA
Notes on Interface Growth Kinetics 50 Years after Burton, Cabrera and Frank
Chernov, A. A.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

This overview is devoted to some unresolved basic problems in crystal growth kinetics. The density wave approach to propagation of a spatially diffuse interface between a growing crystal and its simple (e.g., metallic) melt is discussed is Section 2. This approach allows for the calculation of kinetic coefficients and is an alternative to the localized interface concept in which each atom belongs to either a solid or a liquid. Sections 3 and 4 deals mainly with layer growth from solution. Mutual retardation of the growth steps via their bulk and d a c e diffusion fields is the major subject. The influence of solution flow

on step bunching (Section 4) suggests the essential influence of bulk diffusion on the surface morphology. The flow within the solution boundary layer enhances step-step interaction, influences the step bunching process and the resulting step pattern morphology on the growing surface. Recent experiments on the rates at which strongly polygonized steps on protein and small molecule crystals propagate during growth from solution are analyzed in Section 5 . We have shown that the step segments may be 'singular' and that 'one-dimensional nucleation' may be the rate limiting stage for the segments that are shorter or comparable in length to the thermodynamically equilibrium interlink distance. In this case, the reciprocal dependence of the segment propagation rate on the segment length that follow from the Gibbs-Thompson law, should be replaced by an abrupt switch from zero to a finite constant velocity. Until recently, the Kossel crystal remained the only model used in crystal growth theory. In such Kossel Gibbs-Thomson law, should be replaced by an abrupt switch &om zero to a finite constant velocity. crystals, all kinks at the steps are identical and the kink rate is a linear function of the supersaturation. In the non-Kossel crystals, there may be several kink configurations characterized by different geometries and energies. These configurations should appear in a specific sequence when each new lattice unit cell is filled. As a result of such a cooperative interaction within the unit cell, a non-linear dependence of the kink rate on the vapor pressure or solution concentration in excess over the equilibrium value should be expected.
Author
Crystal Growth; Kinetics; Diffusion; Wave Propagation; Kossel Pattern

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*.

20040034190 NASA Ames Research Center, Moffett Field, CA, USA
FAA Pilot Knowledge Tests: Learning or Rote Memorization?
Casner, Stephen M.; Jones, Karen M.; Puentes, Antonio; Irani, Homi; January 2004; 16 pp.; In English
Contract(s)/Grant(s): 728-20-30
Report No.(s): NASA/TM-2004-212814; IH-044; No Copyright; Avail: CASI; A03, Hardcopy

The FAA pilot knowledge test is a multiple-choice assessment tool designed to measure the extent to which applicants for FAA pilot certificates and ratings have mastered a corpus of required aeronautical knowledge. All questions that appear on the test are drawn from a database of questions that is made available to the public. The FAA and others are concerned that releasing test questions may encourage students to focus their study on memorizing test questions. To investigate this concern, we created our own database of questions that differed from FAA questions in four different ways. Our first three question types were derived by modifying existing FAA questions: (1) rewording questions and answers; (2) shuffling answers; and (3) substituting different figures for problems that used figures. Our last question type posed a question about required knowledge for which no FAA question currently exists. Forty-eight student pilots completed one of two paper-and-pencil knowledge tests that contained a mix of these experimental questions. The results indicate significantly lower scores for some question types when compared to unaltered FAA questions to which participants had prior access.
Author
Pilot Performance; Tests; Validity

20040034253 Defence Science and Technology Organisation, Edinburgh, Australia
An Overview of Crowd Control Theory and Considerations for the Employment of Non-Lethal Weapons
Grieger, Dion; August 2003; 55 pp.; In English
Report No.(s): DSTO-GD-0373; DODA-AR-012-860; Copyright; Avail: Other Sources

Many recent coalition operations have involved Operations Other Than War (OOTW). At various stages during these campaigns military forces have been confronted with crowds consisting of non-combatants, often including women and children, sometimes in addition to armed and violent militia. In campaigns such as these, there is a case for the use of nonlethal weapons to complement the existing range of traditional weapons in order to help bridge the gap between responding with lethal force, and not responding at all. Crowd behaviours and characteristics are important factors when considering the deployment of non-lethal weapons. This paper reviews literature on the characteristics of crowds and of the methods and

tactics used for crowd control. In addition there is a summary of the range of non-lethal weapons currently available and under development.
Author
Military Operations; Ordnance; Crowding; Social Factors

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040031641 Physics and Electronics Lab. TNO, The Hague, Netherlands
DCAM Documentation
Keijer, W.; July 2003; 128 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 015.32514
Report No.(s): TD-2002-0223; FEL-02-A315; Copyright; Avail: Other Sources

The Royal Netherlands Navy intends to design new ships that require minimum levels of manning. An important manning driver is damage control. Therefore the navy wants to investigate damage control options with reduced manning requirements. TNO-FEL has developed the fire fighting process model DCAM (Damage Control Assessment Model). The model is linked with the simulation model RESIST, developed by TNO-PML, using an HLA interface. This report describes the development of the DCAM model. This report also documents the implementation of the model so it can be used as a developers guide for further improvements of the DCAM simulation model. Additionally it describes the fire fighting process on board navy ships (scenarios) and it provides an evaluation of the modelling tool (IPME) used to construct the DCAM simulation model.
Author
Fire Fighting; Ships; Damage

20040033917 Massachusetts Inst. of Tech., Cambridge, MA, USA
SDM Virtualness Project
Lim, Christopher Yit-Seong; Klein, Janice; February 27, 2004; 13 pp.; In English
Contract(s)/Grant(s): NAG5-121268; No Copyright; Avail: CASI; A03, Hardcopy

In the summer of 2001, NASA and Ford Motor Company co-sponsored a research project aimed at improving the education process and application of lessons learned through distant education. The System Design & Management Program (SDM) was used as a laboratory for improving distance learning capabilities. The research project was a follow up to previous research on globally dispersed teams.
Derived from text
Research Management; Education

20040034254 Johns Hopkins Univ., Baltimore, MD, USA
Cooperative Research in High Energy Astrophysics between JHU and GSFC
Vishniac, Ethan; 2004; 7 pp.; In English
Contract(s)/Grant(s): NCC5-447; No Copyright; Avail: CASI; A02, Hardcopy

This grant was awarded to establish and support cooperative research programs between the Center of Astrophysical Sciences (CAS) at the Johns Hopkins University and the Laboratory for High Energy Astrophysics (LHEA) at the NASA/Goddard Space Flight Center (GSFC). The goals o f the program are to facilitate, encourage and initiate: (1) sharing of resources, knowledge and expertise in the general astrophysics, and relevant databases; (2) new collaborations and projects between the two institutions and its scientists, (3) training and mentoring of JHU students and junior researchers by way of connecting them with appropriate researchers and experts at the LHEA.
Derived from text
Research; Astrophysics

20040034744 NASA Ames Research Center, Moffett Field, CA, USA
The Characteristics of Project Managers: An Exploration of Complex Projects in the National Aeronautics and Space Administration
Mulenburg, Gerald M.; December 2000; 88 pp.; In English
Contract(s)/Grant(s): JOK3662M
Report No.(s): NASA/TP-2000-209593; A-0003812; No Copyright; Avail: CASI; A05, Hardcopy

Study of characteristics and relationships of project managers of complex projects in the National Aeronautics and Space Administration. Study is based on Research Design, Data Collection, Interviews, Case Studies, and Data Analysis across varying disciplines such as biological research, space research, advanced aeronautical test facilities, aeronautic flight demonstrations, and projects at different NASA centers to ensure that findings were not endemic to one type of project management, or to one Center's management philosophies. Each project is treated as a separate case with the primary data collected during semi-structured interviews with the project manager responsible for the overall project. Results of the various efforts show some definite similarities of characteristics and relationships among the project managers in the study. A model for how the project managers formulated and managed their projects is included.
Author
NASA Programs; Project Management; Management Methods; Methodology

20040034794 NASA, Washington, DC, USA
Path to a Research Plan
Chiaramonte, Fran; Results of the Workshop on Two-Phase Flow, Fluid Stability and Dynamics: Issues in Power, Propulsion, and Advanced Life Support Systems; December 2003, pp. 45-59; In English; See also 20040034793; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation discusses the status and goals for the NASA OBPR Physical Science Research Program. The following text was used to summarize the presentation. The OBPR Physical Sciences Research program has been comprehensively reviewed and endorsed by National Research Council. The value and need for the research have been re-affirmed. The research program has been prioritized and resource re-allocations have been carried out through an OBPR-wide process. An increasing emphasis on strategic, mission-oriented research is planned. The program will strive to maintain a balance between strategic and fundamental research. A feasible ISS flight research program fitting within the budgetary and ISS resource envelopes has been formulated for the near term (2003-2007). The current ISS research program will be significantly strengthened starting 2005 by using discipline dedicated research facility racks. A research re-planning effort has been initiated and will include active participation from the research community in the next few months. The research re-planning effort will poise PSR to increase ISS research utilization for a potential enhancement beyond ISS IP Core Complete. The Physical Sciences research program readily integrates the cross-disciplinary requirements of the NASA and OBPR strategic objectives. Each fundamental research thrust will develop a roadmap through technical workshops and Discipline Working Groups (DWGs). Most fundamental research thrusts will involve cross-disciplinary efforts. A Technology Roadmap will guide the Strategic Research for Exploration thrust. The Research Plan will integrate and coordinate fundamental Research Thrusts Roadmaps with the Technology Roadmap. The Technology Roadmap will be developed in coordination with other OBPR programs as well as other Enterprise (R,S,M,N). International Partners will contribute to the roadmaps and through research coordination. The research plan will be vetted with the discipline working groups, the BPRAC subcommittees, and with the BPRAC. Recommendations from NRC past and current committees will be implemented whenever appropriate.Proposed theme element content will be 'missionized' around planned content and potential new projects (facilities, modules, initiatives) on approximately a five-year horizon, with the approval of PSRD management. Center/science working group teams will develop descriptions of 'mission' objectives, value, and requirements. Purpose is to create a competitive environment for concept development and to stimulate community ownership/advocacy. Proposed theme elements reviewed and approved by PSRD management. Strawman roadmaps for themes developed. Program budget and technology requirements verified. Theme elements are prioritized with the input of advisory groups. Integration into program themes (questions) and required technology investments are defined by science and technology roadmaps. Review and assessment by OBPR management.
Derived from text
NASA Programs; Research and Development; Mission Planning

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*.

20040031645 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Modeling and Assumptions for Developing a Technical Target Analysis for the 120 mm Mortar Ammunition
Doup, P. W.; May 2003; 30 pp.; In Dutch
Contract(s)/Grant(s): A01/KL/4UF; TNO Proj. 014.13000
Report No.(s): PML-2003-A49; TD-2002-0223; Copyright; Avail: Other Sources

One of the goals of the Advanced Fire Support Information System - Batallion (AFSIS-Bn), which is being developed by the Royal Netherlands Army, is the generation of a Technical Target Analysis (TTA) for the 120 mm mortar ammunition. The TTA shows the user the amount of ammunition which is required to neutralize a certain percentage of target elements, given the operational conditions like number of mortars, firing range, target size, et cetera. This report describes the methodology and the assumptions on which the generation of a TTA is based.
Author
Targets; Artillery; Information Systems

20040031741 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Burst Statistics Using the Lag-Luminosity Relationship
Band, D. L.; Norris, J. P.; Bonnell, J. T.; [2003]; 4 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Using the lag-luminosity relation and various BATSE catalogs we create a large catalog of burst redshifts, peak luminosities and emitted energies. These catalogs permit us to evaluate the lag-luminosity relation, and to study the burst energy distribution. We find that this distribution can be described as a power law with an index of alpha = 1.76 +/- 0.05 (95% confidence), close to the alpha = 2 predicted by the original quasi-universal jet model.
Author
Red Shift; Catalogs (Publications); Gamma Ray Bursts

20040031782 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Metadata Element Set for Project Documentation
Hodge, Gail; Templeton, Clay; Allen, Robert B.; May 22, 2003; 7 pp.; In English; Dublin Core 2003, 28 Sep. - 2 Oct. 2003, Seattle, WA, USA
Contract(s)/Grant(s): NAS5-01161; No Copyright; Avail: CASI; A02, Hardcopy

Abstract NASA Goddard Space Flight Center is a large engineering enterprise with many projects. We describe our efforts to develop standard metadata sets across project documentation which we term the 'Goddard Core'. We also address broader issues for project management metadata.
Author
Data Management; Project Management; Standardization

20040033963 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Standardization Activities in the Content Reference Forum
Yamashita, Hiroyuki; Minami, Kenichi; Horioka, Tsutomu; NTT Technical Review, Volume 1, No. 9; December 2003, pp. 53-55; In English; See also 20040033955; Copyright; Avail: Other Sources

Standardization of a framework for reliable content commerce in a peer-to-peer environment has started. The framework will provide information about how to purchase content and about terms and conditions for using it, as well as rewards for referrers who introduce the content to others. There has been discussion about an experiment to be conducted at the end of 2003.
Author
Commerce; Standardization; Information Transfer

20040034071 Physics and Electronics Lab. TNO, The Hague, Netherlands
Information for Handling Differently Marked Documents in Operational ICT-Infrastructure
Coolen, R.; Veugen, P. J. M.; Luiijf, H. A. M.; September 2003; 51 pp.; In Dutch
Contract(s)/Grant(s): V909; TNO Proj. 015.31952/01.02
Report No.(s): TD-2003-0049; FEL-03-A091; Copyright; Avail: Other Sources

Within the operational C3I environment of the Dutch ministry of Defense, an information security solution is needed for handling documents with different classification levels and markings, preferably on the same ICT infrastructure. TNO has been invited to indicate the direction for a solution from a technical point of view, which could satisfy the prevailing policy. In this report TNO explains the concepts for handling differently marked documents within operational ICT environments, and the limiting conditions that have to be determined. The interviews that were held with the concerned parties gave insufficient insight in the specific limiting conditions for the C3I environment. Based on a number of internationally accepted security operating modes and available products, several technical solution directions are compared for handling differently marked

documents. When the limiting conditions for the C3I environment are determined, one of these directions could be worked out to a suitable solution.
Author
Security; Documents; Classifications

20040034086 NASA Ames Research Center, Moffett Field, CA, USA
Drinking from the Fire Hose: Why the Flight Management System Can Be Hard to Train and Difficult to Use
Sherry, Lance; Feary, Michael; Polson, Peter; Fennell, Karl; July 2003; 45 pp.; In English
Contract(s)/Grant(s): 727-05-20
Report No.(s): NASA/TM-2003-212274; IH-043; No Copyright; Avail: CASI; A03, Hardcopy

The Flight Management Computer (FMC) and its interface, the Multi-function Control and Display Unit (MCDU) have been identified by researchers and airlines as difficult to train and use. Specifically, airline pilots have described the 'drinking from the fire-hose' effect during training. Previous research has identified memorized action sequences as a major factor in a user s ability to learn and operate complex devices. This paper discusses the use of a method to examine the quantity of memorized action sequences required to perform a sample of 102 tasks, using features of the Boeing 777 Flight Management Computer Interface. The analysis identified a large number of memorized action sequences that must be learned during training and then recalled during line operations. Seventy-five percent of the tasks examined require recall of at least one memorized action sequence. Forty-five percent of the tasks require recall of a memorized action sequence and occur infrequently. The large number of memorized action sequences may provide an explanation for the difficulties in training and usage of the automation. Based on these findings, implications for training and the design of new user-interfaces are discussed.
Author
Airline Operations; Control Equipment; Display Devices; Education; Flight Management Systems

20040034291 Lawrence Livermore National Lab., Livermore, CA
Using Fport on Windows NT to Map Applications to Open Ports
Henson, T. J.; Apr. 2001; 12 pp.; In English
Report No.(s): DE2003-15005330; UCRL-ID-143357; No Copyright; Avail: Department of Energy Information Bridge

To develop defense-in-depth computer security, an understanding of various vulnerabilities must be realized before a protection strategy is developed. One element to minimize vulnerabilities is to develop computer security policies, and these policies must be in practice. In addition, risk assessments should be performed, and the highest risk-factor vulnerabilities must be eliminated promptly. A commonly accepted computer security policy usually starts with a firewall being established at the company's Internet connection. A next step could be host scanning or network intrusion detection systems within the organization. Also for consideration is 'backdoor' access to the network via modem connections from other networks. Policies should extend to routine backups for critical data. Additional protection can be installed with host-based intrusion detection systems to protect against the 'insider threat' or access through the firewall. However, to establish an effective host-based intrusion detection system, knowledge of the services and applications that open ports on the system is a necessity.
NTIS
Ports; Computer Information Security; Detection; Protection

20040034292 Lawrence Livermore National Lab., Livermore, CA
Testing a Variety of Encryption Technologies
Henson, T. J.; Apr. 2001; 10 pp.; In English
Report No.(s): DE2003-15005331; UCRL-ID-143356; No Copyright; Avail: Department of Energy Information Bridge

Review and test speeds of various encryption technologies using Entrust Software. Multiple encryption algorithms are included in the product. Algorithms tested were IDEA, CAST, DES, and RC2. Test consisted of taking a 7.7 MB Word document file which included complex graphics and timing encryption, decryption and signing. Encryption is discussed in the GIAC Kickstart section: Information Security: The Big Picture - Part VI.
NTIS
Words (Language); Images

20040034293 Lawrence Livermore National Lab., Livermore, CA
Distortion Corrections for the Many Beam Fabry Perot Velocimeter
Mar. 2001; 30 pp.; In English
Report No.(s): DE2003-15005332; UCRL-ID-143225; No Copyright; Avail: Department of Energy Information Bridge

Graphical curves and text tables are presented that map out time and space distortions for data obtained from film records of the Many Beam Fabry Perot Velocimeter. Effective distortion corrections extracted from these mappings can be applied to upcoming velocimetry experiments, but only with limited success over periods of a year or more into the future. A method of using three fiducials to provide fresh time and space distortion data on each film record is presented as a more reliable procedure to correct distortions to an acceptable level of accuracy.
NTIS
Velocity Measurement; Correction; Distortion

20040034743 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Technology Transfer/Commercialization Report 2002
2002; 29 pp.; In English; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV
Contents include the following: 1. Technology opportunities and successes in 2002: Hilbert-Huang transform. New sensors via sol-gel-filled fiber optics. Hierarchical segmentation software. 2. Activity in 2002: encouraging researcher involvment. 10th annual new technology reporting award program. Commercial technology development program. 3. Inventorying new technologies: Sensors and detectors. Environmental systems. Information systems. Guidance, navigation, and control. Thermal and cryogenics. Optics. Patenting Goddard technologies. Striking gold with NASA technology transfer.
CASI
Technology Transfer; Commercialization; Sol-Gel Processes; Information Systems

20040034751 Lawrence Livermore National Lab., Livermore, CA
Data Mining for Security Information: A Survey
Brugger, S. T.; Kelley, M.; Sumikawa, K.; Wakumoto, S.; Apr. 2001; 14 pp.; In English
Report No.(s): DE2003-15005288; UCRL-JC-143464; No Copyright; Avail: Department of Energy Information Bridge
This paper will present a survey of the current published work and products available to do off-line data mining for computer network security information.
NTIS
Data Mining; Security

20040034761 NVI, Inc., Greenbelt, MD, USA
Research and Development in Very Long Baseline Interferometry (VLBI)
Himwich, William E.; March 09, 2004; 29 pp.; In English
Contract(s)/Grant(s): NAS5-01127; 926-01-03
Report No.(s): Rept-0801; No Copyright; Avail: CASI; A03, Hardcopy
Contents include the following: 1.Observation coordination. 2. Data acquisition system control software. 3. Station support. 4. Correlation, data processing, and analysis. 5. Data distribution and archiving. 6. Technique improvement and research. 7. Computer support.
CASI
Data Processing; Data Acquisition; Coordination

20040035643 Lawrence Livermore National Lab., Livermore, CA
AMRSim: An Object-Oriented Performance Simulator for Parallel Adaptive Mesh Refinement
Jan. 08, 2001; 12 pp.; In English
Report No.(s): DE2003-15005479; UCRL-JC-141940; No Copyright; Avail: Department of Energy Information Bridge
Adaptive mesh refinement is complicated by both the algorithms and the dynamic nature of the computations. In parallel the complexity of getting good performance is dependent upon the architecture and the application. Most attempts to address the complexity of AMR have lead to the development of library solutions, most have developed object-oriented libraries or frameworks. All attempts to date have made numerous and sometimes conflicting assumptions which make the evaluation of performance of AMR across different applications and architectures difficult or impracticable. The evaluation of different approaches can alternatively be accomplished through simulation of the different AMR processes. In this paper we outline our research work to simulate the processing of adaptive mesh refinement grids using a distributed array class library (P++).
NTIS
Object-Oriented Programming; Simulators; Grid Refinement (Mathematics); Algorithms

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*.

20040031718 NASA Glenn Research Center, Cleveland, OH, USA
Observation of Dust Stream Formation Produced by Low Current, High Voltage Cathode Spots
Foster, John E.; January 2004; 24 pp.; In English
Contract(s)/Grant(s): WBS 22-274-00-01-07
Report No.(s): NASA/TM-2004-212725; E-14249; No Copyright; Avail: CASI; A03, Hardcopy

Macro-particle acceleration driven by low current, high voltage cathode spots has been investigated. The phenomenon was observed to occur when nanometer and micrometer-sized particles in the presence of a discharge plasma were exposed to a high voltage pulse. The negative voltage pulse initiates the formation of multiple, high voltage, low current cathode spots which provides the mechanism of actual acceleration of the charged dust particles. Dust streams generated by this process were detected using laser scattering techniques. The particle impact craters observed at the surface of downstream witness badges were documented using SEM and light microscopy.
Author
Cathodes; High Voltages; Low Currents; Micrometeoroids; Dust; Plasmas (Physics)

20040034017 NASA Marshall Space Flight Center, Huntsville, AL, USA
When Earth Songs Filled the Void of Space
Gallagher, D. L.; [2004]; 1 pp.; In English; Birmingham Astronomical Society Meeting, 20 Jan. 2004, Birmingham, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

What we think about space changed dramatically during the 1950's and early 60's. This story, like perhaps most stones about big changes in how scientists think about nature, involves tribulation, risk talung, and a renewal of the scientific method. What do you think about space, that unimaginably large region between planets and stars? Some of the people, their ideas, and how science often works will be discussed during this presentation.
Author
Evolution (Development); Space Exploration

20040034238 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Science Goal Driven Automation for NASA Missions: The Science Goal Monitor
Korathkar, Anuradha; Jones, Jeremy; Jung, John; Grosvenor, Sandy; [2003]; 2 pp.; In English; AAAI Sumposium on Interaction Between Humans and Autonomous Sys. over Extended Operations, 22-24 Mar. 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Infusion of automation technologies into NASA s future missions will be essential not only to achieve substantial reduction in mission operations staff and costs, but also in order to both effectively handle an exponentially increasing volume of scientific data and to successfully meet dynamic, opportunistic scientific goals and objectives. Current spacecraft operations cannot respond to science driven events, such as intrinsically variable or short-lived phenomena in a timely manner. For such investigations, we must teach our platforms to dynamically understand, recognize, and react to the scientists goals. While much effort has gone into automating routine spacecraft operations to reduce human workload and hence costs, applying intelligent automation to the science side, i.e., science data acquisition, data analysis and reactions to that data analysis in a timely and still scientifically valid manner, has been relatively under-emphasized.
Author
Data Acquisition; NASA Programs; Automation

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040031686 Helsinki Univ. of Technology, Kylmaelae
Connections Between Millimeter Continuum Variations and VLBI Structure in 27 AGN
Savolainen, T.; Wiik, K.; Valtaoja, E.; Jorstad, S. G.; Marscher, A. P.; 2003; 20 pp.
Report No.(s): PB2004-102771; HUT-MET-38; Copyright; Avail: National Technical Information Service (NTIS)

We compare total flux density variations in 27 gamma-ray blazers with structural changes in their parsec-scale jets using multi-epoch VLBA observations at 22 and 43 GHz together with data from the Metsahovi quasar monitoring program at 22 and 37 GHz. There is a clear connection between total flux density outbursts and VLBI components emerging into the jet. For essentially every new moving VLBI component, there is a coincident total flux density flare, with evolution similar to that of the component. Furthermore, extrapolated ejection times of the new VLBI components correspond to the beginnings of associated flares. Our results suggest that it is possible to explain all the radio variations as shocks propagating down the jet. A large fraction of the shocks grow and decay within the innermost few tenths of a millisecond and therefore we see them only as 'core flares' in the VLBI images. However, with present data we cannot exclude the possibility that the core itself also brightens (and thus contributes to the flare) as a shock passes through it.
NTIS
Very Long Base Interferometry; Flux Density; Millimeter Waves

20040033371 Edinburgh Univ., UK
Taking the Measure of the Universe: Cosmology from the WMAP Mission
Hinshaw, Gary F.; [2003]; 1 pp.; In English; Particle Physics Seminar, 4 Jul. 2003, Edinburgh, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

The data from the first year of operation of the Wilkinson Microwave Anisotropy Probe (WMAP) satellite provide the first detailed full sky map of the cosmic microwave background radiation. The anisotropy in the radiation temperature provides a wealth of cosmological information, including the age of the universe, the epoch when the first stars formed, and the overall composition of baryonic matter, dark matter, and dark energy. The results also provide constraints on the period of inflationary expansion in the very first moments of time. These and other aspects of the mission will be discussed. The WMAP satellite was built in a close partnership between Princeton University and the Goddard Space Flight Center.
Author
Data Acquisition; Microwave Anisotropy Probe; Cosmic Microwave Background Radiation

20040033943 NASA Marshall Space Flight Center, Huntsville, AL, USA
The X-ray Polarimetry Explorer (XPE)
Ramsey, Brian; [2004]; 1 pp.; In English; X-Ray Polarimetry Conference, 9-11 Feb. 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We present details of a Thomson scattering polarimeter suitable for a small-explorer- class mission. Termed XPE, for X-Ray Polarimetry Explorer, the instrument consists of a beryllium scattering cone surrounded by an annular multiwire proportional counter which registers the energy and position of scattered source photons. The polarimeter is sensitive over an energy range of 7-27 keV and will achieve 3% minimum detectable polarization of Her X-1 in a 1/2-day observation, and cover a 30-target core observation program, at the same sensitivity level, in approximately 8 months.
Author
Polarimetry; X Rays; Proportional Counters; Beryllium; Polarimeters

20040034009 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Spectroscopy of Low Mass X-Ray Binaries: New Insights into Accretion
DilVrtilek, Saeqa; Mushotsky, Richard, Technical Monitor; March 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10070; No Copyright; Avail: CASI; A01, Hardcopy

This project is to observe two low mass X-ray binaries, chosen for their X-ray brightness, low column density, and diversity of accretion behavior. The high spectral resolution of the RGS, the broad energy range and tremendous collecting power of EPIC, and simultaneous optical monitoring with the OM are particularly well-suited to these studies. The second of two objects was observed on September of 2002. Data analysis for both observation has been completed: an investigation of the physical conditions of the emitting gas using emission and recombination line diagnostics to determine temperatures, densities, elemental abundances, and ionization structure. A study of behavior of the emission features as a function of binary orbit shows modulated behavior in one of the systems. A paper on 'High-resolution observations of low-mass X-ray binaries' is near completion. The paper includes observations with the Chandra HETG that are not yet completed.
Author
X Ray Binaries; Brightness; High Resolution; Deposition

20040034030 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Origin and Evolution of Deep Plasmaspheric Notches
Gallagher, D.; Adrian, M.; Liemohn, M.; January 2004; 1 pp.; In English; Inner Magnetosphere Interactions Workshop, 2-7 Feb. 2004, Yosemite, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Deep plasmaspheric notches can extend over more than 2 RE and 3 hours MLT in the magnetic equatorial plane. They can last for days and exhibit varying structure. In this presentation, the low L-shell portion of the recovery-time plasmaspheric convection plume will be explored as the source for these deep evacuations in density. Interactions with the ring current will be explored as the source of features observed in these density depletions.
Author
Notches; Plasmasphere; Plumes; Convection

20040034046 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Star Formation History of Orion and its Environs
Calvet, Nuria; February 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10545; No Copyright; Avail: CASI; A01, Hardcopy

During this period of performance, we have obtained the following observations and carried out the analysis of the Orion associations itemized below. 1. Quest Optical Photometry: The photometric survey carries out with the Quest camera is finished. The strips at declinations +1 degree and -1 degree have already been processed. Photometry for a total of around 400,000 stars was obtained in these two strips with the Quest camera pipeline. Around 24,000 variables were picked out of this total by our variability software. Of these, around 2,500 stars fall above the main sequence and so were picked as candidates for spectroscopic follow-up. 2. Slit spectroscopy of bright candidates: Spectra for some 800 candidate PMS stars were obtained with the FAST spectrograph at the SAO 1.5m telescope in Mt. Hopkins. The spectra are being analyzed; 300 stars have been confirmed as young. 3. Multifiber spectroscopy: The first test of the multifiber spectrograph Hectoechelle were carried out in December 2003. One field of the Orion Nebula Cluster was observed with Hectochelle at three wavelength settings. A total of 157 spectra were obtained. Of these, 63 stars have been confirmed as Classical T Tauri stars, and 36 additional stars need further follow up. A paper is in preparation. 4. UBVRI photometry: We were granted time with the 4-shooter CCD Mosaic Camera at the SAO 1.2m telescope, to obtain UBVRI photometry of a subset of 53 newly identified T Tauri stars in the strips centered at DEC=-1 and +l. This sample is composed of strong Halpha emitting PMS stars (Classical T Tauri stars) located mostly in the Orion OB l b association, around the Orion Belt area. We have estimated mass accretion rates for 22 for these stars using the U photometry and the calibration of Gullbring et al. (1998), and found it to be similar to that of young stars in associations of similar age. 5. Near and mid-IR photometry: During the winter of 2003, we used the IR Camera on the SAO 1.2m telescope, to obtain L- band photometry of a set of the newly identified Orion OB l a and l b stars, in order to look for IR excess emission coming from the hotter inner parts of circumstellar disks. These data is being combined with the GEMINI/OSCIR 10 micron photometry obtained during 2002 and the mass accretion rates to determine the properties of disks in Ori lb. A paper is presently on preparation.
Author
Star Formation; Orion Nebula; Photometry; Spectroscopy; Star Clusters; CCD Cameras

20040034187 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Kepler Mission to Detect Earth-like Planets
Kondo, Yoji; [2002]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Kepler Mission to detect Earth-like planets in our Milky Way galaxy was approved by NASA in December 2001 for a 4-5 year mission. The launch is planned in about 5 years. The Kepler observatory will be placed in an Earth-trailing orbit. The unique feature of the Kepler Mission is its ability to detect Earth-like planets orbiting around solar-type stars at a distance similar to that of Earth (from our Sun); such an orbit could provide an environment suitable for supporting life as we know it. The Kepler observatory accomplishes this feat by looking for the transits of planetary object in front of their suns; Kepler has a photometric precision of 10E-5 (0.00001) to achieve such detections. Other ongoing planetary detection programs (based mostly on a technique that looks for the shifting of spectral lines of the primary star due to its planetary companions' motions around it) have detected massive planets (with masses in the range of Jupiter); such massive planets are not considered suitable for supporting life. If our current theories for the formation of planetary systems are valid, we expect to detect about 50 Earth-like planets during Kepler's 4-year mission (assuming a random distribution of the planetary orbital inclinations with respect to the line of sight from Kepler). The number of detection will increase about 640 planets if the planets to be detected are Jupiter-sized.
Author
Detection; Milky Way Galaxy; Planetary Systems; Earth (Planet); Space Missions; Orbital Mechanics

20040034193 Bohan (Walter A.) Co., Park Ridge, IL, USA, National Environmental Satellite Service, Washington, DC, USA

TIROS Cloud Free Atlas

Popham, Robert W., Editor; Baliles, Maurice, Editor; January 1967; 43 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Highly reflective terrestrial features seen in TV photographs from weather satellites have the same apparent brightness as many cloud features, and for this reason the two are often confused. Satellite picture interpretation requires that salt flats, sandy deserts, coral reefs, ice, snow, and other such features be properly identified. The highly reflective deserts, particularly those in New Mexico, Nevada, and Utah offer some difficulty to the unskilled interpreter. Snow cover, particularly in the central plains of the USA, is especially difficult to distinguish from clouds, even for the relatively experienced interpreter. Ice, although somewhat of a problem, is not quite as difficult to distinguish from clouds as is snow cover over the U.S., mainly because of its restriction by natural geographic boundaries. In order to properly identify highly reflective surface features one must learn to recognize their shape, appearance, and general characteristics.

Author

Brightness; Flats (Landforms); Ice; Images; Shapes; Coral Reefs; Maps

20040034214 Missouri Univ., MO, USA

Coronal Activity in Low-Mass Pre-Main Sequence Stars: NGC 2264

Tebbe, H. J.; Patten, B. M.; [2000]; 1 pp.; In English; AAS 195th Meeting, January 2000

Contract(s)/Grant(s): NAG5-8120; Copyright; Avail: Other Sources; Abstract Only

We present the preliminary results of an analysis of ROSAT images in the region of the populous young (age approx. 3 Myr) star-forming region NGC 2264. The cluster was imaged with the ROSAT HRI in two sets of pointings -- one set near the central region of the cluster, centered on the star LW Mon, and the other set in the southern part of the cluster, centered near the star V428 Mon, just south of the Cone Nebula. In total 113 unique X-ray sources have been identified in the ROSAT images with signal-to-noise ratios greater than 3. The limiting luminosities (log Lx(ergs/sec)) for 3-sigma detections are estimated to be 30.18, 30.23, and 30.08 for the northern field, southern field, and overlap region between the two fields respectively. Extensive optical photometry, classification spectroscopy, and proper motions, obtained from recent ground-based surveys of this region, were used to identify the most likely optical counterpart to each X-ray source. Although most of our X-ray selected sample appears to be associated with NGC 2264 members, we find that the vast majority of the cluster membership was undetected in the ROSAT HRI survey. The X-ray cumulative luminosity function for solar-mass stars in NGC 2264 shows that most of the low-mass members probably have X-ray luminosities similar to those seen for the X-ray brightest members of older clusters such as IC 2391/IC 2602 (age approx. 50 Myr) and the Pleiades (age approx. 100 Myr). This research was funded in part by the SAO Summer Intern Program and NASA grant NAG5-8120.

Author

Pre-Main Sequence Stars; X Ray Astronomy; Stellar Coronas; Stellar Activity

20040034753 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Relativistic Effects and Polarization in Three High-Energy Pulsar Models

Dyks, J.; Harding, Alice K.; Rudak, B.; [2004]; 49 pp.; In English

Contract(s)/Grant(s): KBN-2P03D.004.24; No Copyright; Avail: CASI; A03, Hardcopy

We present the influence of the special relativistic effects of aberration and light travel time delay on pulsar high-energy lightcurves and polarization characteristics predicted by three models: the two-pole caustic model, the outer gap model, and the polar cap model. Position angle curves and degree of polarization are calculated for the models and compared with the optical data on the Crab pulsar. The relative positions of peaks in gamma-ray and radio lightcurves are discussed in detail for the models. We find that the two-pole caustic model can reproduce qualitatively the optical polarization characteristics of the Crab pulsar - fast swings of the position angle and minima in polarization degree associated with both peaks. The anticorrelation between the observed flux and the polarization degree (observed in the optical band also for B0656+14) naturally results from the caustic nature of the peaks which are produced in the model due to the superposition of radiation from many different altitudes, ie. polarized at different angles. The two-pole caustic model also provides an acceptable interpretation of the main features in the Crab's radio profile. Neither the outer gap model nor the polar cap model are able to reproduce the optical polarization data on the Crab. Although the outer gap model is very successful in reproducing the relative positions of gamma-ray and radio peaks in pulse profiles, it can reproduce the high-energy lightcurves only when photon emission from regions very close to the light cylinder is included.

Author

Polarization Characteristics; Pulsars; Relativistic Effects; Gamma Rays; Mathematical Models

20040034772 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evidence for a Significant Intermediate-Age Population in the M31 Halo from Main Sequence Photometry
Brown, Thomas M.; Ferguson, Henry C.; Smith, Ed; Kimble, Randy A.; Sweigart, Allen V.; Renzini, Alvio; Rich, R. Michael; Vandenberg, Don A.; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NAS5-26555
Report No.(s): astro-ph/0305318-v1; Copyright; Avail: CASI; A01, Hardcopy

We present a color-magnitude diagram (CMD) for a minor-axis field in the halo of the Andromeda galaxy (M3l), 51 arcmin (11 kpc) from the nucleus. These observations, taken with the Advanced Camera for Surveys (ACS) on the Hubble Space Telescope, are the deepest optical images yet obtained, attaining 50% completeness at m(sub v) = 30.7 mag. The CMD, constructed from approx. 3 x 10(exp 5) stars, reaches more than 1.5 mag fainter than the old main-sequence turnoff. Our analysis is based on direct comparisons to ACS observations of four globular clusters through the same filters, as well as chi square fitting to a finely-spaced grid of calibrated stellar-population models. We find that the M31 halo contains a major (approx. 30% by mass) intermediate-age (6-8 Gyr) metal-rich ([Fe/H] greater than -0.5) population, as well as a significant globular-cluster age (11-13.5 Gyr) metal-poor population. These findings support the idea that galaxy mergers played an important role in the formation of the M31 halo.
Author
Andromeda Galaxy; Color-Magnitude Diagram; Galactic Halos

20040034774 Smith Coll., Northampton, MA, USA
A Deep HRI Survey of Low-Mass PMS Stars in NGC 2264
Patten, Brian; [1999]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-8120; No Copyright; Avail: CASI; A01, Hardcopy

Brian Patten is the Principal Investigator of the NASA ADP project 'A Deep HRI Survey of Low-Mass PMS Stars in NGC 2264'. This project was funded to support primarily the data reduction and analysis for new ROSAT data to be acquired in ROSAT AO8. For AO8 we were awarded two deep (100 ks) exposures with the ROSAT HRI instrument of a rotation and proper-motion selected sample of young (3 Myr - 15 Myr), low-mass, PMS stars in the populous star-forming region NGC 2264. These X-ray data were to be combined with an extensive rotation database for members of this cluster to allow us, for the first time, to probe the early evolution of magnetic dynamo activity for both fully convective stars and those stars found lower on the Hayashi tracks which have developed radiative cores. This database would have been used to study the interrelationship between coronal activity level, interior structure, and rotation rate as a function of mass and age.in the PMS and to define empirical constraints for theoretical models of angular momentum and magnetic dynamo evolution.
Author
Sky Surveys (Astronomy); Pre-Main Sequence Stars; Open Clusters; X Ray Astronomy

20040035613 NASA Goddard Space Flight Center, Greenbelt, MD, USA
James Webb Space Telescope (JWST) Optical Telescope Element (OTE) Architecture and Technology
Feinberg, Lee D.; [2004]; 3 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, USA; No Copyright; Avail: CASI; A01, Hardcopy

The James Webb Space Telescope (JWST) Optical Telescope Element (OTE) is the first NASA segmented space telescope and is planned for launch in 2011. The telescope architecture was recently finalized with the selection of the primary mirror material. This presentation reviews the telescope architecture and discusses the remaining key technological challenges of this element.
Author
James Webb Space Telescope; Spaceborne Telescopes; Technology Utilization; Design Analysis; Systems Engineering

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040031627 Stanford Univ., Stanford, CA, USA
Numerical Simulation of Protoplanetary Vortices
Lin, H.; Barranco, J. A.; Marcus, P. S.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 81-90; In English
Contract(s)/Grant(s): NCC2-1371; Copyright; Avail: CASI; A02, Hardcopy

The fluid dynamics within a protoplanetary disk has been attracting the attention of many researchers for a few decades. Previous works include, to list only a few among many others, the well-known prescription of Shakura & Sunyaev, the convective and instability study of Stone & Balbus and Hawley et al., the Rossby wave approach of Lovelace et al., as well as a recent work by Klahr & Bodenheimer, which attempted to identify turbulent flow within the disk. The disk is commonly understood to be a thin gas disk rotating around a central star with differential rotation (the Keplerian velocity), and the central quest remains as how the flow behavior deviates (albeit by a small amount) from a strong balance established between gravitational and centrifugal forces, transfers mass and momentum inward, and eventually forms planetesimals and planets. In earlier works we have briefly described the possible physical processes involved in the disk; we have proposed the existence of long-lasting, coherent vortices as an efficient agent for mass and momentum transport. In particular, Barranco et al. provided a general mathematical framework that is suitable for the asymptotic regime of the disk; Barranco & Marcus (2000) addressed a proposed vortex-dust interaction mechanism which might lead to planetesimal formation; and Lin et al. (2002), as inspired by general geophysical vortex dynamics, proposed basic mechanisms by which vortices can transport mass and angular momentum. The current work follows up on our previous effort. We shall focus on the detailed numerical implementation of our problem. We have developed a parallel, pseudo-spectral code to simulate the full three-dimensional vortex dynamics in a stably-stratified, differentially rotating frame, which represents the environment of the disk. Our simulation is validated with full diagnostics and comparisons, and we present our results on a family of three-dimensional, coherent equilibrium vortices. Author

Protoplanetary Disks; Fluid Dynamics

20040031662 Lawrence Livermore National Lab., Livermore, CA

Search for Simultaneous Optical Counterparts of Gamma-Ray Bursts

Park, H. S.; Porrata, R. A.; Bionta, R. M.; Williams, G. G.; Sep. 05, 2000; 14 pp.; In English

Report No.(s): DE2003-15005097; UCRL-ID-140306; No Copyright; Avail: Department of Energy Information Bridge

Gamma Ray Bursts (GRBs) are brief, randomly located, releases of gamma- ray energy from unknown celestial sources that occur almost daily. The study of GRBs has undergone a revolution in the past three years due to an international effort of follow-up observations made possible by the instantaneous distribution of reliable GRB coordinate information over the internet provided by NASA's GCN (GRB Coordinates Network). The 3-year LDRD project described here, done in collaboration with the workers responsible for the GCN, was the very first serious system to actively utilize the GCN and thus played a major role in the development of the GCN and the dramatic increase in our understanding of GRBs. The scientific objective of this project was to measure the intensity of any prompt visible radiation accompanying the gamma-ray emission utilizing a small but sensitive robotic telescope that responded to GCN triggers by rapidly taking images of the GCN error box. The instrument developed for this project, LOTIS, was the first of its kind, and the longest running, collecting data on over 75 GRBs during its 3 year running period.

NTIS

Telescopes; Gamma Ray Bursts; Flux Density; Coordinates; Gamma Rays

20040031692 Stanford Univ., Stanford, CA, USA

The Effect of Surface Topography on the Nonlinear Dynamics of Rossby Waves

Abarzhi, S. I.; Desjardins, O.; Pitsch, H.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 91-100; In English

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

Boussinesq convection in rotating systems attracts a sustained attention of the fluid dynamics community, because it has intricate non-linear dynamics (Cross & Hohenberg 1993) and plays an important role in geophysical and astrophysical applications, such as the motion of the liquid outer core of Earth, the Red Spot in Jupiter, the giant cells in the Sun etc. (Alridge et al. 1990). A fundamental distinction between the real geo- and astrophysical problems and the idealized laboratory studies is that natural systems are inhomogeneous (Alridge et al. 1990). Heterogeneities modulate the flow and influence significantly the dynamics of convective patterns (Alridge et al. 1990; Hide 1971). The effect of modulations on pattern formation and transition to turbulence in Boussinesq convection is far from being completely understood (Cross & Hohenberg 1993; Aranson & Kramer 2002). It is generally accepted that in the liquid outer core of the Earth the transport of the angular momentum and internal heat occurs via thermal Rossby waves (Zhang et al. 2001; Kuang & Bloxham 1999). These waves been visualized in laboratory experiments in rotating liquid-filled spheres and concentric spherical shells (Zhang et al. 2001; Kuang & Bloxham 1999). The basic dynamical features of Rossby waves have been reproduced in a cylindrical annulus, a system much simpler than the spherical ones (Busse & Or 1986; Or & Busse 1987). For convection in a cylindrical annulus, the fluid motion is two-dimensional, and gravity is replaced by a centrifugal force, (Busse & Or 1986; Or & Busse 1987). Hide (1971) has

suggested that the momentum and heat transport in the core might be influenced significantly by so-called bumps, which are heterogeneities on the mantle-core boundary. To model the effect of surface topography on the transport of momentum and energy in the liquid outer core of the Earth, Bell & Soward (1996), Herrmann & Busse (1998) and Westerburg & Busse (2001) have studied the nonlinear dynamics of thermal Rossby waves in a cylindrical annulus with azimuthally modulated height. Derived from text

Topography; Fluid Dynamics; Convection; Heat Transfer; Momentum Transfer; Nonlinearity; Planetary Waves

20040033367 NASA Goddard Space Flight Center, Greenbelt, MD, USA

CHANDRA Observations of RX J1914.4+ 2456: Spin-up of a White Dwarf?

Strohmayer, Tod E.; [2004]; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

RX 51914.4+2456 is a candidate double-degenerate binary with a putative 1.756 mHz orbital frequency. In a previous timing study using archival ROSAT and ASCA data we reported evidence for an increase of the putative orbital frequency at a rate consistent with expectations for gravitational radiation from the system. Here we report the results of new Chandra timing observations which confirm the previous indications of spin-up of the X-ray frequency, and provide much tighter constraints on the frequency derivative, u. We obtained with Chandra a total of 75 ksec of exposure in two epochs separated in time by 10.3 months. The total time span of the archival ROSAT, ASCA and new Chandra data is now 10.2 years. This more than doubles the interval spanned by the ROSAT and ASCA data alone, providing much greater sensitivity to a frequency derivative. With the addition of the Chandra data an increasing frequency is unavoidable, and the mean i/ is 5.9f0.9 x 10-l' Hz s-'. Interestingly, power spectra of the longest Chandra pointing show evidence for a sideband structure to the 1.756 mHz frequency. The fundamental and first harmonic show evidence for upper sidebands with a frequency separation of E 0.5 mHz from their parent peaks. Additionally, the first and second harmonics show evidence for lower sidebands with approximately half the frequency separation of the upper sidebands. Similar sideband structure is a common feature of Intermediate Polars (Ips)-although it is usually observed in the optical-and suggests the presence of a longer period in the system, perhaps the previously unseen orbital period. If this is correct the sideband structure indicates an orbital period close to 1 hr, and the observed u likely represents the accretion-induced spin-up of a white dwarf. We discuss the implications of these findings for the nature of RX J1914.4+2456.

Author

Cataclysmic Variables; White Dwarf Stars

20040033921 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Relativistic Astrophysics in Black Hole and Low-Mass Neutron Star X-ray Binaries

[2000]; 29 pp.; In English

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: CASI; A03, Hardcopy

During the five-year period, our study of 'Relativistic Astrophysics in Black Hole and Low-Mass Neutron Star X-ray Binaries' has been focused on the following aspects: observations, data analysis, Monte-Carlo simulations, numerical calculations, and theoretical modeling. Most of the results of our study have been published in refereed journals and conference presentations.

Author

Black Holes (Astronomy); Neutron Stars; Mass; X Ray Binaries

20040034020 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Magnetic Field in the Outer Heliosphere

Suess, Steve; [2004]; 1 pp.; In English; IGPP 3rd Annual International Astrophysics Conference: Physics of the Outer Heliosphere, 9 Feb. 2004, Riverside, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Voyager and Pioneer empirical results show that the IMF inside the termination shock behaves much as expected, which is not surprising since the field is essentially passively advected in this region. In contrast, MHD and kinematic models imply the field plays a major role in the dynamics in some regions of the heliosheath. However, of the many physical ingredients that constitute the outer heliosphere, the magnetic field poses some of the most interesting and difficult problems when being incorporated into 3D numerical models. Presently, only a few results have been published and much remains to be done. Nevertheless, there are good reasons to press forward with the MHD models. For example, the detailed nature of the field may be important in determining how galactic cosmic rays gain access to the heliosheath. Here I will briefly review the expected behavior of the magnetic field near the termination shock and in the heliosheath and summarize some of the modeling results. I will also review what I believe to be important modeling objectives. Finally, I will speculate on what might be happening

with the magnetic field near the nose of the heliosphere and how this might influence plasma transfer across the heliopause. Author

Heliosphere; Magnetic Fields; Galactic Cosmic Rays; Magnetohydrodynamics

20040034102 Rutgers Univ., Piscataway, NJ, USA

Constraints on the Energy Density Content of the Universe Using Only Clusters of Galaxies

Molnar, Sandor M.; Haiman, Zoltan; Birkinshaw, Mark; [2003]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We demonstrate that it is possible to constrain the energy content of the Universe with high accuracy using observations of clusters of galaxies only. The degeneracies in the cosmological parameters are lifted by combining constraints from different observables of galaxy clusters. We show that constraints on cosmological parameters from galaxy cluster number counts as a function of redshift and accurate angular diameter distance measurements to clusters are complementary to each other and their combination can constrain the energy density content of the Universe well. The number counts can be obtained from X-ray and/or SZ (Sunyaev-Zeldovich effect) surveys, the angular diameter distances can be determined from deep observations of the intra-cluster gas using their thermal bremsstrahlung X-ray emission and the SZ effect (X-SZ method). In this letter we combine constraints from simulated cluster number counts expected from a 12 deg2 SZ cluster survey and constraints from simulated angular diameter distance measurements based on using the X-SZ method assuming an expected accuracy of 7% in the angular diameter distance determination of 70 clusters with redshifts less than 1.5. We find that R, can be determined within about 25%, A within 20%, and w within 16%. Any cluster survey can be used to select clusters for high accuracy distance measurements, but we assumed accurate angular diameter distance measurements for only 70 clusters since long observations are necessary to achieve high accuracy in distance measurements. Thus the question naturally arises: How to select clusters of galaxies for accurate diameter distance determinations? In this letter, as an example, we demonstrate that it is possible to optimize this selection changing the number of clusters observed, and the upper cut off of their redshift range. We show that constraints on cosmological parameters from combining cluster number counts and angular diameter distance measurements, as opposed to general expectations, will not improve substantially selecting clusters with redshifts higher than one. This important conclusion allow us to restrict our cluster sample to clusters closer than one, in a range where the observational time for accurate distance measurements are more manageable. Subject headings: cosmological parameters - cosmology: theory - galaxies: clusters: general - X-rays: galaxies: clusters

Author

Cosmology; Flux Density; Galactic Clusters; Sunyaev-Zeldovich Effect; Surveys; Thermal Emission

20040034113 National Space Science and Technology Center, Huntsville, AL, USA

Large- and Small-Scale Ring Current Electrodynamic Coupling

Khazanov, G. V.; [2003]; 1 pp.; In English; 30th Anniversary Yosemite Workshop on Inner Magnetosphere Interaction, 3-6 Feb. 2004, Yosemite, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In this talk we will address the two primary issues of ring current (RC) electrodynamic coupling: 1. RC self-consistent magnetosphere-ionosphere coupling that includes calculation of the magnetospheric electric field (large scale electrodynamic coupling); and 2. RC self-consistent coupling with electromagnetic ion cyclotron (EMIC) waves (small scale electrodynamic coupling). Our study will be based on two RC models that we have recently developed in our group. The first model by Khazanov et al. [2002] couples the system of two kinetic equations: one equation which describes the RC ion dynamics and another equation which describes the energy density evolution of EMIC waves. The second model by Khazanov et al. [2003] deals with large scale electrodynamic coupling processes and provides a self-consistent simulation of RC ions and the magnetospheric electric field. There is presently no model that addresses both of these issues simultaneously in a self-consistent calculation. However, the need exists for such a model, because these two processes directly influence each other, with the mesoscale coupling changing the drift paths of the thermal and energetic particle populations in the inner magnetosphere, thereby changing the wave interactions, and the microscale coupling altering the pitch angle distributions and ionospheric conductivities (through increased precipitation), thus changing the field-aligned currents and electric potential structure. The initial thrust of the work will be the development of a combined kinetic model of micro- and meso-scale RC electrodynamic coupling processes and to examine their interactions with each other on a global scale.

Author

Mathematical Models; Magnetosphere-Ionosphere Coupling

20040034136 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Emission Line Galaxies in the STIS Parallel Survey II: Star Formation Density
Teplitz, Harry I.; Collins, Nicholas R.; Gardner, Jonathan P.; Hill, Robert S.; Rhodes, Jason; [2002]; 1 pp.; In English
Contract(s)/Grant(s): NAS5-26555; Copyright; Avail: Other Sources; Abstract Only

We present the luminosity function of [OII]-emitting galaxies at a median redshift of z = 0.9, as measured in the deep spectroscopic data in the STIS Parallel Survey (SPS). The luminosity function shows strong evolution from the local value, as expected. By using random lines of sight, the SPS measurement complements previous deep single field studies. We calculate the density of inferred star formation at this redshift by converting from [OII] to H(alpha) line flux as a function of absolute magnitude and find rho = 0.052 +/- 0.017 Solar mass/yr Mpc(sup -3) at a median redshift z approx. 0.9 within the range 0.46 less than z less than 1.415 (H(sub 0) = 50 km/s Mpc(sup -l), Omega(sub M) = 1.0, Omega(sub lambda) = 0.0). This density is consistent with a (1 + z)(sup)4 evolution in global star formation since z approx. 1. To reconcile the density with similar measurements made by surveys targeting H(alpha) may require substantial extinction correction.
Author
Galaxies; Line of Sight; Luminosity; Red Shift

20040034182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
High-Velocity Absorption Features in FUSE Spectra of Eta Carinae
Sonneborn, G.; Iping, R. C.; Gull, T. R.; Vieira, G.; [2003]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

Numerous broad (200 to 1000 km/sec) features in the FUSE spectrum (905-1187 A) of eta Carinae are identified as absorption by a forest of high-velocity narrow lines formed in the expanding circumstellar envelope. These features were previously thought to be P-Cygni lines arising in the wind of the central star. The features span a heliocentric velocity range of -140 to -580 km/sec and are seen prominently in low-ionization ground-state transitions (e.g. N I 1134-35, Fe II 1145-42, 1133, 1127- 22, P II 1153, C I 1158) in addition to C III] 1176 A. The high-velocity components of the FUSE transitions have depths about 50% below the continuum. The identifications are consistent with the complex velocity structures seen in ground- and excited-state transitions of Mg I, Mg 11, Fe II, V II, etc observed in STIS/E230H spectra. The origin of other broad features of similar width and depth in the FUSE spectrum, but without low-velocity ISM absorption, are unidentified. However, they are suspected of being absorption of singly-ionized iron-peak elements (e.g. Fe II, V II, Cr II) out of excited levels 1,000 to 20,000 cmE-l above the ground state. The high-velocity features seen in Fe II 1145 are also present in Fe II 1608 (STIS/E140M), but are highly saturated in the latter. Since these transitions have nearly identical log (flambda) (1.998 vs. 2.080), the differences in the profiles are attributable to the different aperture sizes used (30 x 30 arcsec for FUSE, 0.2 x 0.2 arcsec for STIS/E140M). The high-velocity gas appears to be very patchy or has a small covering factor near the central star. Eta Carinae has been observed several times by FUSE over the past three years. The FUSE flux levels and spectral features in eta Car are essentially unchanged over the 2000 March to June 2002 period, establishing a baseline far-UV spectrum in advance of the predicted spectroscopic minimum in 2003.
Author
Absorption Spectra; Cygnus Constellation; Ionization; Stellar Envelopes

20040034196 NASA Marshall Space Flight Center, Huntsville, AL, USA
The EUSO Mission
Adams, James H., Jr.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The investigation of cosmic rays with energies in excess of 10(exp 20) eV holds the potential for discoveries in astrophysics, cosmology and/or fundamental physics. This has motivated the construction of very large ground-based experiments and has lead to the development of the first space mission to measure these cosmic rays, the Extreme Universe Space Observatory (EUSO). EUSO will use the Earth s atmosphere viewed from space as a detector of extreme energy cosmic rays (EECRs). EUSO s collecting power will exceed the present experiments by more than a factor of 10 and extend the cosmic ray spectrum beyond 10(exp 20) eV with high statistics.
Author
Cosmic Rays; Cosmology; Earth Atmosphere; Energy Spectra

20040034750 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Infrared Extinction and the Initial Conditions for Star and Planet Formation
Lada, Charles J.; March 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9520; No Copyright; Avail: CASI; A01, Hardcopy

This grant funds a research program to use infrared extinction measurements to probe the detailed structure of dark molecular clouds and investigate the physical conditions which give rise to star and planet formation. The goals of the this program are to: 1) acquire deep infrared and molecular-line observations of a carefully selected sample of nearby dark clouds, 2) reduce and analyze the data obtained in order to produce detailed extinction maps of the clouds, 3) prepare results, where appropriate, for publication. A description of how these goals were met are included.
Derived from text
Molecular Clouds; Planetary Evolution; Star Formation; Interstellar Extinction; Extinction; Near Infrared Radiation

20040034769 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Studies of Pressure-Broadening of Alkali Atom Resonance Lines for Modeling Atmospheres of Extrasolar Giant Planets and Brown Dwarfs
Kirby, Kate; Babb, J.; Yoshino, K.; March 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-12751; No Copyright; Avail: CASI; A01, Hardcopy

In L-dwarfs and T-dwarfs the resonance lines of sodium and potassium are so profoundly pressure-broadened that their wings extend several hundred nanometers from line center. With accurate knowledge of the line profiles as a function of temperature and pressure: such lines can prove to be valuable diagnostics of the atmospheres of such objects. We have initiated a joint program of theoretical and experimental research to study the line-broadening of alkali atom resonance lines due to collisions with species such as helium and molecular hydrogen. Although potassium and sodium are the alkali species of most interest in the atmospheres of cool brown dwarfs and extrasolar giant planets, some of our theoretical focus this year has involved the calculation of pressure-broadening of lithium resonance lines by He, as a test of a newly developed suite of computer codes. In addition, theoretical calculations have been carried out to determine the leading long range van der Waals coefficients for the interactions of ground and excited alkali metal atoms with helium atoms, to within a probable error of 2%. Such data is important in determining the behavior of the resonance line profiles in the far wings. Important progress has been made on the experimental aspects of the program since the arrival of a postdoctoral fellow in September. A new absorption cell has been designed, which incorporates a number of technical improvements over the previous cell, including a larger cell diameter to enhance the signal, and fittings which allow for easier cleaning, thereby significantly reducing the instrument down-time.
Author
Alkali Metals; Atoms; Resonance Lines; Atmospheric Models; Brown Dwarf Stars; Extrasolar Planets; Gas Giant Planets

20040034821 Lawrence Livermore National Lab., Livermore, CA
Large-Scale Search for Dark-Matter Axions
Kinion, D.; Van Bibber, K.; Aug. 30, 2000; 12 pp.; In English
Report No.(s): DE2003-15005377; UCRL-JC-129343-REV-1; No Copyright; Avail: Department of Energy Information Bridge

We review the status of two ongoing large-scale searches for axions which may constitute the dark matter of our Milky Way halo. The experiments are based on the microwave cavity technique proposed by Sikivie, and marks a 'second-generation' to the original experiments performed by the Rochester-Brookhaven-Fermilab collaboration, and the University of Florida group.
NTIS
Dark Matter; Milky Way Galaxy

20040034838 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hot HB Stars in Globular Clusters: Physical Parameters and Consequences for Theory, VI, The Second Parameter Pair M 3 and M 13
Moehler, S.; Landsman, W. B.; Sweigart, A. V.; Grundahl, F.; [2003]; 15 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DLR-50-OR-96029-ZA
Report No.(s): astro-ph/0304475v1; Copyright; Avail: CASI; A03, Hardcopy

We present the results of spectroscopic analyses of hot horizontal branch (HB) stars in M 13 and M 3, which form a famous 'second parameter' pair. F rom the spectra and Stromgren photometry we derived - for the first time in M 13 - atmospheric parameters (effective temperature and surface gravity). For stars with Stromgren temperatures between 10,000 and 12,000 K we found excellent agreement between the atmospheric parameters derived from Stromgren photometry and

those derived from Balmer line profile fits. However, for cooler stars there is a disagreement in the parameters derived by the two methods, for which we have no satisfactory explanation. Stars hotter than 12,000 K show evidence for helium depletion and iron enrichment, both in M 3 and M 13. Accounting for the iron enrichment substantially improves the agreement with canonical evolutionary models, although the derived gravities and masses are still somewhat too low. This remaining discrepancy may be an indication that scaled-solar metal-rich model atmospheres do not adequately represent the highly non-solar abundance ratios found in blue HB stars affected by diffusion. We discuss the effects of an enhancement in the envelope helium abundance on the atmospheric parameters of the blue HB stars, as might be caused by deep mixing on the red giant branch or primordial pollution from an earlier generation of intermediate mass asymptotic giant branch stars. Key words. Stars: atmospheres - Stars: evolution - Stars: horizontal branch - Globular clusters: individual: M 3 - Globular clusters: individual: M 13

Author

Asymptotic Giant Branch Stars; Atmospheric Models; Blue Stars; Hot Stars; Clusters

20040035587 Gemini Observatory, USA

Gemini Observatory Newsletter, No. 28

December 2003; 28 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. Image from GMOS-SOUTH rivals view from space. 2. Future science at GEMENI. 3. Board approves long-range instrument plan. 4. Astronomical polamitetry: current status and future directions. 5. Recent scientific highlights. 6. Protected silver coating at GEMINI: a status report. 7. Tunnel to the stars. The GEMINI-IRAF project. 8. Profile: US, UK, Canada, Australia, Chile, Brasil, Argentina

CASI

Image Analysis; Space Missions; Gemini Project; Astronomy

20040035615 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Evolution of the Accretion Disk Around 4U 1820-30 During a Superburst

Ballantyne, D. R.; Strohmayer, T. E.; [2004]; 11 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Accretion from a disk onto a collapsed, relativistic star - a neutron star or black hole - is the mechanism widely believed to be responsible for the emission from compact X-ray binaries. Because of the extreme spatial resolution required, it is not yet possible to directly observe the evolution or dynamics of the inner parts of the accretion disk where general relativistic effects are dominant. Here, we use the bright X-ray emission from a superburst on the surface of the neutron star 4U 1820-30 as a spotlight to illuminate the disk surface. The X-rays cause iron atoms in the disk t o fluoresce, allowing a determination of the ionization state, covering factor and inner radius of the disk over the course of the burst. The time-resolved spectral fitting shows that the inner region of the disk is disrupted by the burst, possibly being heated into a thicker, more tenuous flow, before recovering its previous form in approximately 1000 s. This marks the first instance that the evolution of the inner regions of an accretion disk has been observed in real-time.

Author

Accretion Disks; Star Formation; Black Holes (Astronomy); Astrophysics; X Ray Astronomy; Gamma Ray Bursts

20040035624 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Hybrid Simulation Applied To Shock Waves In Space Plasmas

GoncalvesdoNascimento, Marcelo Henrique; 2003; 344 pp.; In Portuguese; Original contains color illustrations

Report No.(s): INPE-9947-TDI/880; Copyright; Avail: CASI; A15, Hardcopy

In this Master s Degree Dissertation three fundamental problems from Space Physics are studied, namely: the electromagnetic ion-ion resonant instability (EIIRI), a quasi-perpendicular supercritical shock wave and the interaction between a finite-length ion beam with a background ion beam. A one-dimensional electromagnetic hybrid code that treats de ions as particles and the electrons as a massless conducting, neutralizing fluid was used to simulate the three problems. The diagnostics produced by the EIIRI simulation permitted to characterize the main phases of the instability temporal evolution, namely, the exponential growth and the saturation phases. Some events such as energy transfer from the tenuous ion beam to the By component of the magnetic field, the generation of large amplitude magnetic pulses during the resonance process between the ions of the tenuous beam with the electromagnetic waves, the scattering of the ions due to the large amplitude right-handed polarized electromagnetic waves that have positive helicities allow the characterization of the instability exponential growth phase. On the other hand, the energy transfer from the wave magnetic field to the ions of the tenuous beam

heat them both in the parallel and in the perpendicular directions with respect to the magnetic field characterizes the instability saturation phase. The quasi-perpendicular supercritical shock wave simulation used a routine to inject particles inside the simulation region and also used the hard wall method to form a shock wave of this kind self-consistently. The diagnostics allowed to verify the formation of this shock wave and one of its fundamental features: the reflection of a fraction of the incident ions by the shock transition region back to the upstream region. The simulation of the interaction of a finite-length beam with background ions produced diagnostics that allowed to verify that two right-handed polarized electromagnetic wave modes, the resonant and the nonresonant modes with positive and negative helicities, respectively, are both responsible for the interaction and the coupling of the two ion beams.
Author
Shock Wave Interaction; Space Plasmas; Computerized Simulation; Atmospheric Physics; Ion Beams; Magnetic Fields

20040035650 NASA Marshall Space Flight Center, Huntsville, AL, USA, Jacobs Services Co., Huntsville, AL, USA
The Chandra X-Ray Observatory Radiation Environmental Model Update
Blackwell, William C.; Minow, Joseph I.; ODell, Stephen L.; Cameron, Robert A.; Virani, Shanil N.; September 23, 2003; 1 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): NAS8-00187; Copyright; Avail: Other Sources; Abstract Only

CRMFLX (Chandra Radiation Model of ion FLUX) is a radiation environment risk mitigation tool for use as a decision aid in planning the operation times for Chandra's Advanced CCD Imaging Spectrometer (ACIS) detector. The accurate prediction of the proton flux environment with energies of 100 - 200 keV is needed in order to protect the ACIS detector against proton degradation. Unfortunately, protons of this energy are abundant in the region of space where Chandra must operate. In addition, on-board particle detectors do not measure proton flux levels of the required energy range. CRMFLX is an engineering environment model developed to predict the proton flux in the solar wind, magnetosheath, and magnetosphere phenomenological regions of geospace. This paper describes the upgrades to the ion flux databases for the magnetosphere, magnetosheath, and solar wind regions. These data files were created by using Geotail and Polar spacecraft flux measurements only when the Advanced Composition Explorer (ACE) spacecraft's 0.14 MeV particle flux was below a threshold value. This new database allows for CRMFLX output to be correlated with both the geomagnetic activity level, as represented by the Kp index, as well as with solar proton events. Also, reported in this paper are results of analysis leading to a change in Chandra operations that successfully mitigates the false trigger rate for autonomous radiation events caused by relativistic electron flux contamination of proton channels.
Author
Imaging Spectrometers; Environment Models; Radiation Detectors; X Ray Astrophysics Facility; Proton Flux Density

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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*.

20040031657 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Study of the Meteors and Investigations of their Effects in the Ionosphere from Data of SKiYMET Radar and GPS
AlbuquerquedeSouzaCorrea, Jorge; 2003; 151 pp.; In Portuguese
Report No.(s): INPE-9843-TDI/866; Copyright; Avail: Other Sources

We use the data obtained from the SKYiMET (VHF All-Sky Interferometric Meteor Radar) scientific radar and the measurements of the Total Electron Content (TEC) in the ionosphere derived from the Global Positioning System (GPS) satellite network, to study meteoric activity. From the meteor data obtained during the years 1999-2001, properties of sporadic meteors and three meteor showers (Southern Delta Aquarids, Leonids and Geminids) are analysed. Such properties are the influx distributions as a function of altitude and time, the geocentric velocity distributions and the life-time distributions, as well as the radiant positions and maximum activity days of the meteor showers. We present the main characteristics of each meteor shower as well as sporadic meteors to discuss their differences. Finally, during the period of these meteor showers for 1999 and 2000, we investigate whether these have any significant impact on the upper atmosphere related to electronic density fluctuations in the ionosphere.
Author
Global Positioning System; Interferometry; Ionospheres; Very High Frequencies; Radar Measurement; Meteoroids

20040031801 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evidence for Buried 'Pre-Noachian' Crust Pre-Dating the Oldest Observed Surface Units on Mars
Frey, H. V.; Frey, E. L.; Hartmann, W. K.; Tanaka, K. L. T.; [2004]; 3 pp.; In English; Lunar and Planetary Science Conference, Houston, TX, USA; Copyright; Avail: CASI; A01, Hardcopy

MOLA gridded data shows clear evidence for Quasi-Circular Depressions not visible on images in Early Noachian (EN) terrain units on Mars. We suggest these are buried impact basins that pre-date the superimposed craters whose high density makes these EN units the oldest visible at the surface of Mars. There is crust older than the oldest visible terrain units on Mars, and these EN units cannot date from 4.6 BYA. These and other Noachian units have similar total (visible + buried) crater retention ages, suggesting a common 'pre-Noachian' crustal age OR crater saturation beyond which we cannot see.
Author
Mars Surface; Structural Basins; Chronology; Crusts

20040034011 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Long-Term Dynamics of Small Bodies in the Solar System
Holman, Matthew J.; February 2004; 5 pp.; In English
Contract(s)/Grant(s): NAG5-10365; No Copyright; Avail: CASI; A01, Hardcopy

As part of the NASA Planetary Geology and Geophysics program Prof. Norm Murray (CITA) and I have been conducting investigations of the long-term dynamics of small bodies in the outer solar system. This grant, and its predecessor NAG5-7761, supports travel for collaboration by the Investigators and also supports Murray during an annual one month visit to the CfA for further collaboration. In the course of this grant we made a number of advances in solar system dynamics. For example, we developed an analytic model for the origin and consequence of chaos associated with three-body resonances in the asteroid belt. This has been shown to be important for the delivery of near Earth objects. We later extended this model to three- body resonances among planets. We were able to show that the numerically identified chaos among the outer planets results from a three-body resonance involving Jupiter, Saturn, and Uranus. The resulting paper was awarded the 1999 Newcomb Cleveland award from the AAAS. This award singles out one paper published in Science each year for distinction.
Derived from text
Solar System; Gas Giant Planets; Mathematical Models; Planetary Geology; Planets

20040034045 NASA Langley Research Center, Hampton, VA, USA
CRYSTAL/FACE
Baumgardner, Darrel; Kok, Greg; Anderson, Bruce; February 06, 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-11611; No Copyright; Avail: CASI; A01, Hardcopy

Droplet Measurement Technologies (DMT), under funding from NASA, participated in the CRYSTAL/FACE field campaign in July, 2002 with measurements of cirrus cloud hydrometeors in the size range from 0.5 to 1600 microns. The measurements were made with the DMT Cloud, Aerosol and Precipitation Spectrometer (CAPS) that was flown on NASA's WB57F. With the exception of the first research flight when the data system failed two hours into the mission, the measurement system performed almost flawlessly during the thirteen flights. The measurements from the CAPS have been essential for interpretation of cirrus cloud properties and their impact on climate. The CAPS data set has been used extensively by the CRYSTAL/FACE investigators and as of the date of this report, have been included in five published research articles, 10 conference presentations and six other journal articles currently in preparation.
Derived from text
Hydrometeors; Cirrus Clouds; Crystal Field Theory; Data Systems; Size Distribution

20040034100 Utah Univ., Salt Lake City, UT, USA
Small, Highly Reflective Ice Crystals in Low-Latitude Cirrus
Garrett, T. J.; Gerber, H.; Baumgardner, D. G.; Twohy, C. H.; Weinstock, E. M.; Geophysical Research Letters; 2003; ISSN 0094-8276; Volume 30, No. 21, pp. 12-1 - 12-4; In English
Contract(s)/Grant(s): NAG5-11611; Copyright; Avail: Other Sources

At low latitudes, cirrus are ubiquitous and can be in excess of 100 C colder than the surface, limiting the amount of sunlight absorbed by the earth s atmosphere and surface, and reducing its loss of heat. Here we present aircraft measurements within cirrus over southern Florida indicating that ice crystals have smaller sizes and are more reflective than is assumed in most current climate models. If the measurements are generally representative of low-latitude cirrus, they point to a first-order

correction to represenntions of how these clouds affect the earth's climate.
Author
Ice; Climate Models; Cloud Physics; Crystals; Tropical Meteorology; Cirrus Clouds

20040034107 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sample Analysis At Mars
Brinckerhoff, W. B.; Mahaffy, P. R.; Cabane, M.; Atreya, S. K.; Coll, P.; Cornish, T. J.; Harpold, D. N.; Israel, G.; Niemann, H. B.; Owen, T., et al.; [2003]; 4 pp.; In English; Sixth International Conference on Mars, 20-25 Jul. 2003, Pasadena, CA, USA; Copyright; Avail: CASI; A01, Hardcopy

The next landed missions to Mars, such as the planned Mars Science Laboratory and ExoMars, will require sample analysis capabilities refined well beyond what has been flown to date. A key science objective driving this requirement is the determination of the carbon inventory of Mars, and particularly the detection of organic compounds. While the gas chromatograph mass spectrometers (GCMS) on the Viking landers did not detect any indigenous organics in near surface fines, it is possible that these measurements were not representative of Mars on the whole. That is, those compounds to which the GC/MS was sensitive would likely not have survived the strong oxidative decomposition in the regolith at the landing sites in question. The near surface fines could very well contain a significant quantity of refractory compounds that would not have been volatilized in the sample ovens on Viking. It is also possible that volatile organics exist on Mars in sedimentary, subsurface, or polar niches.
Derived from text
Carbon; Gas Chromatography; Mass Spectrometers; Mars Missions; Regolith; Refractories; Refining; Organic Compounds

20040034201 NASA Ames Research Center, Moffett Field, CA, USA
Evolution of a Mars Airplane Concept for the ARES Mars Scout Mission
Smith, Stephen C.; Guynn, Mark D.; Smith, Stephen C.; Parks, Robert W.; Gelhausen, Paul A.; January 2004; 16 pp.; In English; 2nd AIAA Unmanned Unlimited Systems, Technologies, and Operations Conference, 15-18 Sep. 2003, San Diego, CA, USA
Report No.(s): AIAA Paper 2003-6578; Copyright; Avail: CASI; A03, Hardcopy

ARES (Aerial Regional-scale Environmental Survey of Mars) is a proposed Mars Scout mission using an airplane to provide high-value science measurements in the areas of atmospheric chemistry, surface geology and mineralogy, and crustal magnetism. The use of an airplane for robotic exploration of Mars has been studied for over 25 years. There are, however, significant challenges associated with getting an airplane to Mars and flying through the thin, carbon dioxide Martian atmosphere. The traditional wisdom for aircraft design does not always apply for this type of vehicle and geometric, aerodynamic, and mission constraints result in a limited feasible design space. The ARES airplane design is the result of a concept exploration and evolution involving a number of trade studies, downselects, and design refinements. Industry, university, and NASA partners initially proposed a number of different concepts, drawing heavily on past Mars airplane design experience. Concept downselects were conducted with qualitative evaluation and high level analyses, focused on the most important parameters for the ARES mission. Following a successful high altitude test flight of the basic configuration, additional design refinement led to the current design. The resulting Mars airplane concept enables the high-value science objectives of the ARES mission to be accomplished while also fulfilling the desire for a simple, low-risk design.
Author
Mars Atmosphere; Aircraft Design; Space Missions; Planetary Geology; Mars Surface; Surveys

20040034718 NASA Langley Research Center, Hampton, VA, USA
Simulating the ARES Aircraft in the Mars Environment
Kenney, P. Sean; Croom, Mark A.; [2003]; 20 pp.; In English; 2nd AIAA Unmanned Unlimited Systems, Technologies and Operations Conference, 15-18 Sep. 2003, San Diego, CA, USA
Report No.(s): AIAA Paper 2003-6579; No Copyright; Avail: CASI; A03, Hardcopy

NASA Langley proposed the Aerial Regional-scale Environmental Survey (ARES) of Mars science mission in response to the NASA Office of Space Science 2002 Mars Scout Opportunity. The science-driven mission proposal began with trade studies and determined that a rocket powered aircraft was the best suited platform to complete the ARES science objectives. A high fidelity six degree of freedom flight simulation was required to provide credible evidence that the aircraft design fulfilled mission objectives and to support the aircraft design process by providing performance evaluations. The aircraft was initially modeled using the aero, propulsion, and flight control system components of other aircraft models. As the proposed

aircraft design evolved, the borrowed components were replaced with new models. This allowed performance evaluations to be performed as the design was maturing. Basic autopilot features were also developed for the ARES aircraft model. Altitude hold and track hold modes allowed different mission scenarios to be evaluated for both science merit and aircraft performance. Platform stability and data rate requirements were identified for each of the instruments and the aircraft performance was evaluated against those requirements. The results of the simulation evaluations indicate that the ARES design and mission profiles are sound and meet the science objectives.
Author
Mars Environment; Aircraft Models; Flight Simulation; Aerial Reconnaissance; NASA Space Programs; Aircraft Design

20040035550 Cranfield Univ., Bedford, UK
Lunar South Pole Mission (LSPM) Summary of the Group Design Project MSc in Astronautics and Space Engineering 1996/97, Cranfield University
Hobbs, Stephen; Bowling, Tom; February 2003; 87 pp.; In English
Report No.(s): COA-0205; Copyright; Avail: Other Sources

This report is a summary of the group design project of the MSc in Astronautics and Space Engineering at Cranfield University for the year 1996/97. The project was a feasibility study of a European unmanned mission to the lunar south pole to carry out scientific study. The mission proposed uses two spacecraft: (1) an orbiter to take images of the proposed landing site, to measure the Moon's gravitational field, and to act as a communications relay, and (2) a larger lander which carries a small rover and a crate probe. The orbiter is launched first (if gravity and image data are not already available) so that the lander's landing site can be selected. The main goal is scientific study of the permanently dark craters at the lunar south pole. The baseline design (developed to the depth of a feasibility study) meets the stated requirements and is comparable to ESAs medium class missions (cost - Euro 300 M).
Author
Lunar Probes; Lunar Satellites; Lunar Landing; Lunar Roving Vehicles

20040035561 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Energetic Metastable Oxygen and Nitrogen Atoms in the Terrestrial Atmosphere
Kharchenko, Vasili; March 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-11857; No Copyright; Avail: CASI; A01, Hardcopy

We have investigated the impact of hot metastable oxygen atoms on the product yields and rate coefficients of atmospheric reactions involving O((sup 1)D). The contribution of the metastable oxygen atoms to the thermal balance of the terrestrial atmosphere between 50 and 200 km has been determined. We found that the presence of hot O((sup l)D) atoms in the mesosphere and lower thermosphere significantly increases the production rate of the rotationally-vibrationally excited NO molecules. The computed yield of the NO molecules in N2O+ O((sup 1)D) atmospheric collisions, involving non-Maxwellian distributions of the metastable oxygen atoms, is more than two times larger than the NO-yield at a thermal equilibrium. The calculated non-equilibrium rate and yield functions are important for ozone and nitrous oxide modeling in the stratosphere, mesosphere and lower thermosphere.
Derived from text
Nitrogen Atoms; Oxygen Atoms; Terrestrial Planets; Metastable Atoms; Thermodynamic Equilibrium

20040035579 Arizona Univ., Tucson, AZ, USA
Near-Infrared Spectrophotometry of Phobos and Deimos
Rivkin, A. S.; Brown, R. H.; Trilling, D. E.; Bell, J. F., III; Plassmann, J. H.; Icarus; 2002; ISSN 0019-1035; Volume 156, pp. 64-75; In English
Contract(s)/Grant(s): NAG5-10328; Copyright; Avail: Other Sources

We have observed the leading and trailing hemispheres of Phobos from 1.65 to 3.5 microns and Deimos from 1.65 to 3.12 microns near opposition. We find the trailing hemisphere of Phobos to be brighter than its leading hemisphere by 0.24 +/- 0.06 magnitude at 1.65 microns and brighter than Deimos by 0.98 +/- 0.07 magnitude at 1.65 microns. We see no difference larger than observational uncertainties in spectral slope between the leading and trailing hemispheres when the spectra are normalized to 1.65 microns. We find no 3-microns absorption feature due to hydrated minerals on either hemisphere to a level of approx. 5 - 10% on Phobos and approx. 20% on Deimos. When the infrared data are joined to visible and near-IR data obtained by previous workers, our data suggest the leading (Stickney-dominated) side of Phobos is best matched by T-class asteroids. The spectral slope of the trailing side of Phobos and leading side of Deimos are bracketed by the D-class asteroids.

The best laboratory spectral matches to these parts of Phobos are mature lunar soils and heated carbonaceous chondrites. The lack of 3-microns absorption features on either side of Phobos argues against the presence of a large interior reservoir of water ice according to current models of Phobos' interior.
Author
Near Infrared Radiation; Spectrophotometry; Phobos; Deimos; Minerals; Ice

20040035608 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Initiating the 2002 Mars Science Laboratory (MSL) Technology Program
Caffrey, Robert T.; Udomkesmalee, Gabriel; Hayati, Samad A.; Henderson, Rebecca; [2004]; 24 pp.; In English; 2004 IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Mars Science Laboratory (MSL) Project is an aggressive mission launching in 2009 to investigate the Martian environment and requires new capabilities that are currently are not available. The MSL Technology Program is developing a wide-range of technologies needed for this Mission and potentially other space missions. The MSL Technology Program reports to both the MSL Project and the Mars Technology Program (MTP). The dual reporting process creates a challenging management situation, but ensures the new technology meets both the specific MSL requirements and the broader Mars Program requirements. MTP is a NASA-wide technology development program managed by JPL and is divided into a Focused Program and a Base Program. The MSL Technology Program is under the focused program and is tightly coupled to MSL's mission milestones and deliverables. The technology budget is separate from the flight Project budget, but the technology's requirements and the development process are tightly coordinated with the Project. The MSL Technology Program combines the proven management techniques of flight projects with the commercial technology management strategies of industry and academia, to create a technology management program that meets the short-term requirements of MSL and the long-term requirements of MTP. This paper examines the initiation of 2002 MSL Technology program. Some of the areas discussed in this paper include technology definition, task selection, technology management, and technology assessment. This paper also provides an update of the 2003 MSL technology program and examines some of the drivers that changed the program from its initiation.
Author
Mars Environment; Space Missions; Technology Utilization; NASA Space Programs; Aerospace Sciences

20040035669 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Surface Penetrating Radar Simulations for Jupiter's Icy Moons
Markus, Thorsten; Gogineni, S. P.; Green, J. L.; Reinisch, B. W.; Song, P.; Fung, S. F.; Benson, R. F.; Taylor, W. W. L.; Cooper, F., et al.; [2003]; 1 pp.; In English; AGU Meeting, 8-11 Dec. 2003, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The icy moons of Jupiter (Europa, Callisto, and Ganymede) are of similar overall composition but show different surface features as a result of different sub-surface processes. Furthermore, each of these moons could have a liquid ocean of water buried underneath the icy crust, but their depth can only be speculated. For Europa, estimates put the thickness of the ice shell anywhere between 2-30 km, with'a few models predicting up to 100 km. Much of the uncertainties are due to the largely unknown temperature gradients and levels of water impurities across different surface layers. One of the most important geological processes is the possible transportation of heat by ice convection. If the ice is convecting, then an upper limit of about 20 km is set for the depth of the ocean underneath. Convection leads to a sharp increase in temperature followed by a thick region of nearly constant temperature. If ice is not convecting, then an exponentially increasing temperature profile is expected. The crust is thought to be a mixture of ice and rock, and although the exact percentage of rock is not known, it is expected to be low. Additionally, the ice crust could contain salt, similar to sea ice on Earth. The exact amount of salt and how that amount changes with depth is also unknown. In preparation for the Jupiter Icy Moons Orbiter (JIMO) mission, we performed simulations for a surface-penetrating radar investigating signatures for different possible surface and sub-surface structures of these moons in order to estimate the applicability of using radar with a frequency range between 1 and 50 MHz. This includes simulations of power requirements, attenuation losses, layer resolutions for scenarios with and without the presence of a liquid ocean underneath the ice, cases of convecting and non-convecting ice, different impurities within the ice, and different surface roughnesses.
Author
Ice; Surface Layers; Europa; Callisto; Ganymede; Convective Heat Transfer; Water; Radar Signatures

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040031713 Stanford Univ., Stanford, CA, USA
Macroscopic Models of Radiative Transfer as Applied to Computation of the Radiation Field in the Solar Atmosphere
Ripoll, J.-F.; Wray, A. A.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 3-14; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A03, Hardcopy

In this paper a new three dimensional half-moment model for radiative transfer is presented for a gray medium. It describes the evolution of the zeroth and first directional half moments of the radiative intensity. The closure is provided, similarly to Dubroca and Klar, by the maximum entropy concept. This work generalizes that model to three dimensions. The model presented here (the derivation being done in Ripoll and Wray, called the M(sup 1/2)(sub 1) model, is a hyperbolic system consisting of a total of eight equations in three dimensions, four equations for each direction. Each half model has the classical form of a macroscopic moment model in which the pressure tensor is constructed from the well-known Eddington tensor with a particular Eddington factor. Moreover, different source and border terms occur. The latter introduce couplings between the macroscopic and microscopic quantities and between the + and - streams, through the intensity in the plane perpendicular to the flux. The main theoretical application of the half moment model, treated in this paper, is its reduction to a full moment model, called M(sup +)(sub 1), for the particular but important case of a hot, opaque source radiating in a cold transparent (or semi-transparent) medium for very specific applications, such as stellar interiors or atmospheres, or combustion problems. The structure of the paper is as follows. In section 2, the model M(sup 1/2)(sub 1) is presented. In section 3, for the particular case of a hot, opaque source radiating into a cold medium, the half moment model is reduced to the M(sup +)(sub 1) model. In section 4, we first solve a simple and academic problem to validate the models, followed by a simplified solar atmosphere.
Author
Radiative Transfer; Solar Atmosphere; Three Dimensional Models; Radiation Distribution

20040031732 Stanford Univ., Stanford, CA, USA
Subgrid Scale Modeling in Solar Convection Simulations using the ASH Code
Young, Y.-N.; Miesch, M.; Mansour, N. N.; Center for Turbulence Research Annual Research Briefs 2003; [2003], pp. 15-22; In English
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A02, Hardcopy

The turbulent solar convection zone has remained one of the most challenging and important subjects in physics. Understanding the complex dynamics in the solar con- vection zone is crucial for gaining insight into the solar dynamo problem. Many solar observatories have generated revealing data with great details of large scale motions in the solar convection zone. For example, a strong di erential rotation is observed: the angular rotation is observed to be faster at the equator than near the poles not only near the solar surface, but also deep in the convection zone. On the other hand, due to the wide range of dynamical scales of turbulence in the solar convection zone, both theory and simulation have limited success. Thus, cutting edge solar models and numerical simulations of the solar convection zone have focused more narrowly on a few key features of the solar convection zone, such as the time-averaged di erential rotation. For example, Brun & Toomre (2002) report computational finding of differential rotation in an anelastic model for solar convection. A critical shortcoming in this model is that the viscous dissipation is based on application of mixing length theory to stellar dynamics with some ad hoc parameter tuning. The goal of our work is to implement the subgrid scale model developed at CTR into the solar simulation code and examine how the differential rotation will be a affected as a result. Specifically, we implement a Smagorinsky-Lilly subgrid scale model into the ASH (anelastic spherical harmonic) code developed over the years by various authors. This paper is organized as follows. In x2 we briefly formulate the anelastic system that describes the solar convection. In x3 we formulate the Smagorinsky-Lilly subgrid scale model for unstably stratifed convection. We then present some preliminary results in x4, where we also provide some conclusions and future directions.
Author
Solar Convection (Astronomy); Mathematical Models

20040031767 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Long-Range Solar Activity Predictions: A Reprieve from Cycle #24's Activity
Richon, K.; Schatten, K.; [2003]; 11 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA
Contract(s)/Grant(s): NAS5-01090
Report No.(s): FMS-2003-19; No Copyright; Avail: CASI; A03, Hardcopy

We discuss the field of long-range solar activity predictions and provide an outlook into future solar activity. Orbital predictions for satellites in Low Earth Orbit (LEO) depend strongly on exospheric densities. Solar activity forecasting is important in this regard, as the solar ultra-violet (UV) and extreme ultraviolet (EUV) radiations inflate the upper atmospheric layers of the Earth, forming the exosphere in which satellites orbit. Rather than concentrate on statistical, or numerical methods, we utilize a class of techniques (precursor methods) which is founded in physical theory. The geomagnetic precursor method was originally developed by the Russian geophysicist, Ohl, using geomagnetic observations to predict future solar activity. It was later extended to solar observations, and placed within the context of physical theory, namely the workings of the Sun s Babcock dynamo. We later expanded the prediction methods with a SOlar Dynamo Amplitude (SODA) index. The SODA index is a measure of the buried solar magnetic flux, using toroidal and poloidal field components. It allows one to predict future solar activity during any phase of the solar cycle, whereas previously, one was restricted to making predictions only at solar minimum. We are encouraged that solar cycle #23's behavior fell closely along our predicted curve, peaking near 192, comparable to the Schatten, Myers and Sofia (1996) forecast of 182+/-30. Cycle #23 extends from 1996 through approximately 2006 or 2007, with cycle #24 starting thereafter. We discuss the current forecast of solar cycle #24, (2006-2016), with a predicted smoothed F10.7 radio flux of 142+/-28 (1-sigma errors). This, we believe, represents a reprieve, in terms of reduced fuel costs, etc., for new satellites to be launched or old satellites (requiring reboosting) which have been placed in LEO. By monitoring the Sun s most deeply rooted magnetic fields; long-range solar activity can be predicted. Although a degree of uncertainty in the long-range predictions remains, requiring future monitoring, we do not expect the next cycle's + 2-sigma value will rise significantly above solar cycle #23's activity level.
Author
Solar Activity Effects; Solar Magnetic Field; Prediction Analysis Techniques; Low Earth Orbits; Extreme Ultraviolet Radiation; Magnetic Fields; Atmospheric Stratification

20040031774 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Terrestrial Relations Observatory (STEREO)
Davila, Joseph M.; SaintCyr, O. C.; [2003]; 1 pp.; In English; IUGG 2003, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

The solar magnetic field is constantly generated beneath the surface of the Sun by the solar dynamo. To balance this flux generation, there is constant dissipation of magnetic flux at and above the solar surface. The largest phenomenon associated with this dissipation is the Coronal Mass Ejection (CME). The Solar and Heliospheric Observatory (SOHO) has provided remarkable views of the corona and CMEs, and served to highlight how these large interplanetary disturbances can have terrestrial consequences. STEREO is the next logical step to study the physics of CME origin, propagation, and terrestrial effects. Two spacecraft with identical instrument complements will be launched on a single launch vehicle in November 2007. One spacecraft will drift ahead and the second behind the Earth at a separation rate of 22 degrees per year. Observation from these two vantage points will for the first time allow the observation of the three-dimensional structure of CMEs and the coronal structures where they originate. Each STEREO spacecraft carries a complement of 10 instruments, which include (for the first time) an extensive set of both remote sensing and in-situ instruments. The remote sensing suite is capable of imaging CMEs from the solar surface out to beyond Earth's orbit (1 AU), and in-situ instruments are able to measure distribution functions for electrons, protons, and ions over a broad energy range, from the normal thermal solar wind plasma to the most energetic solar particles. It is anticipated that these studies will ultimately lead to an increased understanding of the CME process and provide unique observations of the flow of energy from the corona to the near-Earth environment. An international research program, the International Heliophysical Year (IHY) will provide a framework for interpreting STEREO data in the context of global processes in the Sun-Earth system.
Author
Coronal Mass Ejection; Solar Observatories; Magnetic Flux; Solar Corona; Dynamo Theory; Plasma Interactions

20040031816 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Unified Models of Turbulence and Nonlinear Wave Evolution in the Extended Solar Corona and Solar Wind
Cranmer, Steven R.; Wagner, William, Technical Monitor; February 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-11913
Report No.(s): Rept-2; No Copyright; Avail: CASI; A01, Hardcopy

The PI (Cranmer) and Co-I (A. van Ballegooijen) made substantial progress toward the goal of producing a unified model of the basic physical processes responsible for solar wind acceleration. The approach outlined in the original proposal comprised two complementary pieces: (1) to further investigate individual physical processes under realistic coronal and solar wind conditions, and (2) to extract the dominant physical effects from simulations and apply them to a 1D model of plasma

heating and acceleration. The accomplishments in Year 2 are divided into these two categories: 1a. Focused Study of Kinetic Magnetohydrodynamic (MHD) Turbulence. lb. Focused Study of Non - WKB Alfven Wave Rejection. and 2. The Unified Model Code. We have continued the development of the computational model of a time-study open flux tube in the extended corona. The proton-electron Monte Carlo model is being tested, and collisionless wave-particle interactions are being included. In order to better understand how to easily incorporate various kinds of wave-particle processes into the code, the PI performed a detailed study of the so-called 'Ito Calculus', i.e., the mathematical theory of how to update the positions of particles in a probabilistic manner when their motions are governed by diffusion in velocity space.
Derived from text
Turbulence; Nonlinearity; Wave-Particle Interactions; Solar Corona; Solar Wind; Magnetohydrodynamic Turbulence

20040033913 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Living with a Star: New Opportunities in Sun-Climate Research
December 2003; 54 pp.; In English
Report No.(s): NASA/NP-2003-11-584-GSFC; No Copyright; Avail: CASI; A04, Hardcopy

Living With a Star is a NASA initiative employing the combination of dedicated spacecraft with targeted research and modeling efforts to improve what we know of solar effects of all kinds on the Earth and its surrounding space environment, with particular emphasis on those that have significant practical impacts on life and society. The highest priority among these concerns is the subject of this report: the potential effects of solar variability on regional and global climate, including the extent to which solar variability has contributed to the well-documented warming of the Earth in the last 100 years. Understanding how the climate system reacts to external forcing from the Sun will also greatly improve our knowledge of how climate will respond to other climate drivers, including those of anthropogenic origin. A parallel element of the LWS program addresses solar effects on space weather : the impulsive emissions of charged particles, short-wave electromagnetic radiation and magnetic disturbances in the upper atmosphere and near-Earth environment that also affect life and society. These include a wide variety of solar impacts on aeronautics, astronautics, electric power transmission, and national defense. Specific examples are (1) the impacts of potentially- damaging high energy radiation and atomic particles of solar origin on satellites and satellite operations, spacecraft electronics systems and components, electronic communications, electric power distribution grids, navigational and GPS systems, and high altitude aircraft; and (2) the threat of sporadic, high-energy solar radiation to astronauts and high altitude aircraft passengers and crews. Elements of the LWS program include an array of dedicated spacecraft in near- Earth and near-Sun orbits that will closely study and observe both the Sun itself and the impacts of its variations on the Earth's radiation belts and magnetosphere, the upper atmosphere, and ionosphere. These spacecraft, positioned to study and monitor changing conditions in the Sun-Earth neighborhood, will also serve as sentinels of solar storms and impulsive events.
Derived from text
Solar Terrestrial Interactions; NASA Programs; Climatology; Space Missions

20040034012 California Inst. of Tech., Pasadena, CA, USA
Impact Processes in the Solar System
Ahrens, Thomas J.; March 04, 2004; 10 pp.; In English
Contract(s)/Grant(s): NAG5-10198; No Copyright; Avail: CASI; A02, Hardcopy

Our laboratory has previously conducted impact fracture and dynamic failure tests. Polanskey and Ahrens [1990] mapped the fractures from a series of laboratory craters (Fig. 1) and Ahrens and Rubin [1993] inferred that the usually further extending radial cracks resulted from tensional failure during the compression of the shock propagation. The radial spreading induced by the particle velocity field caused the stresses perpendicular to the shock front to become sufficiently large and tensile. This induces 'radial fractures.' The concentric fractures are attributed to the tensional failure occurring after the initial compressive phase. Upon radial propagation of the stress wave the negative tension behind the stress-wave front caused failure along the quasi-spherical concentric fractures. The near-surface and spall fractures are attributed to the fractures described by Melosh [1984]. These are activated by impact and can launch relatively unshocked samples of planetary surfaces to speeds exceeding escape velocity. In the case of Mars, some of these surface samples presumably become the SNC (Mars) meteorites.
Derived from text
Solar System; Impact Damage; Planetary Surfaces; Stress Propagation; Shock Fronts

20040034076 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling Images and Spectra of a Solar Flare Observed by RHESSI on 20 February 2002
Sui, Linhui; Holman, Gordon D.; Dennis, Brian R.; Krucker, Saem; Schwartz, Richard A.; Tolbert Kim; 2002; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We have analyzed a C7.5 limb flare observed by RHESSI on 20 February 2002. The RHESSI images appear to show two footpoints and a loop-top source. Our goal was to determine if the data are consistent with a simple steady-state model in which high-energy electrons are continuously injected at the top of a semicircular flare loop. A comparison of the RHESSI images with simulated images from the model has made it possible for us to identify spurious sources and fluxes in the RHESSI images. We find the RHESSI results are in many aspects consistent with the model if a thermal source is included between the loop footpoints, but there is a problem with the spectral index of the loop-top source. The thermal source between the footpoints is likely to be a low-lying loop interacting with the northern footpoint of a higher loop containing the loop-top source.
Author
Electrons; Solar Flares; Electron Acceleration

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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*.

20040031719 NASA Johnson Space Center, Houston, TX, USA
Radiation Protection Studies of International Space Station Extravehicular Activity Space Suits
Cucinotta, Francis A., Editor; Shavers, Mark R., Editor; Saganti, Premkumar B., Editor; Miller, Jack, Editor; December 2003; 198 pp.; In English
Report No.(s): NASA/TP-2003-212051; S-904; No Copyright; Avail: CASI; A09, Hardcopy

This publication describes recent investigations that evaluate radiation shielding characteristics of NASA's and the Russian Space Agency's space suits. The introduction describes the suits and presents goals of several experiments performed with them. The first chapter provides background information about the dynamic radiation environment experienced at ISS and summarized radiation health and protection requirements for activities in low Earth orbit. Supporting studies report the development and application of a computer model of the EMU space suit and the difficulty of shielding EVA crewmembers from high-energy reentrant electrons, a previously unevaluated component of the space radiation environment. Chapters 2 through 6 describe experiments that evaluate the space suits' radiation shielding characteristics. Chapter 7 describes a study of the potential radiological health impact on EVA crewmembers of two virtually unexamined environmental sources of high-energy electrons-reentrant trapped electrons and atmospheric albedo or 'splash' electrons. The radiological consequences of those sources have not been evaluated previously and, under closer scrutiny. A detailed computational model of the shielding distribution provided by components of the NASA astronauts' EMU is being developed for exposure evaluation studies. The model is introduced in Chapters 8 and 9 and used in Chapter 10 to investigate how trapped particle anisotropy impacts female organ doses during EVA. Chapter 11 presents a review of issues related to estimating skin cancer risk form space radiation. The final chapter contains conclusions about the protective qualities of the suit brought to light form these studies, as well as recommendations for future operational radiation protection.
Author
Extravehicular Activity; International Space Station; Radiation Protection; Extraterrestrial Radiation; Extravehicular Mobility Units

20040031760 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Galactic Emission in the Wilkinson Microwave Anisotropy Probe (WMAP) Maps
Bennett, Charles, et al.; [2003]; 1 pp.; In English; Planck WG7 Meeting: Galactic Emission in the Willcinson Microwave Anisotropy Probe (WMAP) Maps, 30 Jun. - 2 Jul. 2003, Manchester, UK; No Copyright; Avail: Other Sources; Abstract Only

The Wilkinson Microwave Anisotropy Probe (WMAP) has mapped the full sky in five microwave frequency bands from 23 to 94 GHz with sub-degree angular resolution. While the primary goal of the mission is to measure the cosmic microwave background anisotropy, the data also provide a wealth of information about microwave emission from the Milky Way. We present full sky maps of the synchrotron, free-free, and dust emission obtained from the first-year data and comment on how these maps inform our understanding of the interstellar medium.
Author
Background Radiation; Interstellar Matter; Microwave Anisotropy Probe; Milky Way Galaxy; Electromagnetic Measurement; Galactic Cosmic Rays; Mapping

20040034754 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Abundance of the Radioactive Be-10 in the Cosmic Radiation up to 2 GeVnucleon-l with the Balloon-borne Instrument ISOMAX1998

Hams, T.; Barbier, L. M.; Bremerich, M.; Christian, E. R.; deNolfo, G. A.; Geier, S.; Goebel, H.; Gupta, S. K.; Hof, M.; Menn, W., et al.; [2004]; 1 pp.; In English

Report No.(s): RTOP 353-87-02; No Copyright; Avail: Other Sources; Abstract Only

The Isotope Magnet Experiment (ISOMAX) a balloon-borne superconducting magnet spectrometer was designed to measure the isotopic composition of the light isotopes (3 less than or equal to Z less than or equal to 8) of the cosmic radiation up to 4 GeV nucleon (exp -1) with a mass resolution of better than 0.25 amu by using the velocity vs. rigidity technique. To achieve this stringent mass resolution ISOMAX was comprised of three major detector systems, a magnetic rigidity spectrometer with a precision drift chamber tracker in conjunction with a three-layer time-of-flight system and two silica-aerogel Cherenkov counters for the velocity determination. A special emphasis of the ISOMAX program was the accurate measurement of radioactive Be-10 with respect to its stable neighbor isotope Be-9, which provides important constraints on the age of cosmic rays in the Galaxy. ISOMAX had its first balloon flight on August 4-5, 1998, from Lynn Lake, Manitoba, Canada. Thirteen hours of data were recorded during this flight at a residual atmosphere of less than 5 g per square centimeter. The isotopic ratio at the top of the atmosphere for Be-10/Be-9 was measured to be 0.195 plus or minus 0.036 (statistical) plus or minus 0.039 (systematic) between 0.26 - 1.03GeV nucleon (exp -1) and 0.317 plus or minus 0.109 (statistical) plus or minus 0.042 (systematic) between 1.13 - 2.03GeV nucleon(exp -1). This is the first measurement of its kind above 1 GeV nucleon (exp -1). ISOMAX results tend to be higher than predictions from current propagation models.
Author

Beryllium Isotopes; Abundance; Balloon-Borne Instruments; Nucleons; Superconducting Magnets; Spectrometers; Cosmic Rays

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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.

20040033987 Academia Sinica, Beijing, China

Recognition of Eastern and Western Faces with Internal and External Features: An ERP Study

Peng, Xiao-Hu; Luo, Yue-Jia; Wei, Jing-Han; Wang, Guo-Feng; Space Medicine and Medical Engineering, Volume 16, No. 2; April 2003, pp. 123-127; In Chinese; See also 20040033970; Copyright; Avail: Other Sources

The objective of this investigation was to study the differences between recognitions of eastern and western faces with internal and external features. Event related potentials were recorded in 16 healthy subjects during gender discrimination task.
Author (revised)

Face (Anatomy); Discrimination

20040034266 InDyne, Inc., Cocoa Beach, FL, USA

Chronology of KSC and KSC Related Events for 2003

Liston, Elaine E.; February 2004; 240 pp.; In English

Report No.(s): NASA/TM-2004-211520; No Copyright; Avail: CASI; A11, Hardcopy

This document is intended to serve as a record of KSC events and is a reference source for historians and other researchers. Arrangement is by day and month and individual articles are attributed to published sources. Materials were researched and described by the KSC Library Archivist for KSC Library Services Contractor, InDyne, Inc.
Author

Research Facilities; Accident Investigation; Chronology; Columbia (Orbiter); International Space Station; Spacecraft Landing; Schedules; Spacecraft Launching

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