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Space Administration
Langley Research Center

Scientific and Technical
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NASA STI Program ... in Profile

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

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

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NASA Center for AeroSpace Information (CASI)

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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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Subject Term Index

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20070032871 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Formation Flying for Distributed InSAR

Scharf, Daniel P.; Murray, Emmanuell A.; Ploen, Scott R.; Gromov, Konstantin G.; Chen, Curtis W.; August 21, 2006; 15 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, 20-25 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40237

We consider two spacecraft flying in formation to create interferometric synthetic aperture radar (InSAR). Several candidate orbits for such in InSar formation have been previously determined based on radar performance and Keplerian orbital dynamics. However, with out active control, disturbance-induced drift can degrade radar performance and (in the worst case) cause a collision. This study evaluates the feasibility of operating the InSAR spacecraft as a formation, that is, with inner-spacecraft sensing and control. We describe the candidate InSAR orbits, design formation guidance and control architectures and algorithms, and report the (Delta)(nu) and control acceleration requirements for the candidate orbits for several tracking performance levels. As part of determining formation requirements, a formation guidance algorithm called Command Virtual Structure is introduced that can reduce the (Delta)(nu) requirements compared to standard Leader/Follower formation approaches.

Author

Formation Flying; Synthetic Aperture Radar; Spacecraft Control; Active Control; Algorithms

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.

20070033072 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optimal Wind Corrected Flight Path Planning for Autonomous Micro Air Vehicles

Zollars, Michael D; Mar 2007; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469319; AFIT/GAE/ENY/07-M28; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469319

This research effort focuses on determining the optimal flight path required to put a micro air vehicle's (MAVs) fixed sensor on a target in the presence of a constant wind. Autonomous flight is quickly becoming the future of air power and over the past several years, the size and weight of autonomous vehicles has decreased dramatically. As these vehicles were implemented into the field, it was quickly discovered that their flight paths are severely altered by wind. However, since the size of the vehicle does not allow for a gimbaled camera, only a slight perturbation to the attitude of the vehicle will cause the sensor footprint to be displaced dramatically. Therefore, the goal of this research was to use dynamic optimization techniques to determine the optimal flight path to place a MAV?s sensor footprint on a target when operating in wind for three different scenarios. The first scenario considered the minimum time path given an initial position and heading and a final

position and heading. The second scenario minimized the error between the MAV?s ground track and a straight line to the target in order to force a desired path on the vehicle. The final scenario utilized both a forward mounted sensor as well as a side mounted sensor to optimize the time the target is continually in view of the sensor footprint. Each of these scenarios has been captured in simulated plots that depict varying wind angles, wind speeds, and initial and final heading angles. These optimal flight paths provide a benchmark that will validate the quality of future closed-loop wind compensation control systems.
DTIC
Autonomous Navigation; Autonomy; Flight Paths; Trajectory Planning

20070033294 Arnold Engineering Development Center, Arnold AFS, TN USA
Developing a Data Set and Processing Methodology for Fluid/Structure Interaction Code Validation
Deken, Louis; Tibbals, Thomas; Reed, James; Saunder, Grady P; Yen, Joseph; Jun 2007; 124 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-11012
Report No.(s): AD-A469442; AEDC-TSR-06-T1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the testing reported herein was to obtain data describing fluid and structural behavior (interaction of fluid on structure and of structure on fluid) in a controlled experiment in a systematic manner. These data are to be used for (a) validation of fluid/structure interaction (FSI) modeling codes and (b) to demonstrate a process for archiving and accessing the data. The approach, which uses two types of models (wing and tethered mass), was to obtain ambient upstream, wall, and downstream static and dynamic fluid pressures for the models in various dynamic conditions.
DTIC
Computational Fluid Dynamics; Computer Programming; Data Processing; Software Engineering; Wind Tunnel Models; Wind Tunnel Tests

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.

20070032941 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Information Complexity in Air Traffic Control Displays
Xing, Jing; September 2007; 21 pp.; In English
Contract(s)/Grant(s): HRRD522
Report No.(s): DOT/FAA/AM-07/26; No Copyright; Avail.: CASI: A03, Hardcopy

Air traffic controllers typically use visual displays to interact with various automation systems. Automation tools are intended to reduce controller task load, but they may also create new tasks associated with acquiring, integrating, and utilizing information from displays. Consequently, the complexity of information displayed may reduce the efficiency and effectiveness of an automation system. Moreover, complexity could cause controllers to miss or misinterpret visual data, thereby reducing safety. Thus, information complexity in air traffic control (ATC) displays represents a potential bottleneck in ATC systems. To evaluate the cost and benefit of an automation system, it is important to understand whether the information it provides is too complex for controllers to process. The purpose of this study was to answer three basic questions: 1) What constitutes information complexity in automation displays? 2) What level of display complexity is 'too complex' for controllers? 3) Can we objectively measure information complexity in ATC displays? In this study, we first developed a general framework for measuring information complexity. The framework reduces the concept of complexity into three underlying factors: quantity, variety, and the relations between basic information elements; each factor is evaluated at three generic stages of human information processing: perception, cognition, and action. By this definition, we decompose complexity into a 3x3 matrix, measuring the effects of a complexity factor on information processing at a given stage. We then take the following steps to develop complexity metrics for ATC displays: 1) Identify task requirements of using the displays in ATC; 2) Determine corresponding brain functions pertinent to the task requirements; and 3) Choose the metric that can measure the effects of the

complexity factor on the brain functions. Using this approach, we developed nine metrics of ATC display complexity. These metrics provide an objective method to evaluate automation displays for acquisition evaluation and design prototypes.
Author
Air Traffic Control; Air Traffic Controllers (Personnel); Display Devices; Man Machine Systems; Human Performance

20070032942 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
An International Survey of Maintenance Human Factors Programs
Hackworth, Carla; Holcomb, Kali; Dennis, Melanie; Goldman, Scott; Bates, Crista; Schroeder, David; Johnson, William; September 2007; 30 pp.; In English
Contract(s)/Grant(s): AM-B-06-HRR-521
Report No.(s): DOT/FAA/AM-07/25; Copyright; Avail.: CASI: A03, Hardcopy

There are many international approaches to the regulation of human factors programs for aviation maintenance organizations. Transport Canada and the European Aviation Safety Agency have established specific regulations regarding maintenance human factors. The Federal Aviation Administration has not yet established regulations but, instead, has created pidance documents and developed voluntary reporting programs for maintenance organizations. The purpose of this study was to assess the status of human factors programs in airline maintenance organizations and independent maintenance and repair organizations. Questions focused on training, error management, fatigue management, and other human factors issues. An online link was sent via Email to 630 addresses. Of these, 414 respondents returned a valid questionnaire (i.e., defined as responding to at least one content item), which resulted in a response rate of 66%. A highly-experienced group (i.e., over 65% had 20 years in aviation maintenance) from more than 50 countries responded to the questionnaire. Results highlight the maintenance human factors strategies, methods, and programs that companies use to reduce human error.
Author
Aircraft Maintenance; Human Factors Engineering; Safety Management; Human Performance

20070033058 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Analysis of Aircraft Handling Quality Data Obtained From Boundary Avoidance Tracking Flight Test Techniques
Dotter, Jason D; Mar 2007; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469290; AFIT/GAE/ENY/07-M24; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469290

Cooper-Harper ratings (CHRs) have been used to describe and compare aircraft handling qualities for over 40 years, but are by their very nature, subjective. The subjective and sometimes ambiguous results obtained from qualitative handling quality ratings are inconsistent with the rest of the flight test process, where quantifiable results followed by statistical analysis are the norm. This thesis presents a method for obtaining accurate and consistent flight test data that quantifies the handling qualities of a specific aircraft. The method is demonstrated using both pilot-inthe- loop simulations and flight tests with the NF-16D Variable-Stability In-Flight Simulator Test Aircraft (VISTA). Boundary Avoidance Tracking (BAT), introduced in 2004 by Mr. William Gray III, a test pilot at the US Air Force Test Pilot School (TPS), is used here to provide a novel approach for forcing an increase in pilot workload and tracking performance in order to assess an aircrafts handling qualities. By utilizing BAT with shrinking desired performance boundaries on a point tracking task, pilots are forced to their maximum performance (i.e. minimum error) on the tracking task. This maximum achievable BAT performance can then be used as a measure of the aircraft?s handling ?quality?. The BAT method of assessing an aircraft?s handling quality was used with both pilot-in-the-loop simulations and flight tests to obtain quantitative tracking performance data. This data was compared and correlated to CHR data. In order to collect the data, a 6-degrees-of-freedom (DOF) pilot-in-the-loop F-16 simulator was developed and implemented on a desktop computer. Twenty seven test subjects flew the BAT profile on the desktop simulator; these subjects also flew the same profile in AFRL/VA?s Infinity Cube simulator. Data from these two simulations were used to develop a flight test plan for implementation on AFRL/VA?s Large Amplitude Multi-mode Aerospace RSimulator (LAMARS) and on TPS?s Nde
DTIC
Boundaries; Controllability; Flight Tests

20070033094 Link Simulation and Training, Mesz, AZ USA

Effect of Display Line Rate and Antialiasing on the Recognition of Aircraft Aspect Angle

Winterbottom, Marc D; Geri, George A; Pierce, Byron J; Feb 2007; 7 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-1123

Report No.(s): AD-A469366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469366

Increasing Display line rate did not improve aspect angle recognition performance beyond a level predicted by measured display resolution. Image antialiasing improved performance even though it did not increase the measured spatial resolution. Finally, the threshold for aspect angle recognition was found to be consistent with that obtained for other visual tasks dependent on target spatial detail.

DTIC

Radar Tracking; Signal Processing

20070033300 Air Force Research Lab., Wright-Patterson AFB, OH USA

Computer Modeling of Acceleration Effects on Cerebral Oxygen Saturation

McKinley, Richard A; Tripp, Jr , Lloyd D; Bolia, Steve D; Roark, Marvin A; Apr 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A469448; AFRL-HE-WP-JA-2007-0004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Introduction: Failure to effectively regulate BP and cerebral perfusion during high-G aircraft maneuvering may contribute to reduced performance in pilots due to the fact that perfusion to the peripheral cerebral tissues may not be adequate to support the mental demands of flight. Therefore, a critical area of investigation is the study of cortical tissue oxygenation responses to + Gz acceleration. Methods: Two experiments were used to build two sections of a cerebral oxygen saturation (rso2) model. Experiment 1: Six subjects participated in the study. A cerebral oximeter (gold standard) provided rso2. Acceleration profiles (subjects relaxed) included a 0.1 G .5-1 G onset to central light loss (CLL) and a 3 G .5-I onset to a G level that was 1 Gz above CLL to an endpoint of G-LOC. Experiment 2: There were 12 subjects (with G protection) who participated in this study. The rso2 data were collected during five different simulated aerial combat maneuvers. A model was created that read the Gz profile as input and calculated changes in rso2. The correlation coefficient, linear best-fit slope, and mean percent error were calculated to determine agreement. Results: The average value for the correlation coefficients, linear best-fit slopes, and mean percent errors for the unprotected subjects were 0.79, 0.87, and 6.08, respectively. These values for the protected subjects were 5 G (0.994, 1.011, 0.384), 6 G (0.994, 0.909,0.811), 7 G (0.986,1.061,0.692), 8 G (0.969,1.016,1.300), and 9 G (0.994.979,0.558), respectively. Discussion: The model is a good predictor of rso2 values for protected and unprotected subjects under +Gz stress.

DTIC

Acceleration (Physics); Cerebral Cortex; Cerebrum; Computerized Simulation; Oxygen

20070033328 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optical Tracking for Relative Positioning in Automated Aerial Refueling

Spencer, James H; Mar 2007; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469498; AFIT/GE/ENG/07-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An algorithm is designed to extract features from video of an air refueling tanker for use in determining the precise relative position of a receiver aircraft. The algorithm is based on receiving a known estimate of the tanker aircrafts position and attitude. The algorithm then uses a known feature model of the tanker to predict the location of those features on a video frame. A corner detector is used to extract features from the video. The measured corners are then associated with known features and tracked from frame to frame. For each frame, the associated features are used to calculate three dimensional pointing vectors to the features of the tanker. These vectors are passed to a navigation algorithm which uses extended Kalman ?lters, as well as data-linked INS data to solve for the relative position of the tanker. The algorithms were tested using data from a ?ight test accomplished by the USAF Test Pilot School using a C-12C as a simulated tanker and a Learjet LJ-24 as the simulated receiver. The system was able to provide at least a dozen useful measurements per frame, with and without projection error.

DTIC

Air to Air Refueling; Algorithms; Optical Tracking; Positioning; Refueling

20070033389 Michigan Univ., Ann Arbor, MI USA

Computational Investigation of Unsteady Low-Reynolds Number Aerodynamics for Micro Air Vehicles

Shyy, Wei; Lian, Youngsheng; Mar 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0491

Report No.(s): AD-A469572; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Navier-Stokes equation solver is utilized to investigate the aerodynamics of a flapping airfoil. The roles of plunging and pitching amplitude and frequency, and Strouhal number are studied. For a NACA0012 airfoil at zero geometric angle of attack, chord Reynolds number of 20,000 and at a given plunging frequency, either drag or thrust is produced, depending on the plunging amplitude. When drag is produced, the viscous force dominates the total drag with decreasing influence as the plunging amplitude increases. At the considered plunging amplitude (from 0.0125c to 0.075c), flow history has more influence than the kinematic angle of attack in determining lift. For an airfoil experiencing combined plunge and pitch motion, both thrust and input power increase with the Strouhal number (within the range of 0.03 to 0.5). For the case studied, the thrust is induced by the lift, which follows approximately the curve of kinematic angle of attack. Leading edge vortex moves downstream and interacts with the trailing edge vortex. The impact of a gust on a stationary and flapping airfoil is also studied. DTIC

Aerodynamic Characteristics; Aerodynamics; Airfoils; Computerized Simulation; Low Reynolds Number; Navier-Stokes Equation; Remotely Piloted Vehicles; Reynolds Number

20070034015 NASA Langley Research Center, Hampton, VA, USA

Distributed Traffic Complexity Management by Preserving Trajectory Flexibility

Idris, Husni; Vivona, Robert A.; Garcia-Chico, Jose-Luis; Wing, David J.; October 21, 2007; 12 pp.; In English; 26th Digital Avionics Systems Conference, 21-25 Oct. 2007, Dallas, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): NNA07BA86C; WBS 411931.02.11.07.01.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034015

In order to handle the expected increase in air traffic volume, the next generation air transportation system is moving towards a distributed control architecture, in which groundbased service providers such as controllers and traffic managers and air-based users such as pilots share responsibility for aircraft trajectory generation and management. This paper presents preliminary research investigating a distributed trajectory-oriented approach to manage traffic complexity, based on preserving trajectory flexibility. The underlying hypotheses are that preserving trajectory flexibility autonomously by aircraft naturally achieves the aggregate objective of avoiding excessive traffic complexity, and that trajectory flexibility is increased by collaboratively minimizing trajectory constraints without jeopardizing the intended air traffic management objectives. This paper presents an analytical framework in which flexibility is defined in terms of robustness and adaptability to disturbances and preliminary metrics are proposed that can be used to preserve trajectory flexibility. The hypothesized impacts are illustrated through analyzing a trajectory solution space in a simple scenario with only speed as a degree of freedom, and in constraint situations involving meeting multiple times of arrival and resolving conflicts.
Author

Air Traffic Control; Air Transportation; Weather; Flexibility; Trajectories

20070034018 NASA Langley Research Center, Hampton, VA, USA

A Look at Aircraft Accident Analysis in the Early Days: Do Early 20th Century Accident Investigation Techniques Have Any Lessons for Today?

Holloway, C. M.; Johnson, C. W.; October 22, 2007; 6 pp.; In English; 2nd International Conference on System Safety 2007, 22-24 Oct. 2007, London, UK; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07.07.08; Copyright; Avail.: CASI: A02, Hardcopy

In the early years of powered flight, the National Advisory Committee on Aeronautics in the USA produced three reports describing a method of analysis of aircraft accidents. The first report was published in 1928; the second, which was a revision of the first, was published in 1930; and the third, which was a revision and update of the second, was published in 1936. This paper describes the contents of these reports, and compares the method of analysis proposed therein to the methods used today.
Author

Aircraft Accident Investigation; Aeronautics; Civil Aviation; Air Transportation

20070034081 Micro Analyais and Design, Inc., Okemos, MI USA

Evaluating Competency-based Performance: A Probabilistic Approach

Carolan, Thomas F; Schurig, Ira; Bennett, Jr, Winston; Dec 2006; 14 pp.; In English

Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924

Report No.(s): AD-A469432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469432

This paper describes part of an ongoing research program designed to integrate both objective and observer-provided data to develop comprehensive tools for assessing and diagnosing pilot performance in complex and dynamic training and rehearsal environments. The goal is to provide a probabilistic capability to assess pilot knowledge and skill competencies and to provide results to instructors for their use in the remediation of performance and the identification of 'gaps' that remain. The development process and efforts to date are reported.

DTIC

Pilots; Pilot Performance; Education

20070034132 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Three-Dimensional Analysis of a Composite Repair and the Effect of Overply Shape Variation on Structural Efficiency

Sutter, David A; Mar 2007; 140 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469311; AFIT/GAE/ENY/07-M22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469311

This research characterizes, in the elastic range, a scarf joint with overply using digital image correlation photogrammetry and finite element modeling. Additionally, the effect of varying the overply's geometric profile is examined. Specimens are constructed from AS4/3501-6 prepreg with a [0/+/-45/90]2S layup. A fixture is used to achieve a consistent scarfed hole in each panel. The patch and adhesive (FM 300) are co-cured to the panels using positive pressure, which minimizes repair porosity. Three variations in the overply geometry are used: circular, rooftop-end, and tooth-end. The full strain field in each uni-axially loaded specimen is captured using digital image correlation photogrammetry (ARAMIS). These results validate an ABAQUS 3-D finite element model of a scarf patch with circular overply. Good correlation is evident in the longitudinal strain; strain sensitivity limits correlation in the transverse and shear directions. The finite element model is used to identify peak out-of-plane stresses in the repair joint. Significant normal stresses occur at edge of the overply and at the inner scarf diameter. Finally, the experimentally-measured strains of the 3 overply variations are examined. Variation in strain magnitude is insignificant; the strain gradient at the overply edge, however, is significantly lower on the profile with the tooth-edge.

DTIC

Industries; Maintenance; Shapes; Three Dimensional Composites

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.

20070032807 NASA Dryden Flight Research Center, Edwards, CA, USA

Flight Testing of the Gulfstream Quiet Spike(TradeMark) on a NASA F-15B

Smolka, James W.; Cowert, Robert A.; Molzahn, Leslie M.; September 27, 2007; 41 pp.; In English; 51st SETP Symposium, 27-29 Sep. 2007, Anaheim, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Gulfstream Aerospace has long been interested in the development of an economically viable supersonic business jet (SBJ). A design requirement for such an aircraft is the ability for unrestricted supersonic flight over land. Although independent studies continue to substantiate that a market for a SBJ exists, regulatory and public acceptance challenges still remain for supersonic operation over land. The largest technical barrier to achieving this goal is sonic boom attenuation. Gulfstream's attention has been focused on fundamental research into sonic boom suppression for several years. This research was conducted in partnership with the NASA Aeronautics Research Mission Directorate (ARMD) supersonic airframe cruise efficiency technical challenge. The Quiet Spike, a multi-stage telescopic nose boom and a Gulfstream-patented design (references 1 and 2), was developed to address the sonic boom attenuation challenge and validate the technical feasibility of

a morphing fuselage. The Quiet Spike Flight Test Program represents a major step into supersonic technology development for sonic boom suppression. The Gulfstream Aerospace Quiet Spike was designed to reduce the sonic boom signature of the forward fuselage for an aircraft flying at supersonic speeds. In 2004, the Quiet Spike Flight Test Program was conceived by Gulfstream and NASA to demonstrate the feasibility of sonic boom mitigation and centered on the structural and mechanical viability of the translating test article design. Research testing of the Quiet Spike consisted of numerous ground and flight operations. Each step in the process had unique objectives, and involved numerous test team members from the NASA Dryden Flight Research Center (DFRC) and Gulfstream Aerospace. Flight testing of the Quiet Spike was conducted at the NASA Dryden Flight Research Center on an F-15B aircraft from August, 2006, to February, 2007. During this period, the Quiet Spike was flown at supersonic speeds up to Mach 1.8 at the maximum design dynamic pressure of 685 pounds per square foot. Extension and retraction tests were conducted at speeds up to Mach 1.4. The design of the Quiet Spike to shape the forward shock wave environment of the aircraft was confirmed during near-field shock wave probing at Mach 1.4. Thirty-two flights were performed without incident and all project objectives were achieved. The success of the Quiet Spike Flight Test Program represents an important step towards developing commercial aircraft capable of supersonic flight over land within the continental USA and in international airspace.
Derived from text
Flight Tests; F-15 Aircraft; Quiet Engine Program; Computational Fluid Dynamics; Sonic Booms; Supersonic Speed; Folding Structures

20070032808 ASRC Aerospace Corp., Cleveland, OH, USA
A Database of Supercooled Large Droplet Ice Accretions
FossVanZante, Judith; September 2007; 25 pp.; In English; Aircraft and Engine Icing International Conference, 24-27 Sep. 2007, Seville, Spain; Original contains color illustrations
Contract(s)/Grant(s): NNC06BA07B; WBS 122711.03.11.03.04.04.01
Report No.(s): NASA/CR-2007-215020; SAE 2007-01-3348; E-16222; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032808

A unique, publicly available database regarding supercooled large droplet ice accretions has been developed in NASA Glenn's Icing Research Tunnel. Identical cloud and flight conditions were generated for five different airfoil models. The models chosen represent a variety of aircraft types from the horizontal stabilizer of a large trans-port aircraft to the wings of regional, business, and general aviation aircraft. In addition to the standard documentation methods of 2D ice shape tracing and imagery, ice mass measurements were also taken. This database will also be used to validate and verify the extension of the ice accretion code, LEWICE, into the SLD realm.
Author
Data Bases; Drop Size; Ice Formation; Supercooling; Research; Wind Tunnels; Aircraft Icing

20070032918 NASA Langley Research Center, Hampton, VA, USA
Automatic Conversion of Conceptual Geometry to CFD Geometry for Aircraft Design
Li, Wu; March 25, 2007; 21 pp.; In English; SIAM Conference on Mathematics for Industry: Challenges and Frontiers, 9-11 Oct. 2007, Philadelphia, PA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 984754.02.07.07.12.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032918

Conceptual aircraft design is usually based on simple analysis codes. Its objective is to provide an overall system performance of the developed concept, while preliminary aircraft design uses high-fidelity analysis tools such as computational fluid dynamics (CFD) analysis codes or finite element structural analysis codes. In some applications, such as low-boom supersonic concept development, it is important to be able to explore a variety of drastically different configurations while using CFD analysis to check whether a given configuration can be tailored to have a low-boom ground signature. It poses an extremely challenging problem of integrating CFD analysis in conceptual design. This presentation will discuss a computer code, called iPatch, for automatic conversion of conceptual geometry to CFD geometry. In general, conceptual aircraft geometry is not as well-defined as a CAD geometry model. In particular, a conceptual aircraft geometry model usually does not define the intersection curves for the connecting surfaces. The computer code iPatch eliminates the gap between conceptual geometry and CFD geometry by accomplishing the following three tasks automatically: (1) use bicubic B-splines to extrapolate (if necessary) each surface in a conceptual geometry so that all the independently defined geometry components (such as wing and fuselage) can be intersected to form a watertight CFD geometry, (2) compute the intersection curves of surface patches at any resolution (up to 10-7 accuracy) specified by users, and (3) write the B-spline surface patches and the corresponding boundary points for the watertight CFD geometry in the format that can be directly exported to the meshing

tool VGRID in the CFD software TetrUSS. As a result, conceptual designers can get quick feedback on the aerodynamic characteristics of their concepts, which will allow them to understand some subtlety in their concepts and to be able to assess their concepts with a higher degree of confidence. This integration of CFD analysis in conceptual aircraft design will greatly eliminate some uncertainty due to simple analysis codes used to develop the concepts and improve the feasibility/credibility of the final concept. The presentation will highlight the mathematical challenges of accomplishing the aforementioned three tasks and the computational algorithms used by iPatch.
Derived from text
Aircraft Design; Computational Fluid Dynamics; Structural Analysis; Computer Aided Design; Aerodynamic Characteristics; Body-Wing Configurations

20070032920 NASA Langley Research Center, Hampton, VA, USA
Robust Gain-Scheduled Fault Tolerant Control for a Transport Aircraft
Shin, Jong-Yeob; Gregory, Irene; [2007]; 6 pp.; In English; 16th IEEE Conference on Control Applications (CCA 2007), 1-3 Oct. 2007, Singapore, Japan
Contract(s)/Grant(s): NCC1-02043; WBS 457280.02.07; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032920

This paper presents an application of robust gain-scheduled control concepts using a linear parameter-varying (LPV) control synthesis method to design fault tolerant controllers for a civil transport aircraft. To apply the robust LPV control synthesis method, the nonlinear dynamics must be represented by an LPV model, which is developed using the function substitution method over the entire flight envelope. The developed LPV model associated with the aerodynamic coefficient uncertainties represents nonlinear dynamics including those outside the equilibrium manifold. Passive and active fault tolerant controllers (FTC) are designed for the longitudinal dynamics of the Boeing 747-100/200 aircraft in the presence of elevator failure. Both FTC laws are evaluated in the full nonlinear aircraft simulation in the presence of the elevator fault and the results are compared to show pros and cons of each control law.
Author
Civil Aviation; Fault Tolerance; Transport Aircraft; Mathematical Models; Optimization; Amplification

20070033016 Lockheed Martin Technology Services Group, Mesa, AZ USA
Transforming Training: A Perspective on the Need and Payoffs from Common Standards
Schreiber, Brian T; Dec 2006; 22 pp.; In English
Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924
Report No.(s): AD-A469219; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469219

Standards emerging today position the training research community on the eve of a scientific breakthrough. In the near future, the scientific community will likely benefit from the ability to routinely cross-compare training technologies and techniques from laboratory training study results, various operational training implementations, and possibly even live exercises. To achieve this capability, common standards must exist in the competencies to be assessed, the metrics used to evaluate those competencies, and the technology enablers to implement those assessments across training organizations. The current work aims (1) to discuss how the use of these common standards can afford this cross-comparison capability, (2) to provide a proof-of-concept study relying on only these standards, illustrating how this approach can be capitalized on at numerous training facilities, (3) to highlight where the common standards can be expanded, and (4) to provide some baseline distributed simulation within-simulator learning results. Thirty-five F-16 teams participated in week-long distributed mission operations (DMO) simulator training. The study was successfully conducted using the common standards with data captured on 31 teams. Minor issues were discovered in the technology enabling standards and recommendations are provided. By the end of the training week, F-16 teams increased weapons employment effectiveness and their kill ratios increased, while launching weapons at longer ranges and permitting fewer enemy strikers to reach their target. The results suggest assessing human performance across installations for cross-comparison of results is feasible, but some maturation of technology enabler standards is necessary to provide a routine, automatic, and robust inter-organizational cross-comparison capability.
DTIC
Education; Probability Theory

20070033043 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Damage Detection Using Lamb Waves for Structural Health Monitoring

Crider II, Jeffrey S; Mar 2007; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469262; AFIT/GA/ENY/07-M05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469262

Nondestructive structural health monitoring (SHM) is an evolving technology being developed for monitoring air and space systems. The information gathered on a system's structural integrity through SHM detection methods may result in reduced costly maintenance inspections, enhanced safety, and system failure predictions. This study evaluates Lamb wave approaches used to detect simulated cracks in laboratory experiments on thin plates to detect more realistic damage in a test article representing the complex geometry of an existing aircraft bulkhead. We take a 'hot-spot' monitoring approach, where we monitor an area of the structure known to fail. In our experiment, we evaluated the use of piezoelectric generated tuned Lamb waves for crack detection. The use of Lamb waves, guided elastic waves in a plate, has shown promise in detecting highly localized damage due to the relatively short wavelengths of the propagating waves. We evaluated both pitch-catch and pulse-echo approaches for Lamb wave excitation and measurement. Crack detection is accomplished by comparing the responses from the damaged test article to the responses of the healthy test article.

DTIC

Crack Propagation; Damage; Detection; Health; Lamb Waves; Nondestructive Tests; Structural Failure

20070033115 Army War Coll., Carlisle Barracks, PA USA

Creating a Joint Aviation Engineering and Flight Test Organization

Rombough, Douglas H; Mar 12, 2007; 21 pp.; In English

Report No.(s): AD-A469418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469418

The Department of Defense does not have a joint aviation engineering and flight test (JAEFT) organization, yet each service has its own aviation engineering organizations and multiple flight test organizations. As a result, the Joint Requirements Oversight Council (JROC) does not have a single point of contact within each Service if faced with a joint aviation issue. This project will argue that a joint aviation engineering and flight test (JAEFT) organization is necessary to prevent duplication of effort within and among the services, to ensure joint compatibility where appropriate, and to standardize engineering practices. Having this organization will result in reduced acquisition timelines, reduced costs, and improved joint warfighting capabilities.

DTIC

Aeronautical Engineering; Flight Tests; Military Operations

20070033324 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Toward a Flying MEMS Robot

Glauvitz, Nathan E; Mar 2007; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469488; AFIT/GE/ENG/07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The work in this thesis includes the design, modeling, and testing of motors and rotor blades to be used on a millimeter-scale helicopter style flying micro air vehicle (MAV). Three different types of motor designs were developed and tested, which included circular scratch drives, electrostatic motors, and comb drive resonators. Six different rotor designs were tested; five used residual stress while one design used photoresist to act as a hinge to achieve rotor blade deflection. Two key parameters of performance were used to evaluate the motor and rotor blade designs: the frequency of motor rotation and the angle of deflection achieved in the rotor blades. One successful design utilized a scratch drive motor with four attached rotor blades to try to achieve lift. While the device rotated successfully, the rotational frequency was insufficient to achieve lift-off. The electrostatic motor designs proved to be a challenge, only briefly moving before shorting out; nonetheless, lessons were learned. Comb drive designs operated over a wide range of high frequencies, lending them to be a promising method of turning a rotary MAV. None of the fabricated devices were able to achieve lift, due to insufficient rotational rates and low angles of attack on the rotor blades. With slight modifications to the current designs, the required rotational rates and rotor blade deflections would yield a viable MAV. The ultimate objective of this effort was to create an autonomous MAV on the millimeter scale, able to sense and act upon targets in its environment. Such a craft would be virtually undetectable, stealthily maneuvering and capable of precision engagement.

DTIC

Helicopters; Microelectromechanical Systems; Robots

20070034067 Army War Coll., Carlisle Barracks, PA USA
Time for Centralized Control of Unmanned Aerial Systems
Leister, Barry P; Feb 1, 2007; 24 pp.; In English
Report No.(s): AD-A469584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of UAVs in peace and conflict is not new; however, when UAVs are used to perform tasks historically accomplished by manned aircraft, they make national headlines. The increased use of UAVs in military operations in Kosovo, Afghanistan, and Iraq since prior to the turn of the century has brought the advantages and disadvantages of these systems to the forefront for military users. With the help of a UAV overhead, troops on the ground can get instantaneous situational awareness of the threats behind nearby hills or buildings. Despite the significant successes of unmanned systems on the battlefield, several issues exist which must be addressed before UAVs can truly integrate into joint and combined operations. The major issues are airspace congestion, frequency/bandwidth saturation, and limited interoperability of UAV systems. This paper will briefly outline the history of UAVs and the anticipated future growth of these systems in militaries around the world, especially in the USA. The main focus will be on detailing the three identified issues with UAVs, and explain why continuing to address each issue with a disjointed, service-specific approach will limit UAV employment in current and future combat zones.
DTIC
Remotely Piloted Vehicles; Military Operations; Interoperability

20070034090 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Systems Engineering Process for an Integrated Structural Health Monitoring System
Bond, Matthew S; Rodriguez, James A; Nguyen, Hieu T; Mar 2007; 240 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469542; AFIT/GSE/ENY/07-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force is continually researching ways to reduce costs associated with aircraft maintenance and improve operational safety. This study focuses on creating a systems engineering process to develop an Integrated Structural Health Monitoring System (ISHMS). The overarching process was then applied to design a conceptual ISHMS for a real-world scenario involving the F-15. Sensor selection, integration and testing were explored in detail using frequency response methods to detect structural damage. Testing was accomplished using a simplified structural specimen with Monitoring & Evaluation Technology Integration System (METIS) disk nodes attached at various locations. Two different METIS disk operation modes were utilized; pulse-echo and pitch-catch. Simulated and actual damage were introduced to the specimen allowing comparison between baseline and damaged tests. Comparative analysis validated the capabilities of frequency response sensors to detect damage. This analysis demonstrates that structural health monitoring systems using frequency response methods may be promising in the aerospace sector.
DTIC
Health; Maintenance; Structural Failure; Systems Engineering; Systems Integration

20070034136 Naval Academy, Annapolis, MD USA
Mobile Vehicle Teleoperated Over Wireless IP
Akin, Micah; Crabbe, Frederick L; Jun 13, 2007; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469238; USNA-CS-TR-2007-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469238

This document describes an effort to create a low cost teleoperated vehicle that is controlled via 802.11g Wifi and the Internet. It is unusual in that it can be controlled at a great distance but yet is still inexpensive. The appendices provide instruction on how to construct and operate the vehicle, along with the necessary source code.
DTIC
Remote Control; Remotely Piloted Vehicles; Teleoperators; Wireless Communication

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.

20070034017 NASA Langley Research Center, Hampton, VA, USA

The Dangers of Failure Masking in Fault-Tolerant Software: Aspects of a Recent In-Flight Upset Event

Johnson, C. W.; Holloway, C. M.; October 22, 2007; 6 pp.; In English; 2nd International Conference on System Safety 2007, 22-24 Oct. 2007, London, UK; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 457280.02.07.07.08; Copyright; Avail.: CASI: A02, Hardcopy

On 1 August 2005, a Boeing Company 777-200 aircraft, operating on an international passenger flight from Australia to Malaysia, was involved in a significant upset event while flying on autopilot. The Australian Transport Safety Bureau's investigation into the event discovered that an anomaly existed in the component software hierarchy that allowed inputs from a known faulty accelerometer to be processed by the air data inertial reference unit (ADIRU) and used by the primary flight computer, autopilot and other aircraft systems. This anomaly had existed in original ADIRU software, and had not been detected in the testing and certification process for the unit. This paper describes the software aspects of the incident in detail, and suggests possible implications concerning complex, safety-critical, fault-tolerant software.

Author

Automatic Pilots; Boeing 777 Aircraft; Fault Tolerance; Masking; Single Event Upsets; Failure Analysis; Avionics; Hazards; Computer Programs

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.

20070032926 NASA Glenn Research Center, Cleveland, OH, USA

A Retro-Fit Control Architecture to Maintain Engine Performance With Usage

Litt, Jonathan S.; Sowers, T. Shane; Garg, Sanjay; September 2007; 15 pp.; In English; 18th ISABE Conference, September 2007, Beijing, China; Original contains color illustrations

Contract(s)/Grant(s): WBS 457280.02.07.03.04

Report No.(s): NASA/TM-2007-214977; ARL-TR-4130; E-16135; Copyright; Avail.: CASI: A03, Hardcopy

An outer loop retrofit engine control architecture is presented which modifies fan speed command to obtain a desired thrust based on throttle position. This maintains the throttle-to-thrust relationship in the presence of engine degradation, which has the effect of changing the engine s thrust output for a given fan speed. Such an approach can minimize thrust asymmetry in multi-engine aircraft, and reduce pilot workload. The outer loop control is demonstrated under various levels of engine deterioration using a standard deterioration profile as well as an atypical profile. It is evaluated across various transients covering a wide operating range. The modified fan speed command still utilizes the standard engine control logic so all original life and operability limits remain in place. In all cases it is shown that with the outer loop thrust control in place, the deteriorated engine is able to match the thrust performance of a new engine up to the limits the controller will allow.

Author

Control Systems Design; Engine Control; Retrofitting; Throttling; Turbofan Engines; Thrust Control

20070033352 BAE Systems, UK

Engine Health Diagnostics Using Radar

Shephard, David; Wright, Barbara; Richards, Gordon; Oct 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Debris; Diagnosis; Foreign Bodies; Health; Impact Damage; Jet Engines; Radar

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20070033063 Army Engineer Research and Development Center, Vicksburg, MS USA

Laboratory Investigation of Chemical Dust Pallative Performance on Sandy Soil

Rushing, John F; Newman, J K; McCaffrey, Timothy J; Jun 2007; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469306; ERDC/GSL-TR-07-19; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469306

The U.S. Army and Marine Corps initiated a search for chemical dust palliatives for mitigating dust on helipads. The purpose of this investigation was to evaluate the effectiveness of current technologies for suppressing dust caused by rotor wash during helicopter landings. The study used an air impingement device to simulate wind speeds similar to field conditions. Chemical dust suppressants were applied topically to prepared soil specimens and allowed to cure for 1 and 48 hr. Effectiveness was determined from the relative weight loss of the soil samples from erosion during the test procedure. An optical sensor was installed in the test device to provide an additional method for quantifying performance.

DTIC

Dust; Dust Collectors; Heliports; Soils

20070033308 Army Engineer Research and Development Center, Vicksburg, MS USA

A Comparative Field Study of Permastripe(Trademark) Polymer Concrete and Waterborne Airfield Pavement Markings

Newman, J K; Speidel, Donna; Boeger, Ron; Hudson, Betsy; Jun 2007; 68 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469457; ERDC/GSL-TR-07-20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The study reported herein compared polymer concrete pavement markings (Permastripe) to Federal specification waterborne airfield marking paint for field durability and retroreflectivity. The markings were placed at Tyndall Air Force Base (AFB) (hot, wet climate) and Mountain Home AFB (cold, snowy climate). American Association State Highway and Transportation Officials Type I, Type III, and a Type I/Type III retroreflectivity bead combinations were included at Tyndall AFB. Additionally, Adsil, a novel clear coating, was used at Tyndall AFB to evaluate the effects on retroreflectivity and durability of Permastripe and paint. This study suggests that Permastripe is more durable than standard airfield paint, may exhibit better bead retention, and holds promise as a durable pavement marking if certain technical problems can be overcome. The Permastripe studied in this work is not readily removable from asphalt pavement using water-blasting. The data clearly show that high-refractive index Type III beads result in higher retroreflectivity than Type I beads initially and over time. The Adsil clear coating applied to the markings resulted in significant reductions in retroreflectivity. The retroreflectivity data from one test clearly indicates that the retroreflectivity increases with time as the coating wears.

DTIC

Airports; Concretes; Durability; Landing Sites; Pavements; Polymers

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*.

20070034084 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Spacecraft Proximity Operations Used to Estimate the Dynamical & Physical Properties of a Resident Space Object

Brunner, Abraham F; Mar 2007; 147 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469281; AFIT/GA/ENY/07-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469281

When conducting a space proximity operation, developing high-fidelity estimates of the dynamical and physical properties of a Resident Space Object (RSO) based on post-rendezvous observational data acquired, is imperative for the

understanding of the RSO itself and the operating environment. This research investigates the estimation of relative motion dynamics, rotational dynamics, and the feasibility of estimating the moments of inertia of a RSO. Using the Hill-Clohessy-Wiltshire equations, rigid-body dynamics, and estimation theory, a nonlinear least squares estimation algorithm is implemented in the processing of range data from tracked observation points on the RSO body. Through simulation, it was determined that accurately estimating the relative motion and rotational dynamics is possible. However directly estimating the moments of inertia using range data proved to be problematic and exposed a possible observability limitation. Yet in general, the solutions were heavily dependent on the quality of the a priori knowledge as well as the reduction of solution ambiguity through the use of multiple observational data sets.
DTIC
Rotation; Rigid Structures; Estimates; Algorithms

13
ASTRODYNAMICS

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

20070032693 NASA Marshall Space Flight Center, Huntsville, AL, USA
Atmospheric Environments for Entry, Descent and Landing (EDL)
Justus, Carl G.; Braun, Robert D.; June 23, 2007; 37 pp.; In English; 5th International Planetary Probes Workshop and Short Course, 23-29 Jun. 2007, Bordeaux, France; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNM04AA02C; Copyright; Avail.: CASI: A03, Hardcopy

Scientific measurements of atmospheric properties have been made by a wide variety of planetary flyby missions, orbiters, and landers. Although landers can make in-situ observations of near-surface atmospheric conditions (and can collect atmospheric data during their entry phase), the vast majority of data on planetary atmospheres has been collected by remote sensing techniques from flyby and orbiter spacecraft (and to some extent by Earth-based remote sensing). Many of these remote sensing observations (made over a variety of spectral ranges), consist of vertical profiles of atmospheric temperature as a function of atmospheric pressure level. While these measurements are of great interest to atmospheric scientists and modelers of planetary atmospheres, the primary interest for engineers designing entry descent and landing (EDL) systems is information about atmospheric density as a function of geometric altitude. Fortunately, as described in in this paper, it is possible to use a combination of the gas-law relation and the hydrostatic balance relation to convert temperature-versus-pressure, scientific observations into density-versus-altitude data for use in engineering applications. The following section provides a brief introduction to atmospheric thermodynamics, as well as constituents, and winds for EDL. It also gives methodology for using atmospheric information to do 'back-of-the-envelope' calculations of various EDL aeroheating parameters, including peak deceleration rate ('g-load'), peak convective heat rate. and total heat load on EDL spacecraft thermal protection systems. Brief information is also provided about atmospheric variations and perturbations for EDL guidance and control issues, and atmospheric issues for EDL parachute systems. Subsequent sections give details of the atmospheric environments for five destinations for possible EDL missions: Venus. Earth. Mars, Saturn, and Titan. Specific atmospheric information is provided for these destinations, and example results are presented for the 'back-of-the-envelope' calculations mentioned above.
Derived from text
Aerodynamic Heating; Atmospheric Density; Atmospheric Pressure; Planetary Atmospheres; Atmospheric Entry; Descent Trajectories; Thermodynamics

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)*.

20070032862 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
NASA Critical Facilities Maintenance Assessment
Oberhettinger, David J.; November 1, 2006; 12 pp.; In English; Second Annual International Maintenance Excellence

Conference University of Toronto, 1 Nov. 2006, Toronto,, Canada; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40265

Critical Facilities Maintenance Assessment (CFMA) was first implemented by NASA following the March 2000 overtest of the High Energy Solar Spectroscopic Imager (HESSI) spacecraft. A sine burst dynamic test using a 40 year old shaker failed. Mechanical binding/slippage of the slip table imparted 10 times the planned force to the test article. There was major structural damage to HESSI. The mechanical 'health' of the shaker had not been assessed and tracked to assure the test equipment was in good working order. Similar incidents have occurred at NASA facilities due to inadequate maintenance (e.g., rainwater from a leaky roof contaminated an assembly facility that housed a spacecraft). The HESSI incident alerted NASA to the urgent need to identify inadequacies in ground facility readiness and maintenance practices. The consequences of failures of ground facilities that service these NASA systems are severe due to the high unit value of NASA products.
Derived from text
Maintenance; Dynamic Tests; Contamination; Damage

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*.

20070032703 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Platforms for Discovery: Exploring Titan and Venus. Conversations with Jeff Hanley; Interview by Frank Sietzen
Aerospace America; June 2007; ISSnN 0740-722X, pp. 10-12; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

An interview with Jeff Hanley, manager of NASA's Constellation program, is presented. He answers questions concerning the status of project constellation, his assessment of the impact of fy07 continuing budget reductions to Constellation, his thoughts on how the elimination of the robotic precision lunar lander will affect the design of the manned lunar landing vehicle, the design and modifications to the Apollo lander, the status of Ares I Upper Stage Vehicle, the difference between Ares I upper stage and the Earth departure stage on Ares V, status of trade studies on choosing a landing system for Orion, and Orion heat shield materials.
Author
Constellation Program; Ares 5 Cargo Launch Vehicle; Robotics; Ares 1 Upper Stage; Conversation; NASA Space Programs

20070032938 NASA Marshall Space Flight Center, Huntsville, AL, USA
Building Operations Efficiencies into NASA's Ares I Crew Launch Vehicle Design
Dumbacher, Daniel L.; Davis, Stephan R.; May 14, 2007; 25 pp.; In English; 54th Joint JANNAF Propulsion Conference, 14-17 May 2007, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032938

The U.S. Vision for Space Exploration guides the National Aeronautics and Space Administration's (NASA's) challenging missions that expand humanity's boundaries and open new routes to the space frontier. With the Agency's commitment to complete the International Space Station (ISS) and to retire the venerable Space Shuttle by 2010, the NASA Administrator commissioned the Exploration Systems Architecture Study (ESAS) in 2005 to analyze options for safe, simple, cost-efficient launch solutions that could deliver human-rated space transportation capabilities in a timely manner within fixed budget guidelines. The Exploration Launch Projects (ELP) Office, chartered by the Constellation Program in October 2005, has been conducting systems engineering studies and business planning to successively refine the design configurations and better align vehicle concepts with customer and stakeholder requirements, such as significantly reduced life-cycle costs. As the Agency begins the process of replacing the Shuttle with a new generation of spacecraft destined for missions beyond low-Earth orbit to the Moon and Mars, NASA is designing the follow-on crew and cargo launch systems for maximum operational efficiencies. To sustain the long-term exploration of space, it is imperative to reduce the $4 billion NASA typically spends on space transportation each year. This paper gives toplevel information about how the follow-on Ares I Crew Launch Vehicle (CLV) is being designed for improved safety and reliability, coupled with reduced operations costs. These methods include carefully developing operational requirements; conducting operability design and analysis; using the latest information

technology tools to design and simulate the vehicle; and developing a learning culture across the workforce to ensure a smooth transition between Space Shuttle operations and Ares vehicle development.
Author
Ares 1 Launch Vehicle; Design Analysis; Efficiency; Constellation Program; Design Optimization; Launch Vehicle Configurations

20070033039 Dayton Univ. Research Inst., OH USA
Power and Thermal Technology for Air and Space-Scientific Research Program Delivery Order 0003: Electrical Technology Component Development
Tsao, Bang-Hung; Lawson, Jacob; Mar 2007; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-2403-0003; Proj-3145
Report No.(s): AD-A469257; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469257
The goals of this delivery order were to study and develop materials, processes, and techniques for use in the fabrication of high-performance power electronic devices used in power management and control equipment and systems, which will be capable of operating in extreme environments in aircraft and on space platforms.
DTIC
Space Programs; Thermal Stability

20070033045 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Satellite Attitude Control Using Atmospheric Drag
Guettler, David B; Mar 2007; 177 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469265; AFIT/GA/ENY/07-M10; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469265
Attitude control is a requirement for most satellites. Many schemes have been devised over the years including control moment gyros, reaction wheels, spin stabilization and gravity gradient stabilization. For low Earth orbits, the Earth's atmosphere can have an affect on a satellite's orbit and attitude. This research effort examines the feasibility of using the atmosphere to actively control a spacecraft's attitude using drag panels. Using the atmosphere to control spacecraft attitude has been researched in the past however very little research has been done using an active feedback control system to maintain spacecraft attitude. A linear computer model was created using a proportional controller. This model was used to evaluate the effectiveness of using drag panels for attitude control. Results from the simulation show that the spacecraft can recover from disturbance torques that may cause a change in attitude very effectively especially at low altitudes (200-300km). Settling time increases as altitude increases and varies from minutes to weeks.
DTIC
Artificial Satellites; Attitude Control; Drag; Earth Orbits; Panels; Satellite Attitude Control; Satellite Drag

20070033339 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Parametric Reliability of Space-Based Field Programmable Gate Arrays
Pomager, Joseph C; Mar 2007; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469513; AFIT/GE/ENG/07-19; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The high cost of failure for microelectronic devices operating in the space environment has led to a need for an accurate characterization of a device's reliability prior to being deployed. In addition, significant cost savings can be achieved by determining this reliability prior to fabrication. With the increased performance needs required for many missions, designers are seeking to utilize devices that have smaller and smaller feature sizes. Specifically, feature sizes as small as 130, 90, and 65 nm. A characterization of the space environment is constructed specifically to address the extreme conditions that can affect the performance and functionality of small feature-sized microelectronic devices. The characterization is centered on temperature, non-ideal supply voltage, and radiation effects. A simulation technique is developed to determine the reliability of a microelectronic device prior to fabrication and deployment into the space environment. The technique is based on identifying the key elements of a circuit, simulating these key elements under each characterized condition individually, and then a comprehensive simulation of the elements under all combinations of the characterized conditions in each significant element operating state. Reliability calculations are performed based on simulation results and identified critical performance criteria. A demonstration of the technique is accomplished showing the poor reliability of non-radiation hardened small

feature-sized commercial-off-the-shelf FPGAs in four common orbits. The results are then compared to an established, radiation hardened FPGA.
DTIC
Field-Programmable Gate Arrays; Reliability

20070033365 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wessling, Germany
De-Shadowing of Satellite/Airborne Multispectral and Hyperspectral Imagery
Richter, R; Oct 2005; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469544; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Artificial Satellites; Imagery; Satellite Imagery; Shadows

20070034134 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Satellite Formation Control Using Atmospheric Drag
Hajovsky, Blake B; Mar 2007; 146 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469289; AFIT/GA/ENY/07-M11; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469289
This study investigates the use of a linear quadratic terminal controller to reconfigure satellite formations using atmospheric drag actuated control while minimizing the loss of energy of the formation. The linearized Clohessy-Wiltshire equations of motion are used to describe the motion of the two-satellite formation about an empty reference position maintained at the formation center. Reconfigurations to final in-plane and elliptical formations are simulated at orbital radii of 6800 km and 7000 km, and the altitude loss and a ?v budget were recorded as performance measures for each reconfiguration. The final states of the spacecraft upon reconfiguration were propagated forward in time over 20 orbital periods to ensure the final conditions were achieved. Simulations proved that minimizing the loss of orbital energy effectively minimizes the loss in altitude, and drag actuated control is fully capable of controlling the radial and in-track motion of satellite formations, although the cross-track motion is uncontrollable.
DTIC
Aerodynamic Drag; Artificial Satellites; Drag; Evolution; Natural Satellites

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*.

20070032701 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Hail Atlantis
Aerospace America; June 2007; ISSN 0740-722X, pp. 14-17; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
An intense thunderstorm burst over launch pad 39A, where Atlantis stood just two weeks from its STS-117 launch. Winds gusting to nearly 70 mph drove hailstones, some the size of golf balls, against Atlantis' wing tiles, boosters, and ET. The collective impact of the damaging hail was unprecedented. 'This constitutes, in our evaluation, the worst damage that we have ever seen from hail on the external tank foam,' shuttle program manager Wayne Hale said a day after the storm. Hale immediately postponed the March 15 launch of Atlantis with the space station's S3/S4 solar array truss for at least a month; a few days later the stack, carried by its crawler-transporter, rolled back to the Vehicle Assembly Building for a detailed assessment of the damage to ET-124. The unfolding story of how NASA has grappled with the hail damage highlights the challenges the agency faces in keeping the shuttle system flylng safely for its remaining three years. More important than the technical solution has been the manner in which NASA confronted the safety and schedule pressures posed by the damage. Derived from text
Hail; Atlantis (Orbiter); Thunderstorms; Space Transportation System; Damage Assessment

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*.

20070032875 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Real-Time EDL Navigation Performance Using Spacecraft to Spacecraft Radiometric Data
Burkhart, P. Daniel; Ely, Todd; Duncan, Courtney; Lightsey, Glenn; Campbell, Todd; Mogensen, Andy; August 21, 2006; 13 pp.; In English; AIAA Guidance, Navigation and Control Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40248

A two-year task sponsored by NASA's Mars Technology Program's Advanced Entry, Descent and Landing (EDL) work area includes investigation of improvements to EDL navigation by processing spacecraft-to-spacecraft radiometric data. Spacecraft-to- spacecraft navigation will take advantage of the UHF link between two spacecraft (i.e. to an orbiter from an approaching lander for EDL telemetry relay) to build radiometric data, specifically the velocity between the two spacecraft along the radio beam, that are processed to determine position and velocity in real time. The improved onboard state knowledge provided by spacecraft-to-spacecraft navigation will improve the performance of entry guidance by providing a more accurate state estimate and ultimately reduce the landed position error. Work on the final year of this task is reported here.
Author
Space Navigation; Real Time Operation; Ultrahigh Frequencies; Radiometers; Telemetry

20070032881 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
MRO Ka-Band Demonstration
Shambayati, Shervin; March 29, 2006; 12 pp.; In English; Ground System Architectures Workshop, 29 Mar. 2006, Manhattan Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40177

This viewgraph presentation reviews the Mars Reconnaissance Orbiter use of the Ka-band. Due to lack of spectrum at X-band (8.41 GHz) NASA is switching to Ka-band (32 GHz) for its Deep Space Missions. This is 50 MHz bandwidth at X-band vs. 500 MHz at Ka-band. Weather events cause a greater degradation for the Ka-band link. Therefore, the Ka-band needs to be operated in a different manner than the X-band. The Ka-band achieves a maximum average capacity at a lower weather reliability than X-band (80 to 90% for Ka-band vs. 95% for X-band). Studies have been done to suggest different methods of operation for Ka-band. The Mars Reconnaissance Orbiter (MRO) will allow us to evaluate the proposed methods of operations for the Ka-band The MRO is the first spacecraft to have a fully functioning independent Ka-band downlink stream.
Derived from text
Extremely High Frequencies; Mars Reconnaissance Orbiter; Superhigh Frequencies; Satellite Communication

20070032974 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
High-Capacity Communications from Martian Distances Part 2: Spacecraft Antennas and Power Systems
Hodges, Richard E.; Kodis, Mary Anne; Epp, Larry W.; Orr, Richard; Schuchman, Leonard; Collins, Michael; Sands, O. Scott; Vyas, Hemali; Williams, W. Dan; September 27, 2006; 8 pp.; In English; 12th Ka and Broadband Communications Conference, 27-29 Sep. 2006, Naples, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40358

This paper summarizes recent advances in antenna and power systems technology to enable a high data rate Ka-band Mars-to-Earth telecommunications system. Promising antenna technologies are lightweight, deployable space qualified structures at least 12-m in diameter (potentially up to 25-m). These technologies include deployable mesh reflectors, inflatable reflectarray and folded thermosetting composite. Advances in 1kW-class RF power amplifiers include both TWTA and SSPA technologies.
Author
Spacecraft Antennas; Antenna Arrays; Extremely High Frequencies; Power Amplifiers; Reflector Antennas; Telecommunication; Antenna Design

20070034049 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Overview of the Current CCSDS Program of Work

Hooke, Adrian J.; September 26, 2006; 21 pp.; In English; Consultative Committee for Space Data Systems (CCSDS) Management Council Meeting, 26-29 Sep. 2006, Moscow, Russia; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40287

This viewgraph presentation gives an overview of the Consultative Committee for Space Data Systems (CCSDS) program of work in space standardization.

CASI

Data Systems; General Overviews; Aerospace Systems; Space Communication; Computer Networks

20070034050 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

VOIP over Space Networks

Okino, C.; Kwong, W.; Pang, Jackson; Gao, Jerry; Clare, L.; September 12, 2006; 20 pp.; In English; 5th Space Interworking Workshop, 12-13 Sep. 2006, Hanover, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40286

This viewgraph presentation reviews Voice over Internet Protocol (VOIP) over a space networking environment. The topics include: 1) Drivers for VOIP in Space; 2) Challenges in the Space Networking Environment: Long Latencies, Path errors, Simplex paths, Asymmetric paths, QoS requirements, Team-based operations, and Overhead concerns; 3) Possible VOIPOSN approaches; 4) Study of BER, code type and voice frame length on PESQ-MOS; 5) Codec Latency Trade Space; and 6) Testbed.

CASI

Internets; Protocol (Computers); Voice Communication; Space Communication; Communication Networks

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20070032717 NASA Marshall Space Flight Center, Huntsville, AL, USA

Evaluation of Bulk Charging in Geostationary Transfer Orbit and Earth Escape Trajectories Using the Numit 1-D Charging Model

Minow, Joseph I.; Coffey, Victoria N.; Parker, Linda N.; Blackwell, William C., Jr.; Jun, Insoo; Garrett, Henry B.; June 18, 2007; 43 pp.; In English; 10th Spacecraft Charging and Technology Conference, 18-21 Jun. 2007, Biarritz, France; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The NUMIT 1-dimensional bulk charging model is used as a screening tool for evaluating time-dependent bulk internal or deep dielectric) charging of dielectrics exposed to penetrating electron environments. The code is modified to accept time dependent electron flux time series along satellite orbits for the electron environment inputs instead of using the static electron flux environment input originally used by the code and widely adopted in bulk charging models. Application of the screening technique ts demonstrated for three cases of spacecraft exposure within the Earth's radiation belts including a geostationary transfer orbit and an Earth-Moon transit trajectory for a range of orbit inclinations. Electric fields and charge densities are computed for dielectric materials with varying electrical properties exposed to relativistic electron environments along the orbits. Our objective is to demonstrate a preliminary application of the time-dependent environments input to the NUMIT code for evaluating charging risks to exposed dielectrics used on spacecraft when exposed to the Earth's radiation belts. The results demonstrate that the NUMIT electric field values in GTO orbits with multiple encounters with the Earth's radiation belts are consistent with previous studies of charging in GTO orbits and that potential threat conditions for electrostatic discharge exist on lunar transit trajectories depending on the electrical properties of the materials exposed to the radiation environment.

Author

Earth-Moon Trajectories; Electric Charge; Electric Fields; Lunar Trajectories; Mathematical Models; Spacecraft Charging

20070032801 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GN&C Engineering Best Practices For Human-Rated Spacecraft Systems

Dennehy, Cornelius J.; Lebsock, Kenneth; West, John; [2007]; 26 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 20-23 Aug. 2007, Hilton Head, SC, USA; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Engineering and Safety Center (NESC) recently completed an in-depth assessment to identify a comprehensive set of engineering considerations for the Design, Development, Test and Evaluation (DDT&E) of safe and reliable human-rated spacecraft systems. Reliability subject matter experts, discipline experts, and systems engineering experts were brought together to synthesize the current 'best practices' both at the spacecraft system and subsystems levels. The objective of this paper is to summarize, for the larger Community of Practice, the initial set of Guidance, Navigation and Control (GN&C) engineering Best Practices as identified by this NESC assessment process.

Author

Guidance (Motion); Navigation; Systems Engineering; Satellite Design; Safety; Reliability; System Effectiveness

20070032803 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Titan Orbiter with Aerorover Mission (TOAM)

Sittler, E. C., Jr.; Cooper, J. F.; Mahaffy, P.; Esper, J.; Fairbrother, D.; Farley, R.; Pitman, J.; Kojiro, D. R.; Acuna, M.; Allen, M.; Bjoraker, G.; Brasunas, J.; Farrell, W.; Burchell, M. J.; Burger, M.; Chin, G.; Coates, A. J.; Farrell, W.; Flasar, M.; Gerlach, B.; Gorevan, S.; Hartle, R. E.; Im, Eastwood; Jennings, D.; Johnson, R. E.; [2007]; 1 pp.; In English; Titan Workshop, 14-15 Feb. 2007, Paris, France; Copyright; Avail.: Other Sources; Abstract Only

We propose to develop a new mission to Titan called Titan Orbiter with Aerorover Mission (TOAM). This mission is motivated by the recent discoveries of Titan, its atmosphere and its surface by the Huygens Probe, and a combination of in situ, remote sensing and radar mapping measurements of Titan by the Cassini orbiter. Titan is a body for which Astrobiology (i.e., prebiotic chemistry) will be the primary science goal of any future missions to it. TOAM is planned to use an orbiter and balloon technology (i.e., aerorover). Aerobraking will be used to put payload into orbit around Titan. One could also use aerobraking to put spacecraft into orbit around Saturn first for an Enceladus phase of the mission and then later use aerocapture to put spacecraft into orbit around Titan. The Aerorover will probably use a hot air balloon concept using the waste heat from the MMRTG approx. 1000 watts. Orbiter support for the Aerorover is unique to our approach for Titan. Our strategy to use an orbiter is contrary to some studies using just a single probe with balloon. Autonomous operation and navigation of the Aerorover around Titan will be required, which will include descent near to the surface to collect surface samples for analysis (i.e., touch and go technique). The orbiter can provide both relay station and GPS roles for the Aerorover. The Aerorover will have all the instruments needed to sample Titan's atmosphere, surface, possible methane lakes-rivers, use multi-spectral imagers for surface reconnaissance; to take close up surface images; take core samples and deploy seismometers during landing phase. Both active and passive broadband remote sensing techniques will be used for surface topography, winds and composition measurements.

Author

Titan; Huygens Probe; Remote Sensing; Radar Maps; Autonomous Navigation; Aerobraking; Broadband

20070032830 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Trajectory Generation and Path Planning for Autonomous Aerobots

Sharma, Shivanjli; Kulczycki, Eric A.; Elfes, Alberto; April 10, 2007; 6 pp.; In English; IEEE International Conference on Robotics and Automation, 10-14 Apr. 2007, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40295

This paper presents global path planning algorithms for the Titan aerobot based on user defined waypoints in 2D and 3D space. The algorithms were implemented using information obtained through a planner user interface. The trajectory planning algorithms were designed to accurately represent the aerobot's characteristics, such as minimum turning radius. Additionally, trajectory planning techniques were implemented to allow for surveying of a planar area based solely on camera fields of view, airship altitude, and the location of the planar area's perimeter. The developed paths allow for planar navigation and three-dimensional path planning. These calculated trajectories are optimized to produce the shortest possible path while still remaining within realistic bounds of airship dynamics.

Author

Navigation; Trajectory Planning; Position (Location); Algorithms; Airships

20070032876 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Maneuver Analysis and Targeting Strategy for the Stardust Re-Entry Capsule

Helfrich, Clifford E.; Bhat, Ram; Kangas, Julie; Wilson, Roby; Wong, Mau; Potts, Chris; Williams, Ken; August 22, 2006; 12 pp.; In English; AIAA Astrodynamics Conference, 22 Aug. 2006, Keystone, Co, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40250

Stardust employed biased maneuvers to limit turns and minimize execution errors. Biased maneuvers also addressed planetary protection and safety issues. Stardust utilized a fixed-direction burn for the final maneuver to match the prevailing attitude so no turns were needed. Performance of the final burn was calibrated in flight.

Derived from text

Stardust Mission; Maneuverable Spacecraft; Maneuverability; Planetary Protection; Bias; Attitude (Inclination)

20070032877 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Maneuver Analysis and Targeting Strategy for the Stardust Re-Entry Capsule

Helfrich, Cliff; Bhat, Ramachand S.; Kangas, Julie A.; Wilson, Roby S.; Wong, Mau C.; Potts, Christopher L.; Williams, Kenneth E.; August 22, 2006; 11 pp.; In English; AIAA Astrodynamics Conference, 22 Aug. 2006, Keystone, Co, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40249

The Stardust Sample Return Capsule (SRC) returned to Earth on January 15, 2006 after seven years of collecting interstellar and comet particles over three heliocentric revolutions, as shown in Figure 1. The SRC was carried on board the Stardust spacecraft, as shown in Figure 2. Because the spacecraft was built with unbalanced thrusters, turns and attitude control maintenance resulted in undesirable delta-v being imparted to the trajectory. As a result, a carefully planned maneuver strategy was devised to accurately target the Stardust capsule to the Utah Test and Training Range (UTTR). This paper provides an overview of the Stardust spacecraft and mission and describes the maneuver strategy that was employed to achieve the stringent targeting requirements for landing in Utah. In addition, an overview of Stardust maneuver analysis tools and techniques will also be presented.

Author

Stardust Mission; Maneuverability; Reentry; Trajectories; Targets; Attitude Control

20070032886 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Overview of the Formation and Attitude Control System for the Terrestrial Planet Finder Formation Flying Interferometer

Scharf, Daniel P.; Hadaegh, Fred Y.; Rahman, Zahidul H.; Shields, Joel F.; Singh, Gurkipal; September 14, 2004; 13 pp.; In English; International Symposium on Formation Flying Missions and Technologies, 14 Sep. 2004, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40212

The Terrestrial Planet Finder formation flying Interferometer (TPF-I) will be a five-spacecraft, precision formation operating near a Sun-Earth Lagrange point. As part of technology development for TPF-I, a formation and attitude control system (FACS) is being developed that achieves the precision and functionality associated with the TPF-I formation. This FACS will be demonstrated in a distributed, real-time simulation environment. In this paper we present an overview of the FACS and discuss in detail its constituent formation estimation, guidance and control architectures and algorithms. Since the FACS is currently being integrated into a high-fidelity simulation environment, component simulations demonstrating algorithm performance are presented.

Author

Formation Flying; Attitude Control; Interferometers; Terrestrial Planets; Algorithms; Component Reliability

20070032906 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Testing of a Miniature Loop Heat Pipe with Multiple Evaporators and Multiple Condensers for Space Applications

Nagano, Hosei; Ku, Jentung; September 24, 2006; 7 pp.; In English; 8th International Heat Pipe Symposium, 24-27 Sep. 2006, Kumamoto, Japan; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Thermal performance of a miniature loop heat pipe (MLHP) with two evaporators and two condensers is described. A comprehensive test program, including start-up, high power, low power, power cycle, and sink temperature cycle tests, has been executed at NASA Goddard Space Flight Center for potential space applications. Experimental data showed that the loop could start with heat loads as low as 2W. The loop operated stably with even and uneven evaporator heat loads, and even and uneven condenser sink temperatures. Heat load sharing between the two evaporators was also successfully demonstrated. The loop had a heat transport capability of l00W to 120W, and could recover from a dry-out by reducing the heat load to evaporators. Low power test results showed the loop could work stably for heat loads as low as 1 W to each evaporator. Excellent adaptability of the MLHP to rapid changes of evaporator power and sink temperature were also demonstrated. Author

Evaporators; Miniaturization; Heat Pipes; Condensers; Aerospace Engineering; Technology Utilization

20070032912 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Implementation of a Collision Probability Prediction Technique for Constellation Maneuver Planning

Concha, Marco a.; February 03, 2007; 14 pp.; In English; 30th Annual AAS Guidance and Control Conference, 3-7 Feb. 2007, Breckenridge, CO, USA; Original contains black and white illustrations

Report No.(s): AAS 07-033; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032912

On March 22, 2006, the Space Technology 5 (ST5) constellation spacecraft were successfully delivered to orbit by a Pegasus XI, launch vehicle. An unexpected relative motion experienced by the constellation after orbit insertion brought about a problem. Soon after launch the observed relative position of the inert rocket body was between the leading and the middle spacecraft within the constellation. The successful planning and execution of an orbit maneuver that would create a fly-by of the rocket body was required to establish the.formation. This maneuver would create a close approach that needed to conform to predefined collision probability requirements. On April 21, 2006, the ST5 '155' spacecraft performed a large orbit maneuver and successfully passed the inert Pegasus 3rd Stage Rocket Body on April 30, 2006 15:20 UTC at a distance of 2.55 km with a Probability of Collision of less than 1.0E-06. This paper will outline the technique that was implemented to establish the safe planning and execution of the fly-by maneuver. The method makes use of Gaussian distribution models of state covariance to determine underlying probabilities of collision that arise under low velocity encounters. Specific numerical examples used for this analysis are discussed in detail. The mechanics of this technique are explained to foster deeper understanding of the concepts presented and to improve existing processes for use in future constellation maneuver planning. Author

Pegasus Air-Launched Booster; Spacecraft Design; Aerospace Engineering; Probability Theory; Spacecraft Maneuvers; Flyby Missions; Collision Avoidance

20070032977 NASA Marshall Space Flight Center, Huntsville, AL, USA

Ares I-X Flight Test Philosophy

Davis, S. R.; Tuma, M. L.; Heitzman, K.; May 14, 2007; 27 pp.; In English; 54th Joint JANNAF Propulsion Meeting, 14-17 May 2007, Denver, Co, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032977

In response to the Vision for Space Exploration, the National Aeronautics and Space Administration (NASA) has defined a new space exploration architecture to return humans to the Moon and prepare for human exploration of Mars. One of the first new developments will be the Ares I Crew Launch Vehicle (CLV), which will carry the Orion Crew Exploration Vehicle (CEV), into Low Earth Orbit (LEO) to support International Space Station (ISS) missions and, later, support lunar missions. As part of Ares I development, NASA will perform a series of Ares I flight tests. The tests will provide data that will inform the engineering and design process and verify the flight hardware and software. The data gained from the flight tests will be used to certify the new Ares/Orion vehicle for human space flight. The primary objectives of this first flight test (Ares I-X) are the following: Demonstrate control of a dynamically similar integrated Ares CLV/Orion CEV using Ares CLV ascent

control algorithms; Perform an in-flight separation/staging event between an Ares I-similar First Stage and a representative Upper Stage; Demonstrate assembly and recovery of a new Ares CLV-like First Stage element at Kennedy Space Center (KSC); Demonstrate First Stage separation sequencing, and quantify First Stage atmospheric entry dynamics and parachute performance; and Characterize the magnitude of the integrated vehicle roll torque throughout the First Stage (powered) flight. This paper will provide an overview of the Ares I-X flight test process and details of the individual flight tests.
Author
Ares 1 Launch Vehicle; Crew Exploration Vehicle; Flight Tests

20070032980 NASA Marshall Space Flight Center, Huntsville, AL, USA
A New Heavy-Lift Capability for Space Exploration: NASA's Ares V Cargo Launch Vehicle
Sumrall, John P.; McArthur, J. Craig; May 14, 2007; 28 pp.; In English; 54th Joint JANNAF Propulsion Meeting, 14-17 May 2007, Denver, CO, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032980

The National Aeronautics and Space Administration (NASA) is developing new launch systems and preparing to retire the Space Shuttle by 2010, as directed in the USA (U.S.) Vision for Space Exploration. The Ares I Crew Launch Vehicle (CLV) and the Ares V heavy-lift Cargo Launch Vehicle (CaLV) systems will build upon proven, reliable hardware derived from the Apollo-Saturn and Space Shuttle programs to deliver safe, reliable, affordable space transportation solutions. This approach leverages existing aerospace talent and a unique infrastructure, as well as legacy knowledge gained from nearly 50 years' experience developing space hardware. Early next decade, the Ares I will launch the new Orion Crew Exploration Vehicle (CEV) to the International Space Station (ISS) or to low-Earth orbit for trips to the Moon and, ultimately, Mars. Late next decade, the Ares V's Earth Departure Stage will carry larger payloads such as the lunar lander into orbit, and the Crew Exploration Vehicle will dock with it for missions to the Moon, where astronauts will explore new territories and conduct science and technology experiments. Both Ares I and Ares V are being designed to support longer future trips to Mars. The Exploration Launch Projects Office is designing, developing, testing, and evaluating both launch vehicle systems in partnership with other NASA Centers, Government agencies, and industry contractors. This paper provides top-level information regarding the genesis and evolution of the baseline configuration for the Ares V heavy-lift system. It also discusses riskbased, management strategies, such as building on powerful hardware and promoting common features between the Ares I and Ares V systems to reduce technical, schedule, and cost risks, as well as development and operations costs. Finally, it summarizes several notable accomplishments since October 2005, when the Exploration Launch Projects effort officially kicked off, and looks ahead at work planned for 2007 and beyond.
Author
Ares 5 Cargo Launch Vehicle; Mission Planning; Research and Development; Project Management

20070034022 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Mars Reconnaissance Orbiter Mission: From Launch to the Primary Science Orbit
Johnston, Martin D.; Graf, James E.; Zurek, Richard W.; Eisen, Howard J.; Jai, Benhan; Erickson, James K.; March 3, 2007; 20 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color and black and white illustrations
Report No.(s): IEEEAC Paper #1001, Version 6; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40313; http://dx.doi.org/10.1109/AERO.2007.352746

The Mars Reconnaissance Orbiter (MRO) was launched from Cape Canaveral Air Force Station, Florida, USA, aboard an Atlas V-401 launch vehicle on August 12, 2005. The MRO spacecraft carries a very sophisticated scientific payload. Its primary science mission is to to provide global, regional survey, and targeted observations from a low altitude orbit for one Martian year (687 Earth days). After a seven month interplanetary transit, the spacecraft fired its six main engines and established a highly elliptical capture orbit at Mars. During the post-MOI early check-out period, four instruments acquired engineering-quality data. This was followed by five months of aerobraking operations. After aerobraking was terminated, a series of propulsive maneuvers were used to establish the desired low altitude science orbit. As the spacecraft is readied for its primary science mission, spacecraft and instrument checkout and deployment activities have continued.
Author
Mars Reconnaissance Orbiter; Interplanetary Spacecraft; Launching; Mars (Planet); Elliptical Orbits

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20070032694 NASA Marshall Space Flight Center, Huntsville, AL, USA
US Plans for the JEM-EUSO
Adams, James H.; June 04, 2007; 15 pp.; In English; EUSO Kickoff Meeting, 4-9 Jun. 2007, Satima, Japan; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032694

This viewgraph presentation reviews the planned USA work on the Extreme Universe Space Observatory (EUSO.) The EUSO is to be mounted to the JEM (Japanese Experiment Module). The plans areas for US participation are the Optics Investigations, Trigger Design and Event Reconstruction.
CASI
International Space Station; Space Station Modules; Astronomical Satellites; Simulation; Diffractive Optics

20070032823 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
AutoNav Mark3: Engineering the Next Generation of Autonomous Onboard Navigation and Guidance
Riedel, Joseph Ed; Bhaskaran, Shyam; Eldred, Dan B.; Gaskell, Robert A.; Grasso, Christopher A.; Kennedy, Brian; Kubitscheck, Daniel; Mastrodemos, Nickolaos; Synnott, Stephen. P.; Vaughan, Andrew; Werner, Robert A.; August 22, 2006; 18 pp.; In English; AIAA GN&C Conference, 22-25 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40242

The success of JPL's AutoNav system at comet Tempel-1 on July 4, 2005, demonstrated the power of autonomous navigation technology for the Deep Impact Mission. This software is being planned for use as the onboard navigation, tracking and rendezvous system for a Mars Sample Return Mission technology demonstration, and several mission proposals are evaluating its use for rendezvous with, and landing on asteroids. Before this however, extensive re-engineering of AutoNav will take place. This paper describes the AutoNav systems-engineering effort in several areas: extending the capabilities, improving operability, utilizing new hardware elements, and demonstrating the new possibilities of AutoNav in simulations.
Author
Onboard Equipment; Autonomous Navigation; Mars Sample Return Missions; Systems Engineering

20070032979 NASA Marshall Space Flight Center, Huntsville, AL, USA
AVGS, AR and D for Satellites, ISS, the Moon, Mars and Beyond
Hintze, Geoffrey C.; Cornett, Keith G.; Rahmatipour, Michael H.; Heaton, Andrew F.; Newman, Larry E.; Fleischmann, Kevin D.; Hamby, Byron J.; May 07, 2007; 11 pp.; In English; Infotech\@Aerospace Meeting, 7-10 May 2007, Rohnert Park, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

With the continuous need to rotate crew and re-supply the International Space Station (ISS) and the desire to return humans to the Moon and for the first time, place humans on Mars, NASA must develop a more robust and highly reliable capability to perform Autonomous Rendezvous and Capture (AR&C) because, unlike the Apollo missions, NASA plans to send the entire crew to the Lunar or Martian surface and must be able to dock with the Orion spacecraft upon return. In 1997, NASA developed the Video Guidance Sensor (VGS) which was flown and tested on STS-87 and STS-95. In 2001, NASA designed and built a more enhanced version of the VGS, called the Advanced Video Guidance Sensor (AVGS). The AVGS offered significant technology improvements to the precursor VGS design. This paper will describe the AVGS as it was in the DART mission of 2005 and the Orbital Express mission of 2007. The paper will describe the capabilities and design concepts of the AVGS as it was flown on the DART 2005 Mission and the DARPA Orbital Express Mission slated to fly in 2007. The paper will cover the Flight Software, problems encountered, testing for Orbital Express and where NASA is going in the future.
Author
Guidance Sensors; Signal Processing; Image Processing; Pattern Recognition; Spacecraft Guidance; Rendezvous Guidance

20
SPACECRAFT PROPULSION AND POWER

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

20070032695 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Solar Sail Propulsion Technology Development
Johnson, Les; Montgomery, Edward E.; Young, Roy; Adams, Charles; June 27, 2007; 1 pp.; In English; 1st International Symposium on Solar Sailing, 27-29 Jun. 2007, Herrsching, Germany; Copyright; Avail.: Other Sources; Abstract Only

NASA's In-Space Propulsion Technology Program has developed the first generation of solar sail propulsion systems sufficient to accomplish inner solar system science and exploration missions. These first generation solar sails, when operational, will range in size from 40 meters to well over 100 meters in diameter and have an areal density of less than 13 grams per square meter. A rigorous, multi-year technology development effort culminated in 2005 with the testing of two different 20-m solar sail systems under thermal vacuum conditions. The first system, developed by ATK Space Systems of Goleta, California, uses rigid booms to deploy and stabilize the sail. In the second approach, L'Garde, Inc. of Tustin, California uses inflatable booms that rigidize in the coldness of space to accomplish sail deployment. This effort provided a number of significant insights into the optimal design and expected performance of solar sails as well as an understanding of the methods and costs of building and using them. In a separate effort, solar sail orbital analysis tools for mission design were developed and tested. Laboratory simulations of the effects of long-term space radiation exposure were also conducted on two candidate solar sail materials. Detailed radiation and charging environments were defined for mission trajectories outside the protection of the earth's magnetosphere, in the solar wind environment. These were used in other analytical tools to prove the adequacy of sail design features for accommodating the harsh space environment. Preceding and in conjunction with these technology efforts, NASA sponsored several mission application studies for solar sails. Potential missions include those that would be flown in the near term to study the sun and be used in space weather prediction to one that would use an evolved sail capability to support humanity's first mission into nearby interstellar space. This paper will describe the status of solar sail propulsion within NASA, nearterm solar sail mission applications, and near-term plans for further development.
Author
Propulsion System Performance; Solar Sails; Spacecraft Propulsion

20070032707 NASA Marshall Space Flight Center, Huntsville, AL, USA
FPP [Floating Potential Probe] Results, Final Report
Ferguson, Dale C.; June 18, 2007; 3 pp.; In English; 10th International Spacecraft Charging Technology Conferences/ESA, 18-22 Jun. 2007, Biarritz, France; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032707

The Floating Potential Probe (FPP) operated on the International Space Station (ISS) from December 2000 to April 2001. During that time, it took many measurements of the ISS floating potential and the electron density and temperature. Those measurements were used as inputs to the Environments WorkBench (EWB) model of ISS potentials (originally developed by SAIC, but now sometimes called the Boeing model) that is used even today to predict charging levels for ISS. FPP is now completely defunct, having been removed and ejected from ISS. With the advent of the new Floating Potential Monitoring Unit (FPMU) on ISS, and the beginning of ISS operations with two large solar array panels instead of just one, a review of FPP measurements can offer comparisons with the new FPMU data and perhaps improve the accuracy of future ISS charging predictions. In particular, FPP measurements during times of low electron temperature and high electron density (the times of worst ISS charging) will be brought forward for comparison with the newly obtained FPMU data.
Author
International Space Station; Space Probes; Contactors; Plasmas (Physics); Plasma Propulsion

20070032723 NASA Marshall Space Flight Center, Huntsville, AL, USA
Initial Results from the Floating Potential Measurement Unit aboard the International Space Station
Wright, Kenneth H., Jr.; Swenson, Charles; Thompson, Don; Barjatya, Aroh; Koontz, Steven L.; Schneider, Todd; Vaughn, Jason; Minow, Joseph; Craven, Paul; Coffey, Victoria; Parker, Linda; Bui, Them; [2007]; 25 pp.; In English; 10th Spacecraft

Charging and Technology Conference, 18-21 Jun. 2007, Biarritz, France; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Floating Potential Measurement Unit (FPMU) is a multi-probe package designed to measure the floating potential of the 1nternational Space Station (ISS) as well as the density and temperature of the local ionospheric plasma environment. The role oj the FPMU is to provide direct measurements of ISS spacecraft charging as continuing construction leads to dramatic changes in ISS size and configuration. FPMU data are used for refinement and validation of the ISS spacecraft charging models used to evaluate the severity and frequency of occurrence of ISS charging hazards. The FPMU data and the models are also used to evaluate the effectiveness of proposed hazard controls. The FPMU consists of four probes: a floating potential probe, two Langmuir probes. and a plasma impedance probe. These probes measure the floating potential of the ISS, plasma density, and electron temperature. Redundant measurements using different probes support data validation by inter-probe comparisons. The FPMU was installed by ISS crewmembers, during an ExtraVehicular Activity, on the starboard (Sl) truss of the ISS in early August 2006, when the ISS incorporated only one 160V US photovoltaic (PV) array module. The first data campaign began a few hours after installation and continued for over five days. Additional data campaigns were completed in 2007 after a second 160V US PV array module was added to the ISS. This paper discusses the general performance characteristics of the FPMU as integrated on ISS, the functional performance of each probe, the charging behavior of the ISS before and after the addition of a second 160V US PV array module, and initial results from model comparisons.

Author

Electrostatic Probes; Impedance Probes; International Space Station; Solar Arrays; Spacecraft Charging; Plasma Probes; Photovoltaic Cells

20070032726 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of High Fidelity, Fuel-Like Thermal Simulators for Non-Nuclear Testing

Bragg-Sitton, Shannon; Dickens, Ricky; Dixon, David; June 24, 2007; 36 pp.; In English; American Nuclear Society (ANS), 24-28 Jun. 2007, Boston, MA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews the development of a simulator for non-nuclear tests for the development of a space nuclear power system. The development of the Instrumented Thermal Simulator is to assist in developing an understanding of individual components and integrated system operation without the cost, time, safety concerns associated with nuclear testing. The presentation shows the design, the electrical integration, the hardware, and the assembly of the simulators. There are slides that show the test plan, the analysis, and the initial results.

CASI

Simulators; Spacecraft Power Supplies; Nuclear Electric Power Generation; Test Facilities

20070032738 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Stirling Technology Development at NASA Glenn Research Center

Shaltens, Richard K.; Wong, Wayne A.; September 2007; 13 pp.; In English; NASA Science Technology Conference (NSTC2007), 19-21 Jun. 2007, Adelphi, MD, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 138494.04.01.01

Report No.(s): NASA/TM-2007-214930; E-16126; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032738

The NASA Glenn Research Center has been developing advanced energy-conversion technologies for use with both radioisotope power systems and fission surface power systems for many decades. Under NASA's Science Mission Directorate, Planetary Science Theme, Technology Program, Glenn is developing the next generation of advanced Stirling convertors (ASCs) for use in the Department of Energy/Lockheed Martin Advanced Stirling Radioisotope Generator (ASRG). The next-generation power-conversion technologies require high efficiency and high specific power (watts electric per kilogram) to meet future mission requirements to use less of the Department of Energy's plutonium-fueled general-purpose heat source modules and reduce system mass. Important goals include long-life (greater than 14-yr) reliability and scalability so that these systems can be considered for a variety of future applications and missions including outer-planet missions and continual operation on the surface of Mars. This paper provides an update of the history and status of the ASC being developed for Glenn by Sunpower Inc. of Athens, Ohio.

Author

Stirling Cycle; Technology Utilization; Energy Conversion; Fabrication; Mechanical Engineering

20070032740 NASA Glenn Research Center, Cleveland, OH, USA

Robust Low-Cost Cathode for Commercial Applications

Patterson, Michael J.; September 2007; 18 pp.; In English; 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color illustrations

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

Report No.(s): NASA/TM-2007-214984; AIAA Paper-2007-5170; E-16155; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032740

Under funding from the NASA Commercial Technology Office, a cathode assembly was designed, developed, fabricated, and tested for use in plasma sources for ground-based materials processing applications. The cathode development activity relied on the large prior NASA investment and successful development of high-current, high-efficiency, long-life hollow cathodes for use on the International Space Station Plasma Contactor System. The hollow cathode was designed and fabricated based on known engineering criteria and manufacturing processes for compatibility with the requirements of the plasma source. The transfer of NASA GRC-developed hollow cathode technology for use as an electron emitter in the commercial plasma source is anticipated to yield a significant increase in process control, while eliminating the present issues of electron emitter lifetime and contamination.

Author

Hollow Cathodes; Fabrication; Technology Utilization; Product Development; Electrical Engineering

20070032794 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of the J-2X Engine for the Ares I Crew Launch Vehicle and the Ares V Cargo Launch Vehicle: Building on the Apollo Program for Lunar Return Missions

Greene, WIlliam; May 14, 2007; 13 pp.; In English; 54th Joint JANNAF Propulsion Meeting, 14-17 May 2007, Denver, CO, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032794

The USA (U.S.) Vision for Space Exploration has directed NASA to develop two new launch vehicles for sending humans to the Moon, Mars, and beyond. In January 2006, NASA streamlined its hardware development approach for replacing the Space Shuttle after it is retired in 2010. Benefits of this approach include reduced programmatic and technical risks and the potential to return to the Moon by 2020 by developing the Ares I Crew Launch Vehicle (CLV) propulsion elements now, with full extensibility to future Ares V Cargo Launch Vehicle (CaLV) lunar systems. The Constellation Program selected the Pratt & Whitney Rocketdyne J-2X engine to power the Ares I Upper Stage Element and the Ares V Earth Departure Stage (EDS). This decision was reached during the Exploration Systems Architecture Study and confirmed after the Exploration Launch Projects Office performed a variety of risk analyses, commonality assessments, and trade studies. This paper narrates the evolution of that decision; describes the performance capabilities expected of the J-2X design, including potential commonality challenges and opportunities between the Ares I and Ares V launch vehicles; and provides a current status of J-2X design, development, and hardware testing activities. This paper also explains how the J-2X engine effort mitigates risk by testing existing engine hardware and designs; building on the Apollo Program (1961 to 1975), the Space Shuttle Program (1972 to 2010); and consulting with Apollo era experts to derive other lessons learned to deliver a human-rated engine that is on an aggressive development schedule, with its first demonstration flight in 2012.

Author

J-2 Engine; Engine Design; Ares 1 Launch Vehicle; Ares 5 Cargo Launch Vehicle

20070032831 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Convert Ten Foot Environmental Test Chamber into an Ion Engine Test Chamber

VanVelzer, Paul; October 10, 2006; 33 pp.; In English; 23rd Aerospace Testing Seminar (ATS), 10-12 Oct. 2006, Manhattan Beach, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40293

The 10 Foot Space Simulator at the Jet Propulsion Laboratory has been used for the last 40 years to test numerous spacecraft, including the Ranger series, several Mariner class, among many others and finally, the Spirit and Opportunity Mars Rovers. The request was made to convert this facility to an Ion Engine test facility, with a possible long term life test. The Ion engine was to propel the Prometheus spacecraft to Jupiter's moons. This paper discusses the challenges that were met, both from a procedural and physical standpoint. The converted facility must operate unattended, support a 30 Kw Ion Engine, operate economically, and be easily converted back to former operation as a spacecraft test facility.

Author

Test Chambers; Environmental Tests; Engine Tests; Ion Engines; Roving Vehicles

20070032861 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Implementation of a Low-Thrust Trajectory Optimization Algorithm for Preliminary Design

Sims, Jon A.; Finlayson, Paul A.; Rinderle, Edward A.; Vavrina, Matthew A.; Kowalkowski, Theresa D.; August 21, 2006; 10 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, 20-25 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40263

A tool developed for the preliminary design of low-thrust trajectories is described. The trajectory is discretized into segments and a nonlinear programming method is used for optimization. The tool is easy to use, has robust convergence, and can handle many intermediate encounters. In addition, the tool has a wide variety of features, including several options for objective function and different low-thrust propulsion models (e.g., solar electric propulsion, nuclear electric propulsion, and solar sail). High-thrust, impulsive trajectories can also be optimized.

Author

Trajectory Optimization; Algorithms; Nonlinear Programming; Solar Electric Propulsion; Nuclear Electric Propulsion; Solar Sails

20070032924 NASA Glenn Research Center, Cleveland, OH, USA

Cryogenic Technology Development for Exploration Missions

Chato, David J.; September 2007; 17 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 253225.04.01.02.04.01.03

Report No.(s): NASA/TM-2007-214824; AIAA Paper-2007-0953; E-16016; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032924

This paper reports the status and findings of different cryogenic technology research projects in support of the President s Vision for Space Exploration. The exploration systems architecture study is reviewed for cryogenic fluid management needs. It is shown that the exploration architecture is reliant on the cryogenic propellants of liquid hydrogen, liquid oxygen and liquid methane. Needs identified include: the key technologies of liquid acquisition devices, passive thermal and pressure control, low gravity mass gauging, prototype pressure vessel demonstration, active thermal control; as well as feed system testing, and Cryogenic Fluid Management integrated system demonstration. Then five NASA technology projects are reviewed to show how these needs are being addressed by technology research. Projects reviewed include: In-Space Cryogenic Propellant Depot; Experimentation for the Maturation of Deep Space Cryogenic Refueling Technology; Cryogenic Propellant Operations Demonstrator; Zero Boil-Off Technology Experiment; and Propulsion and Cryogenic Advanced Development. Advances are found in the areas of liquid acquisition of liquid oxygen, mass gauging of liquid oxygen via radio frequency techniques, computational modeling of thermal and pressure control, broad area cooling thermal control strategies, flight experiments for resolving low gravity issues of cryogenic fluid management. Promising results are also seen for Joule-Thomson pressure control devices in liquid oxygen and liquid methane and liquid acquisition of methane, although these findings are still preliminary.

Author

Cryogenic Rocket Propellants; Technology Utilization; Space Exploration; Space Missions; Cryogenic Fluids; Computational Fluid Dynamics

20070034038 NASA Marshall Space Flight Center, Huntsville, AL, USA

Electric Propulsion Upper-Stage for Launch Vehicle Capability Enhancement

Kemp, Gregory E.; Dankanich, John W.; Woodcock, Gordon R.; Wingo, Dennis R.; May 14, 2007; 15 pp.; In English; 54th Joint JANNAF Propulsion Meeting, 14-17 May 2007, Denver, CO, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The NASA In-Space Propulsion Technology Project Office initiated a preliminary study to evaluate the performance benefits of a solar electric propulsion (SEP) upper-stage with existing and near-term small launch vehicles. The analysis included circular and elliptical Low Earth Orbit (LEO) to Geosynchronous Earth Orbit (GEO) transfers, and LEO to Low Lunar Orbit (LLO) applications. SEP subsystem options included state-of-the-art and near-term solar arrays and electric thrusters. In-depth evaluations of the Aerojet BPT-4000 Hall thruster and NEXT gridded ion engine were conducted to compare performance, cost and revenue potential. Preliminary results indicate that Hall thruster technology is favored for low-cost, low power SEP stages, while gridded-ion engines are favored for higher power SEP systems unfettered by transfer time constraints. A low-cost point design is presented that details one possible stage configuration and outlines system limitations, in particular fairing volume constraints. The results demonstrate mission enhancements to large and medium class

launch vehicles, and mission enabling performance when SEP system upper stages are mounted to low-cost launchers such as the Minotaur and Falcon 1. Study results indicate the potential use of SEP upper stages to double GEO payload mass capability and to possibly enable launch on demand capability for GEO assets. Transition from government to commercial applications, with associated cost/benefit analysis, has also been assessed. The sensitivity of system performance to specific impulse, array power, thruster size, and component costs are also discussed.
Author
Solar Electric Propulsion; Hall Thrusters; Upper Stage Rocket Engines; Propulsion System Performance; Sensitivity; Ion Engines

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*.

20070032697 NASA Marshall Space Flight Center, Huntsville, AL, USA
Analysis of Thermal Control Coatings on MISSE for Aerospace Applications
Finckenor, Miria; Kenny, Mike; June 25, 2007; 1 pp.; In English; National Space and Missile Materials Symposium, 25-29 Jun. 2007, Keystone, CO, USA
Contract(s)/Grant(s): 401769.06.03.07.02.02; Copyright; Avail.: Other Sources; Abstract Only

Many different passive thermal control materials were flown as part of the Materials on International Space Station Experiment. Engineers and scientists at the Marshall Space Flight Center have analyzed a number of these materials, including: Zinc oxide/potassium silicate coating, Zinc oxide/potassium silicate/silicone coating, Zinc orthotitanate/potassium silicate coating, Electrically conductive thermal control coatings and Various coatings for part marking, automated rendezvous and capture, and astronaut visual aids These and other material samples were exposed to the low Earth orbital environment of atormc oxygen, ultraviolet radiation, thermal cycling, and hard vacuum, though atomic oxygen exposure was very limited for some samples. Solar absorptance, infrared emittance, and mass measurements indicate the durability of these materials to withstand the space environment. The effect of contamination from an active space station on the performance of white thermal control coatings is discussed.
Author
Aerospace Environments; Earth Orbital Environments; Thermal Control Coatings; Thermal Cycling Tests; Temperature Sensitive Paints

20070032966 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Observation of Night OH in the Mesosphere
Pickett, H. M.; Read, W. G.; Lee, K. K.; Yung, Y. L.; Geophysical Research Letters; October 6, 2006; ISSN 0094-8276; Volume 33; 4 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNG04GD76G; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40381; http://dx.doi.org/10.1029/2006GL026910

Satellite measurements from the Aura MLS instrument show a layer of OH near 82 km in the night. This layer confirms earlier measurements by ground-based LIDAR. The MLS and LIDAR observations measure OH in the lowest vibrational state and are distinct, but related chemically, from vibrationally-excited emission from the OH Meinel bands in the near infrared. The Caltech 1-D model has been extended to include vibrational dependence of OH reactions and shows good agreement with MLS OH data and with observations of the Meinel bands. The model shows a chemical lifetime of HO(x) that increases from less than a day at 80 km to over a month at 87 km. Above this altitude transport processes become an important part of HOx chemistry. The model predicts that ground state OH represents 99% of the total OH up to 84 km.
Author
Satellite Observation; Hydrogen Compounds; Hydroxyl Emission; Optical Radar; Near Infrared Radiation; Mesosphere

20070032967 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Temporal Decrease in Upper Atmospheric Chlorine

Froidevaux, L.; Livesey, N. J.; Read, W. G.; Salawitch, R. J.; Waters, J. W.; Drouin, B.; MacKenzie, I. A.; Pumphrey, H. C.; Bernath, P.; Boone, C.; Nassar, R.; Montzka, S.; Elkins, J.; Cunnold, D.; Waugh, D.; Geophysical Research Letters; December 14, 2006; ISSN 0094-8276; Volume 33; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40388; http://dx.doi.org/10.1029/2006GL027600

We report a steady decrease in the upper stratospheric and lower mesospheric abundances of hydrogen chloride (HCl) from August 2004 through January 2006, as measured by the Microwave Limb Sounder (MLS) aboard the Aura satellite. For 60(deg)S to 60(deg)N zonal means, the average yearly change in the 0.7 to 0.1 hPa (approx.50 to 65 km) region is -27 +/- 3 pptv/year, or -0.78 +/- 0.08 percent/year. This is consistent with surface abundance decrease rates (about 6 to 7 years earlier) in chlorine source gases. The MLS data confirm that international agreements to reduce global emissions of ozone-depleting industrial gases are leading to global decreases in the total gaseous chlorine burden. Tracking stratospheric HCl variations on a seasonal basis is now possible with MLS data. Inferred stratospheric total chlorine (CITOT) has a value of 3.60 ppbv at the beginning of 2006, with a (2-sigma) accuracy estimate of 7%; the stratospheric chlorine loading has decreased by about 43 pptv in the 18-month period studied here. We discuss the MLS HCl measurements in the context of other satellite-based HCl data, as well as expectations from surface chlorine data. A mean age of air of approx. 5.5 years and an age spectrum width of 2 years or less provide a fairly good fit to the ensemble of measurements.

Author

Upper Atmosphere; Stratosphere; Mesosphere; Hydrogen Chlorides; Abundance; Microwave Sounding

20070033313 Office of Naval Research, Arlington, VA USA

Nanomaterials: Reality Versus Hype

Kabacoff, Lawrence T; Aug 1, 2006; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469469; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Nanotechnology; Structural Design

20070034037 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

On the Stratospheric Chemistry of Hydrogen Cyanide

Kleinbohl, Armin; Toon, Geoffrey C.; Sen, Bhaswar; Blavier, Jean-Francois L.; Weisenstein, Debra K.; Strekowski, Rafal S.; Nicovich, J. Michael; Wine, Paul H.; Wennberg, Paul O.; Geophysical Research Letters; June 3, 2006; ISSN 0094-8275; Volume 33; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40374; http://dx.doi.org/10.1029/2006gl026015

HCN profiles measured by solar occultation spectrometry during 10 balloon flights of the JPL MkIV instrument are presented. The HCN profiles reveal a compact correlation with stratospheric tracers. Calculations with a 2D-model using established rate coefficients for the reactions of HCN with OH and O(1D) severely underestimate the measured HCN in the middle and upper stratosphere. The use of newly available rate coefficients for these reactions gives reasonable agreement of measured and modeled HCN. An HCN yield of approx.30% from the reaction of CH3CN with OH is consistent with the measurements.

Author

Hydrocyanic Acid; Occultation; Atmospheric Chemistry; Stratosphere; Two Dimensional Models

20070034062 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Interaction of Ethyl Alcohol Vapor with Sulfuric Acid Solutions

Leu, Ming-Taun; Journal of Physical Chemistry A; January 24, 2006; Volume 110, No. 21, pp. 6660-6666; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40379; http://dx.doi.org/10.1021/jp055810h

We investigated the uptake of ethyl alcohol (ethanol) vapor by sulfuric acid solutions over the range approx.40 to approx.80 wt % H2SO4 and temperatures of 193-273 K. Laboratory studies used a fast flow-tube reactor coupled to an electron-impact ionization mass spectrometer for detection of ethanol and reaction products. The uptake coefficients ((gamma)) were measured and found to vary from 0.019 to 0.072, depending upon the acid composition and temperature. At

concentrations greater than approx.70 wt % and in dilute solutions colder than 220 K, the values approached approx.0.07. We also determined the effective solubility constant of ethanol in approx.40 wt % H2SO4 in the temperature range 203-223 K. The potential implications to the budget of ethanol in the global troposphere are briefly discussed.
Author
Sulfuric Acid; Ethyl Alcohol; Reaction Products; Fast Nuclear Reactors; Electron Impact; Mass Spectrometers; Ionization

24
COMPOSITE MATERIALS

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

20070032923 NASA Langley Research Center, Hampton, VA, USA
Elastic Response and Failure Studies of Multi-Wall Carbon Nanotube Twisted Yarns
Gates, Thomas S.; Jefferson, Gail D.; Frankland, Sarah-Jane V.; September 19, 2007; 15 pp.; In English; 22nd Annual Technical Conference of the American Society for Composites, 17-19 Sep. 2007, Seattle, WA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 014368.05.07.03; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032923

Experimental data on the stress-strain behavior of a polymer multiwall carbon nanotube (MWCNT) yarn composite are used to motivate an initial study in multi-scale modeling of strength and stiffness. Atomistic and continuum length scale modeling methods are outlined to illustrate the range of parameters required to accurately model behavior. The carbon nanotubes yarns are four-ply, twisted, and combined with an elastomer to form a single-layer, unidirectional composite. Due to this textile structure, the yarn is a complicated system of unique geometric relationships subjected to combined loads. Experimental data illustrate the local failure modes induced by static, tensile tests. Key structure-property relationships are highlighted at each length scale indicating opportunities for parametric studies to assist the selection of advantageous material development and manufacturing methods.
Author
Yarns; Carbon Nanotubes; Polymers; Composite Materials; Mechanical Properties; Failure Modes; Twisting

20070034091
Fatigue Prediction for Composite Materials and Structures
Salomon, Omar; Rastellini, Fernando; Oller, Sergio; Onate, Eugenio; Oct 1, 2005; 23 pp.; In English; Meeting on Evaluation, Control and Prevention of High Cycle Fatigue in Gas Turbine Engines for Land, Sea and Air Vehicles, 3-5 Oct. 2005, Grenada, Spain; Original contains color illustrations
Report No.(s): AD-A469538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Composite Materials; Composite Structures; Fatigue (Materials)

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20070032905 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Formulation of Equivalent Effective Stratospheric Chlorine (EESC)
Newman, P. A.; Daniel, J. S.; Waugh, D. W.; Nash, E. R.; [2007]; 15 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Equivalent effective stratospheric chlorine (EESC) is a convenient parameter to quantify the effects of halogens (chlorine and bromine) on ozone depletion in the stratosphere. We show and discuss a new formulation of EESC that now includes the effects of age-of-air dependent fractional release values and an age-of-air spectrum. This new formulation provides quantitative estimates of EESC that can be directly related to inorganic chlorine and bromine throughout the stratosphere. Using this EESC formulation, we estimate that human-produced ozone depleting substances will recover to 1980 levels in

2041 in the midlatitudes, and 2067 over Antarctica. These recovery dates are based upon the assumption that the international agreements for regulating ozone-depleting substances are adhered to. In addition to recovery dates, we also estimate the uncertainties in the estimated time of recovery. The midlatitude recovery of 2041 has a 95% confidence uncertainty from 2028 to 2049, while the 2067 Antarctic recovery has a 95% confidence uncertainty from 2056 to 2078. The principal uncertainties are from the estimated mean age-of-air, and the assumption that the mean age-of-air and fractional release values are time independent. Using other model estimates of age decrease due to climate change, we estimate that midlatitude recovery may be accelerated from 2041 to 2031.
Author
Chlorine; Ozone Depletion; Stratosphere; Atmospheric Chemistry; Bromine; Formulations

20070032917 NASA Langley Research Center, Hampton, VA, USA
Thermal Conductivity of Ethylene Vinyl Acetate Copolymer/Nanofiller Blends
Ghose, Sayata; Watson, Kent A.; Working, Dennis C.; Connell, John W.; Smith, Joseph G., Jr.; Lin, Y.; Sun, Y. P.; [2007]; 35 pp.; In English; 1st International Conference on Polymers in Defence and Aerospace 2007, 18-19 Sep. 2007, Toulouse, France
Contract(s)/Grant(s): WBS 321878.04.07.04; Copyright; Avail.: CASI: A03, Hardcopy

To reduce weight and increase the mobility, comfort, and performance of future spacesuits, flexible, thermally conductive fabrics and plastic tubes are needed for the Liquid Cooling and Ventilation Garment. Such improvements would allow astronauts to operate more efficiently and safely for extended extravehicular activities. As an approach to raise the thermal conductivity (TC) of an ethylene vinyl acetate copolymer (Elvax(TM)260), it was compounded with three types of carbon based nanofillers: multi-walled carbon nanotubes (MWCNTs), vapor grown carbon nanofibers (CNFs), and expanded graphite (EG). In addition, other nanofillers including metallized CNFs, nickel nanostrands, boron nitride, and powdered aluminum were also compounded with Elvax(TM) 260 in the melt at various loading levels. In an attempt to improve compatibility between Elvax 260 and the nanofillers, MWCNTs and EG were modified by surface coating and through noncovalent and covalent attachment of organic molecules containing alkyl groups. Ribbons of the nanocomposites were extruded to form samples in which the nanofillers were aligned in the direction of flow. Samples were also fabricated by compression molding to yield nanocomposites in which the nanofillers were randomly oriented. Mechanical properties of the aligned samples were determined by tensile testing while the degree of dispersion and alignment of nanoparticles were investigated using high-resolution scanning electron microscopy. TC measurements were performed using a laser flash (Nanoflash(TM)) technique. TC of the samples was measured in the direction of, and perpendicular to, the alignment direction. Additionally, tubing was also extruded from select nanocomposite compositions and the TC and mechanical flexibility measured.
Author
Acetates; Ethylene; Thermal Conductivity; Vinyl Copolymers; Nanoparticles; Fillers

20070032944 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Investigation of Ruthenium Dissolution in Advanced Membrane Electrode Assemblies for Direct Methanol Based Fuel Cells Stacks
Valdez, T. I.; Firdosy, S.; Koel, B. E.; Narayanan, S. R.; October 19, 2005; 20 pp.; In English; 208th Meeting of the Electrochemical Society (ECS), 19 Oct. 2005, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40195

This viewgraph presentation gives a detailed review of the Direct Methanol Based Fuel Cell (DMFC) stack and investigates the Ruthenium that was found at the exit of the stack. The topics include: 1) Motivation; 2) Pathways for Cell Degradation; 3) Cell Duration Testing; 4) Duration Testing, MEA Analysis; and 5) Stack Degradation Analysis.
CASI
Dissolving; Electrodes; Fuel Cells; Methyl Alcohol; Ruthenium; Electrochemistry

20070033013 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA
A Method for the Analysis of Tabun in Multisol Using Gas Chromatographic Flame Photometric Detection
Logan, Thomas P; Allen, Edward D; Way, Mark R; Swift, Austin T; Soni, Sunil-Datta; May 2006; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469216; USAMRICD-TR-06-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469216

In the past we have found tabun (GA) in saline at 2 microgram/ml to be stable for only a month or less at -70 degrees

C. Previous studies have shown that Multisol provides stable solutions of GA. We confirmed the stability of GA in Multisol with phosphorus nuclear magnetic resonance and developed a method for the analysis of GA in Multisol using gas chromatographic flame photometric detection (GCFPD) in the phosphorus mode. The GC method used acetonitrile (CH3CN) for a dilution solvent because of its miscibility with GA in chloroform (CHC13) standards and GA in Multisol samples at 1% (v/v). Furthermore, the dilutions with CH3CN made the phosphorus mode interference peak present in CHC13 analytically manageable, reduced the interferences of Multisol in the GC separation, and contributed to a safe and reliable analysis of GA at 20 microgram/ml. We demonstrated the stability of GA in Multisol stored for more than a year at -70 degrees C. This method contributes a suitable technique for the preparation and analysis of reliable solutions of GA in nerve agent medical research and demonstrates the extended stability of GA in Multisol.
DTIC
Detection; Flames; Gas Chromatography; Photometry

20070033057 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Experimental Investigation of Turbojet Thrust Augmentation Using an Ejector
Hoffman, David A; Mar 2007; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469288; AFIT/GAE/ENY/07-M13; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469288

In recent years a significant number of commercially available micro turbines have become available. At the same time unmanned aerial vehicles and smart munitions have decreased in size while their endurance needs have increased. With these new platform requirements comes the need for a propulsion system with reliability, good endurance and low acoustic signature. There has been much research accomplished in the area of steady cold flow primary sources, but little experimental work has been done using a gas turbine as a steady flow hot source. This investigation concerns the performance of an ejector driven by a small gas turbine. Aircraft applicability was a deciding factor in test geometry. Varying both engine throttle and the ejector?s downstream distance resulted in peak augmentation values of nearly 1.4.
DTIC
Ejectors; Exhaust Nozzles; Propulsion System Configurations; Propulsion System Performance; Thrust; Thrust Augmentation; Turbojet Engines

20070033059 Dayton Univ. Research Inst., OH USA
Atomic Force Microscopy Based Eddy Current Imaging and Characterization of Composite and Nanocomposite Materials (Preprint)
Nalladega, Vijayaraghava; Sathish, Shamachary; Klosterman, Don; Jata, Kumar V; Blodgett, Mark P; Mar 2007; 12 pp.; In English
Contract(s)/Grant(s): F33615-03-C-5219; F33615-03-3-9001; Proj-4349
Report No.(s): AD-A469299; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469299

Atomic Force Microscope (AFM) based eddy current imaging technique has been used to characterize carbon fiber reinforced composites and carbon nanofibers nanocomposite. The surface topography and eddy current images of the same region of the sample acquired at the same time are presented. While the contrast in AFM images is due to surface topography variations, the contrast in the eddy current images is due to the local variation in the electrical conductivity of the sample. The results show that the combined techniques of AFM and eddy current imaging can be used effectively to investigate the distribution, dispersion of the carbon fibers in the polymer matrix and the fiber matrix interphase. An enhanced contrast at the interface between the fiber and the matrix has been observed in the eddy current images. The implications of the improved contrast in eddy current images and its application to investigation of fiber-matrix interface/interphase in carbon fiber polymer matrix composites is discussed.
DTIC
Atomic Force Microscopy; Carbon Fibers; Composite Materials; Eddy Currents; Fiber Composites; Images; Imaging Techniques; Nanocomposites; Nondestructive Tests

20070033089 Air Force Research Lab., Eglin AFB, FL USA

Equation of State of Aluminum-Iron Oxide (Fe2O3) - Epoxy Composite: Modeling and Experiment

Jordan, Jennifer L; Ferranti, Louis; Thadhani, Naresh N; Benson, David; Dick, Richard D; Austin, Ryan; McDowell, David; May 2007; 6 pp.; In English

Contract(s)/Grant(s): F08630-03-C-0001; Proj-2502

Report No.(s): AD-A469359; AFRL-MN-EG-TP-2007-7404; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469359

We report on the investigation of the equation of state of an 2Al+Fe2O3+ 50 wt.% epoxy composite in the 2-23 GPa pressure range. An explosive loading technique, with piezoelectric pins to measure the shock velocity in the sample and in a donor material, was used for experiments exceeding 5 GPa. Gas gun experiments were performed on the same composites at lower pressures, using PVDF stress gauges to record the input and propagated stresses and the shock velocity based on the time of travel through the sample thickness. The experimental results are compared to numerical simulations of shock compression in discrete particle models. Model results are in agreement with experimental results.

DTIC

Aluminum Oxides; Composite Materials; Epoxy Matrix Composites; Epoxy Resins; Equations of State; Gas Guns; Iron Oxides; Shock Waves

20070033104 Bristol Univ., UK

Report of study visits by University of Bristol, UK to University of Illinois in Urbana-Champaign, USA to initiate collaboration and coordination with 2005 MURI 'MICROVASCULAR AUTONOMIC COMPOSITES'

Bond, Ian; Feb 15, 2007; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0258

Report No.(s): AD-A469398; ACCIS-AE055; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469398

This report details two study visits undertaken by University of Bristol researchers to the University of Illinois at Urbana-Champaign between 13th - 17th March 2006 and 5th - 9th February 2007 to discuss collaboration on MURI activities and broader self-healing work. During the first visit (see Agenda/Itinerary in Appendix 1 and 2). the programme of work started with two days of discussions and presentations by UlUC researchers and a seminar by the Bristol team on their current work. A day of laboratory activities and familiarization was interspersed with these activities. Time for consolidation allowed the generation of several areas for future collaboration.

DTIC

Autonomic Nervous System; Coordination; Laminates; Maintenance

20070033106 Science Applications International Corp., Abingdon, MD USA

Pulmonary Effects of Pyrotechnically Disseminated Titanium Dioxide Smoke in Rats

Anthony, J S; Kristovich, Robert L; McCaskey, David A; Davis, Emily A; Matson, Kathy L; Burnett, David; Gaviola, Bernardita P; Crouse, Charles L; Horsmon, Michael S; Kimmel, Edgar C; May 2007; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469402; ECBC-TR-551; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469402

The Fast Obscurant Grenade (FOG) is a bursting type grenade that has been developed within the Family of Tactical Obscuration Devices to fulfill the small through medium area screening obscuration need. After the health hazards were analyzed for the currently used obscurant payloads, titanium dioxide (TiO2) was chosen as the candidate smoke, while maintaining the necessary performance characteristics. Many studies have been performed evaluating the toxicity of inhaled TiO2; however, most have evaluated long exposure times (i.e., 30 min) at low concentrations. For the current need supported by FOG, elevated concentrations for short exposure times would be the predominant operational scenario for inhalation exposures to TiO2 smoke. Acute and repeat exposures are therefore possible as maneuvers are performed in confined areas and in close proximity to the dissemination source. The current study evaluated clearance of the smoke material from the respiratory system, as well as other biological effects. Groups of rats were exposed for 10 min to high concentrations of smoke generated from the FOG. Broncheoalveolar lavage, histopathology, particle size analysis, and chemical characterization of the aerosol were performed to assess the toxicity of the inhaled smoke.

DTIC

Rats; Respiratory System; Smoke; Titanium Oxides

20070033117 Mitretek Systems, Inc., Falls Church, VA USA

Characteristics and Sampling Efficiencies of Portable High Throughput Liquid-Assisted Aerosol Sampler Model APAS-2 (PHTLAAS-APAS-2)

Kesavan, Jana S; Schepers, Deborah R; Apr 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469422; ECBC-TN-030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469422

Characteristics and aerosol sampling efficiencies of a Portable High Throughput Liquid-Assisted Air Sampler Model APAS-2 (PHTLAAS-APAS-2) (Zaromb Research Corp., Hinsdale, IL) were determined at the U.S. Army Edgewood Chemical Biological Center (ECBC). The PHTLAAS-APAS-2 is a portable, battery-operated bioaerosol sampler designed to collect 0.5- to 10-micrometers particles into a buffer solution to preserve the viability of bio-organisms. Sampling efficiency tests were conducted with 1- and 3-micrometers polystyrene latex microspheres and 3-, 5-, and 8-micrometers fluorescent oleic acid particles. The results show that the sampler has a high (>55%) sampling efficiency for the particle sizes tested with a peak sampling efficiency of 87.7 plus or minus 3.8% for 3-micrometers particles. The sample collection liquid (25 microLiters) was placed in the cyclone before each sampling. After 10 min of sampling, the average sample output was 18.1 plus or minus 1.0 microLiters. The measured air flowrate using a hot wire anemometer was 305.9 Lpm at the inlet. A previous version, the PHTLAAS, was also tested at ECBC, and the results show that the PHTLAAS-APAS-2 is smaller, lighter, and has a slightly higher sampling efficiency for larger size (>5 micrometers) particles compared to the PHTLAAS (its predecessor).

DTIC

Aerosols; Atmospheric Models; Efficiency; Samplers; Sampling

20070033122 Syracuse Univ., NY USA

Effects of Subzero Temperatures and Seawater Immersion on Damage Initiation and Growth in Sandwich Composites

Davidson, Barry D; Jun 12, 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-1-0418

Report No.(s): AD-A469430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469430

Progress to-date is described on the project 'Effects of Subzero Temperatures and Seawater Immersion on Damage Initiation and Growth in Sandwich Composites.' Funding for this two-year effort was received at Syracuse University (SU) in late February of 2007. The work since that tune has focused on obtaining materials and supplies, creating the infrastructure to do the work, and on performing preparatory and exploratory experiments and analyses. To this end, freezers have been purchased for storage of sandwich laminates at 0 deg., -20 deg. and -40 deg., test fixtures have been designed and are being fabricated at the SU machine shop, manufacturing supplies have been procured, and a vacuum-assisted resin transfer molding (VARTM) process for fabricating sandwich panel laminates has been successfully implemented. Work in-progress includes seawater immersion and freezing studies on core and sandwich panel specimens, as well as a preliminary evaluation of the proposed crack tip element based approach for predicting energy release rates for sandwich debonding and crack kinking out of the core-to-face sheet interface.

DTIC

Composite Materials; Crack Initiation; Crack Propagation; Freezing; Growth; Initiation; Sandwich Structures; Sea Water; Submerging; Subzero Temperature; Temperature Effects

20070033295 Notre Dame Univ., IN USA

Determination of Physical Properties of Energetic Ionic Liquids Using Molecular Simulations

Maginn, Edward J; Dec 31, 2006; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0212

Report No.(s): AD-A469443; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Research results for AFOSR grant F49620-03-1-0212 for the period 1 April, 2003 to 31 December, 2006 is described. The objectives of this research were to develop and validate classical force fields for different model compounds representative of a range of ionic liquids; compute a wide range of physical properties for these model compounds; obtain molecular-insight into how property variations are related to structure; and develop new simulation tools to accurately compute melting points and gas solubilities in ionic liquids. All of these objectives were achieved. Force fields for a range of imidazolium- pyridinium- and triazolium-based ionic liquids were developed and published. Properties including densities, heat capacities, cohesive energy densities, enthalpies of vaporization, and diffusion coefficients and gas solubilities were computed. Liquid structure and these properties were relates to molecular interactions identified in the simulations. A new rigorous melting point prediction simulation method was developed and applied to teat systems including NaCI, benzene and triazole. It is currently being

applied to ionic liquid systems.- A new semi-grand ensemble simulation method for predicting liquid-liquid equilibrium and vapor-liquid equilibrium was developed and published.
DTIC
Liquids; Simulation

20070033297 Spectral Sciences, Inc., Burlington, MA USA
Quasiclassical Trajectory Study of NO Vibrational Relaxation by Collisions with Atomic Oxygen
Duff, James W; Sharma, Ramesh D; Jan 2007; 21 pp.; In English
Report No.(s): AD-A469445; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Room temperature and temperature-dependent thermal rate constants are calculated for the state-to-state vibrational relaxation of NO by atomic oxygen using the quasiclassical trajectory method and limited ab initio information on the two lowest O+NO potential energy surfaces which are responsible for efficient vibrational relaxation. Comparisons of the theoretical results with the available experimental measurements indicate reasonable agreement for the deactivation of NO(v=2,3) at 300 K and NO(v=1) at 2700 K, although the calculated relaxation rate constant for NO(v=1) at 300 K is approximately a factor of 2 below the measured value. The state-to-state relaxation rate coefficients involve the formation of long lived collision complexes and indicate the importance of multiquantum vibrational relaxation consistent with statistical behavior in O+NO collisions. The present results, combined with recent measurements of vibrational relaxation for NO(v=2.3), suggest that the current atmospheric models of NO cooling rates require higher atmospheric temperatures and/or an increase in the NO/O number densities.
DTIC
Collisions; Molecular Relaxation; Nitric Oxide; Oxygen Atoms; Trajectories; Vibration

20070033309 Army Engineer Research and Development Center, Vicksburg, MS USA
Grenade Range Management Using Lime for Metals Immobilization and Explosives Transformation Treatability Study
Larson, Steven L; Davis, Jeffrey L; Martin, W A; Felt, Deborah R; Nestler, Catherine C; Brandon, Dennis L; Fabian, Gene; O'Connor, Gregory; Jun 2007; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469458; ERDC/EL-TR-07-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense operates hundreds of hand grenade ranges (HGRs) for training purposes. Live fire training is a necessary function to maintain mission readiness for our Nation's warfighters, but it creates a potential source zone for munitions constituents such as metals and explosives. Fragmentation grenades typically containing composition B within a steel shell casing constitute the majority of hand grenades used at fixed position ranges. Explosives have been detected in HGR soils at levels in the low parts per billion (microg/kg) up to percent levels. Two mechanisms with potential for offsite migration of metals and explosives from HGR soil are transport in surface water and subsurface transport in leachate or pore water. Simple, innovative, and cost-effective technologies are being developed that can break down munitions constituents quickly at the training sites and prevent residues from migrating to local surface water or ground water supplies. The application of hydrated lime to HGRs provides both a mechanism for metals immobilization and explosives transformation. The results from this treatability study indicate that the application of lime can be incorporated into range sustainability operations and the management practices for active HGRs.
DTIC
Calcium Oxides; Explosives; Grenades; Hydration; Hydrolysis; Immobilization; Land Management; Metals; Rangelands; Surface Water

20070033326 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization of Intercalated Graphite Fibers for Microelectromechanical Systems (MEMS) Applications
Winningham, Bryan W; Mar 2007; 135 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469495; AFIT/GE/ENG/07-25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Research was accomplished to characterize the electrical and physical characteristic changes of the Thornel(trade name) P-100 carbon fiber and five variants when intercalated with 96% sulfuric acid and incorporated the use of Microelectromechanical Systems (MEMS) structures for testing purposes. The five fiber variants were oxidized in 1 M nitric acid at 0.5 A for 30 seconds, 1 and 2 minutes, the last two samples were detreated at 1150 deg C for one hour prior to the nitric acid treatment. The fibers were mounted onto a MEMS die, placed into a chip carrier, sulfuric acid added, the chip carrier sealed and testing accomplished. This thesis explains the approach and methods that were completed to mount carbon fibers. We have designed MEMS structures with an inset trench that 10 μm carbon fibers can be mounted into for testing. Which

reduced the amount of coverage required to bind the fiber in place. The original and five anodically oxidized fibers were inspected with a scanning electron microscope (SEM), studied with Raman spectroscopy, and small signal responses were measured from 20Hz to 1 MHz.
DTIC
Actuators; Carbon Fibers; Graphite; Microelectromechanical Systems

20070033380 Colorado Univ., Boulder, CO USA
Detonation Initiation and Evolution in Spray- Fueled Pulsed Detonation Rocket Engines
Kassoy, D R; Kuehn, J A; Nabity, M W; Clarke, J F; Jun 28, 2007; 85 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-02-1-0121
Report No.(s): AD-A469561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Successful pulsed detonation engine operation requires robust, reliable, repetitive detonation initiation and evolution, up to 100 times per second. Spark-initiated combustion of fuel-oxidizer mixtures appears to be the operational technology. Our research program was designed to model the transient events following time-resolved deposition of thermal energy into a finite volume of reactive mixture. Computational solutions of the reactive Euler equations are used to predict the time history of deflagration to detonation transitions (DDT's). Solutions describe the temporal variation of the spatial distributions of temperature, pressure and fuel concentration.. The presence of shocks, localized reactive hot spots and high speed reaction zones are noted. Solution dependence on the location of the initial power deposition, the amount of power deposition and the activation energy on a one step reaction is investigated. In all cases the DDT process is facilitated by the spontaneous appearance of localized high pressure and temperature ':reaction centers' that are the subsequent sources of acoustic compression waves.
DTIC
Deflagration; Detonation; Detonation Waves; Initiation; Pulse Detonation Engines; Rocket Engines; Sprayers

20070033387 Pennsylvania State Univ., University Park, PA USA
Cluster Dynamics: Laying the Foundations for Developing Nanoscale Materials
Castleman, Jr, A W; Dec 2006; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469568; FA9550-04-1-0066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The program which ended December 31, 2006 was directed towards: 1) developing approaches for the design of new nanoscale materials that can be tailored to have desired properties; 2) investigating electronic and reactive properties that will find applications of interest to the Air Force in energetic, electromagnetic, optical and structural materials; and 3) finding synthetic methods to produce materials as condensed phase deposits for further characterization. This section summarizes progress and accomplishments made during the first two years of this 3-year program.
DTIC
Aluminum Compounds; Carbon Compounds; Nanostructures (Devices)

20070033388 North Carolina State Univ., Raleigh, NC USA
An Integrated Approach to the Bulk III-Nitride Crystal Growth and Wafering
Sitar, Zlatko; Jun 12, 2007; 86 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0716
Report No.(s): AD-A469570; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recognizing that native substrates are crucial for future development of III-nitride-based devices, this MURI investigated several approaches to III-nitride crystal growth: (1) growth of GaN from the vapor phase, (2) growth of GaN from the Na flux, (3) ammonothermal growth of GaN and (4) growth of AlN by sublimation. While all approaches generated important findings, the latter two processes have been developed the furthest and are currently being pursued commercially. Following basic studies of solubility and transport in the alkaline supercritical ammonia solutions, seeded growth of GaN has been achieved at rates exceeding 20 m/day. The process is commercially appealing due to: simple equipment, scalability, high output volume and low growth temperature. Seeded growth of AlN has been achieved on SiC and AlN seeds. While growth on SiC enabled growth over large areas, it produced defective material with dislocation density in the 108 cm-2 range. In contrast, growth on spontaneously nucleated AlN seeds produced smaller but near perfect crystals with dislocations densities below 103 cm-2. Following these findings, an iterative scheme for gradual crystal expansion was developed, which allowed a diameter

expansion of about 5 mm in each step. The quality and properties of grown single crystals were assessed by structural, optical, thermal and electrical characterization techniques.
DTIC
Aluminum Nitrides; Crystal Growth; Gallium Nitrides; Nitrides; Silicon Dioxide; Wafers

20070033390 California Univ., Santa Barbara, CA USA
The Chemistry of Cyclic All-Nitrogen Molecules
Wodtke, Alec M; Dec 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0057
Report No.(s): AD-A469573; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document reports on work performed under the grant FA9650-04-1-0057, Air Force Office of Scientific Research, $474,927, February 15, 2004 - December 31, 2006. During this period, we have extended our preliminary investigations of azide photochemistry, with the aim of demonstrating unambiguously the photochemical production of cyclic-N, and of revealing the fundamental photochemical mechanism of N-N-N ring closure in azide photochemistry. The remainder of this report is organized as follows. First, we present a list of publications and scientific presentations of the work supported by this grant. A brief review of the important results is then presented.
DTIC
Molecules; Nitrogen; Photochemical Reactions

26
METALS AND METALLIC MATERIALS

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

20070032910 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effect of Mechanical Stresses on Characteristics of Chip Tantalum Capacitors
Teverovsky, Alexander A.; [2007]; 13 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The effect of compressive mechanical stresses on chip solid tantalum capacitors is investigated by monitoring characteristics of different part types under axial and hydrostatic stresses. Depending on part types, an exponential increase of leakage currents was observed when stresses exceeded 10 MPa to 40 MPa. For the first time, reversible variations of leakage currents (up to two orders of magnitude) with stress have been demonstrated. Mechanical stresses did not cause significant changes of AC characteristics of the capacitors, whereas breakdown voltages measured during the surge current testing decreased substantially indicating an increased probability of failures of stressed capacitors in low impedance applications. Variations of leakage currents are explained by a combination of two mechanisms: stress-induced scintillations and stress-induced generation of electron traps in the tantalum pentoxide dielectric.
Author
Capacitors; Chips; Mechanical Properties; Tantalum; Axial Stress

20070032921 NASA Glenn Research Center, Cleveland, OH, USA
Measured Activities of Al and Ni in gamma-(Ni) and gamma'-(Ni)3Al in the Ni-Al-Pt System
Copland, Evan; [2007]; 18 pp.; In English; MS&T2007, 17-20 Sep. 2007, Detroit, MI, USA
Contract(s)/Grant(s): NNC05AA14A; WBS 561581.02.08.03.15.02; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032921

Adding Pt to Ni-Al coatings is critical to achieving the required oxidation protection of Ni-based superalloys, but the nature of the Pt effect remains unresolved. This research provides a fundamental part of the answer by measuring the influence of Pt on the activities of Al and Ni in gamma-(Ni), gamma prime-(Ni)3Al and liquid in the Ni-Al-Pt system. Measurements have been made at 25 compositions in the Ni-rich corner over the temperature range, T = 1400-1750 K, by the vapor pressure technique with a multiple effusion-cell mass spectrometer (multi-cell KEMS). These measurements clearly show adding Pt (for X(sub Pt) less than 0.25) decreases a(Al) while increasing a(Ni). This solution behavior supports the idea that Pt increases Al transport to an alloy / Al2O3 interface and also limits the interaction between the coating and substrate alloys in the gamma-(Ni) + gamma prime-(Ni)3Al region. This presentation will review the progress of this study.
Author
Nickel Aluminides; Coatings; Aluminum Oxides; Platinum; Heat Resistant Alloys

20070033021 Scientific Forming Technologies Corp., Columbus, OH USA

Microstructure Modeling of the Superalloy Ingot Breakdown Process

Bandar, Alexander R; Shankar, Ravi; Cai, Li; Wu, Wei-Tsu; May 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-06-C-5203; FA8650-05-M-5205; Proj-3005

Report No.(s): AD-A469235; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469235

A microstructure evolution model is presented, integrated into the Finite Element Modeling (FEM) software package DEFORM(tm). Recrystallization and grain growth, during and after thermomechanical deformation, are predicted via a phenomenologically-informed Cellular Automata (CA) algorithm. Strain, strain rate, and temperature are computed via FEM and provided as inputs to the model. Examples of a CA technique to predict microstructure evolution during cogging of a nickel base superalloy are presented. Although this model is focused on and will be validated for cogging of nickel base superalloy U720, it is designed to accommodate a range of alloys, thermomechanical processes, and other microstructure evolution algorithms, such as Monte Carlo (MC) and Phase Field (PF) methods as well.

DTIC

Heat Resistant Alloys; Ingots; Mathematical Models; Microstructure

20070033121 Naval Surface Warfare Center, Bethesda, MD USA

A Study on the Tensile and Fracture Toughness Behavior of Pure Rhenium Metal

Robinson, Amy C; Zhang, Xian J; L'Heureux, Brian P; Gaies, Jennifer G; Feb 2006; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469429; NSWCCD-61-TR-2006/01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469429

High-temperature tensile properties of pure rhenium metal were studied to better understand the material's behavior under load at elevated temperatures. Different processing procedures, particularly hot isostatically pressing (HIP) and diffusion bonding of cold-rolled plate, cause microstructure differences (grain size, porosity, texture) that significantly affect the resulting tensile properties. For this study, tensile specimens were tested at 2500 deg F and characterized through extensive metallography and fractography. Results indicate rhenium is inherently ductile at 2500 deg F with transgranular fracture being the dominant fracture mode. The HIPed specimens deform primarily through slip while the cold-rolled specimens deform through twinning. Additionally, the stress/strain properties of the HIPed material are consistently better than the cold-rolled plate. Fracture toughness testing on cold-rolled rhenium plate was conducted at room temperature. Two plates of different thickness and grain sizes were tested per ASTM E 1820 and evaluated using Appendix A9: JIC and KJIC Evaluation. The two plates yielded significantly different results, likely due to the difference in the percent cold-work and grain size between the plates.

DTIC

Cold Rolling; Fracture Strength; Rhenium; Toughness

20070033363 Air Force Research Lab., Wright-Patterson AFB, OH USA

Effects of Temperature and Frequency on the HCF Behavior of a Ni-based Superalloy

Morrissey, Ryan J; Golden, Patrick J; Oct 1, 2005; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Frequencies; Heat Resistant Alloys; Temperature Effects

20070033384 George Mason Univ., Fairfax, VA USA

Atomistic Modeling of Advanced Intermetallic Alloys

Mishin, Yuri; Jun 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0017

Report No.(s): AD-A469565; 200661; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A fundamental study of structure, thermodynamic and kinetic properties of structural intermetallic alloys was performed by means of atomistic computer simulations. Gamma-gamma prime alloys of the Ni-Al system were chosen as model materials due to their high promise as structural alloys for high-temperature aerospace application, such as superalloys for gas-turbine engines. The methodology included the construction of new interatomic potentials for multi-component systems,

large-scale molecular dynamics and Monte Carlo simulations and other advanced methods. A New Nye-tensor method for the analysis of dislocation core structure in materials has been developed. The properties studied include atomic diffusion, dislocation behavior, structure and energy of generalized stacking faults in the gamma-prime phase, and energetics of inter-phase boundaries. The project provides new fundamental understanding of diffusion mechanisms in ordered intermetallic phase, understanding of dynamics of the locking-unlocking processes in moving dislocations during plastic deformation and reliable data on interface energies in alloys.
DTIC
Alloys; Intermetallics

20070034021 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Planck Sorption Cooler: Using Metal Hydrides to Produce 20 K
Pearson, David P.; Bowman, R.; Prina, M.; Wilson, P.; October 1, 2006; 12 pp.; In English; International Sumposium on Metal Hydrogen Systems Fundamentals and Applications, 1 Oct. 2006, Maui, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40312

The Jet Propulsion Laboratory has built and delivered two continuous closed cycle hydrogen Joule-Thomson (JT) cryocoolers for the ESA Planck mission, which will measure the anisotropy in the cosmic microwave background. The metal hydride compressor consists of six sorbent beds containing LaNi4.78Sn0.22 alloy and a low pressure storage bed of the same material. Each sorbent bed contains a separate gas-gap heat switch that couples or isolates the bed with radiators during the compressor operating cycle. ZrNiHx hydride is used in this heat switch. The Planck compressor produces hydrogen gas at a pressure of 48 Bar by heating the hydride to approx.450 K. This gas passes through a cryogenic cold end consisting of a tube-in-tube heat exchanger, three pre-cooling stages to bring the gas to nominally 52 K, a JT value to expand the gas into the two-phase regime at approx.20 K, and two liquid - vapor heat exchangers that must remove 190 and 646 mW of heat respectively.
Author
Sorption; Anisotropy; Cryogenic Cooling; Hydrogen; Metal Hydrides; Gas Pressure

20070034041 NASA Glenn Research Center, Cleveland, OH, USA
Mechanical Properties of 17-4PH Stainless Steel Foam Panels
Raj, S. V.; Ghosn, L. J.; Lerch, B. a.; Hebsur, M.; Cosgriff, L. M.; Fedor, J.; Materials Science Engineering A; September 2007; Volume 456, pp. 305-316; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.04.03
Report No.(s): NASA/TM-2007-214926; E-15637; Copyright; Avail.: CASI: A03, Hardcopy

Rectangular 17-4PH stainless steel sandwiched foam panels were fabricated using a commercial manufacturing technique by brazing two sheets to a foam core. Microstructural observations and ultrasonic nondestructive evaluation of the panels revealed large variations in the quality of the brazed areas from one panel to the next as well as within the same panel. Shear tests conducted on specimens machined from the panels exhibited failures either in the brazed region or in the foam core for the poorly brazed and well-brazed samples, respectively. Compression tests were conducted on the foam cores to evaluate their elastic and plastic deformation behavior. These data were compared with published data on polymeric and metallic foams, and with theoretical deformation models proposed for open cell foams.
Author
Mechanical Properties; Metal Foams; Stainless Steels; Fabrication; Rectangular Panels; Microstructure

27
NONMETALLIC MATERIALS

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

20070032698 NASA Marshall Space Flight Center, Huntsville, AL, USA
A One-Piece Lunar Regolith-Bag Garage Prototype
Smithers, Gweneth A.; Nehls, Mary K.; Hovater, Mary A.; Evans, Steven W.; Miller, J. Scott; Broughton, Roy M.; Beale, David; Killing-Balci, Fatma; June 03, 2007; 64 pp.; In English; Rutgers Symposium on Lunar Settlements, 3-8 Jun. 2007, New Brunswick, NJ, USA; Copyright; Avail.: CASI: A04, Hardcopy

Shelter structures on the moon, even in early phases of exploration, should incorporate lunar materials as much as

possible. We designed and constructed a prototype for a one-piece regolith-bag unpressurized garage concept, and, in parallel, we conducted a materials testing program to investigate six candidate fabrics to learn how they might perform in the lunar environment. In our concept, a lightweight fabric form is launched from Earth to be landed on the lunar surface and robotically filled with raw lunar regolith. In the materials testing program, regolith-bag fabric candidates included: Vectran(TM), Nextel(TM), Gore PTFE Fabric(TM), Zylon(TM), Twaron(TM), and Nomex(TM). Tensile (including post radiation exposure), fold, abrasion, and hypervelocity impact testing were performed under ambient conditions, and, within our current means, we also performed these tests under cold and elevated temperatures. In some cases, lunar simulant (JSC-1) was used in conjunction with testing. Our ambition is to continuously refine our testing to reach lunar environmental conditions to the extent possible. A series of preliminary structures were constructed during design of the final prototype. Design is based on the principles of the classic masonry arch. The prototype was constructed of Kevlar(TM) and filled with vermiculite (fairly close to the weight of lunar regolith on the moon). The structure is free-standing, but has not yet been load tested. Our plan for the future would be to construct higher fidelity mockups with each iteration, and to conduct appropriate tests of the structure.
Author
Fabrics; Materials Tests; Tensile Strength; Wear Tests; Wear Resistance; Radiation Tolerance; Impact Tests; Lunar Shelters

20070033019 Air Force Research Lab., Wright-Patterson AFB, OH USA
Aligned Carbon Nanotube to Enhance Through Thickness Thermal Conductivity in Adhesive Joints (Preprint)
Ganguli, Sabyasachi; Roy, Ajit K; Dai, Liming; Qu, Liangti; Dec 2006; 16 pp.; In English
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A469231; AFRL-ML-WP-TP-2007-446; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469231

Currently out of plane thermal conductivity (Kz) in adhesive joints fails to meet the needed Kz at the overall system level. Carbon nanotubes theoretically have an extremely high thermal conductivity along the longitudinal axis and according to molecular dynamics simulations the value can be as high as 3500 W/mK at room temperature for multi-walled carbon nanotubes (MWCNT). The thermal conductivity along the radial axis for MWCNTs is between 10-15 W/sq mK. Studies to increase Kz for adhesive joints only had minimal enhancement in the thermal conductivity. In order to utilize the superior thermal conductivity of the MWCNTs along the axial direction; vertically aligned MWCNTs have been used in this study. Vertically aligned MWCNTs have been grown on silicon wafers. The aligned nanotube array has been partially infused with epoxy. Selective reactive ion etching (RIE) of the epoxy revealed the nanotube tips. In order to reduce the impedance mismatch and phonon scattering at the interface, gold is thermally evaporated on the nanotube tip. A MEMS based steady state thermal conductivity measurement technique has been designed to assess the thermal conductivity of the device with special attention to the interface/transition zone.
DTIC
Adhesive Bonding; Carbon Nanotubes; Joints (Junctions); Thermal Conductivity; Thickness

20070033051 Dayton Univ. Research Inst., OH USA
Investigation of Bond Quality Effects on Piezoelectric Sensing of Impact Damage (Preprint)
Na, Jeong K; Blackshire, James L; Mar 2007; 11 pp.; In English
Report No.(s): AD-A469277; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469277

Elastic waves generated by foreign materials impacting surfaces of aerospace vehicle can be used to detect and quantify the severity of damage. Passive acoustical emission sensors, made of piezoelectric elements, are typically used as impact signal detection devices. In this study, we have concentrated on characterizing the bonding qualities of piezoelectric sensors in terms of various bonding materials and adhesion conditions such as bond strength, bond stiffness, partial bonding, and disbonding. The experiment has been performed with an automated impact testing setup under controlled bonding and disbonding conditions in an attempt to establish a standardized sensor bond quality inspection methodology.
DTIC
Adhesive Bonding; Damage; Detection; Detectors; Fluorides; Impact Damage; Joints (Junctions); Piezoelectricity; Vinyl Polymers; Vinylidene

20070033075 Rutgers - The State Univ., New Brunswick, NJ USA

Combat Ration Network for Technology Implementation. Retort Racks for Polymeric Trays in 1400 Style Spray Retorts

Bruins, Henderikus B; Coburn, John F; May 2003; 12 pp.; In English

Contract(s)/Grant(s): SPO103-02-D-0024-0005

Report No.(s): AD-A469329; FTR-202; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469329

The objective of this project was to design a retort rack that would maximize the retort capacity of a 1400 style spray retort and to select a material that would withstand the harsh retort spray environment. The contract consisted of three phases: (1) mold design, (2) mold fabrication, and (3) rack production. Test rack samples were produced at the end of phase 2 using three different materials. A blend of Polyphenylene (PPE) and Polypropylene (PP) with 15% short glass fiber filling was selected as the preferred material for the production of the final set of racks. The resulting material offers unique balance of stiffness, impact strength, temperature resistance, elongation and low specific gravity. Two ration producers were supplied with 100 retort racks each for testing in a production environment. The racks increased the capacity of the retort by 29%-33% and the rack material has withstood the retort environment without any problems after exposure to 3 months of production environment.

DTIC

Combat; Fabrication; Injection; Injection Molding; Rations; Sprayers; Trays

20070033113 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Effects of Prior Aging at Elevated Temperature in Air and in Argon Environments on Creep Response of PMR-15 Neat Resin at 288 deg C

Broeckert, Joseph L; Mar 2007; 176 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469415; AFIT/GMS/ENY/07-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469415

Creep behavior of PMR-15 neat resin, a polyimide thermoset polymer, aged in air or argon gaseous environments at 288 C for up to 1000 h was evaluated. Creep tests were performed at 288 C at creep stress levels of 20 and 10 MPa. Creep periods of at least 25 h in duration were followed by recovery at zero stress. Weight loss and growth of the oxidation layer were also monitored and correlated with aging time. The aging time in both air and argon environments had a strong influence on the creep and recovery response of PMR-15 neat resin. Samples aged in argon for 1000 h and tested at a creep stress level of 20 MPa produced creep strain of 4%, while the as-processed samples accumulated creep strain of 16%. DMA tests were performed to examine any changes in the glass transition temperature (Tg) of the PMR-15 neat resin. DMA results revealed an increase in (Tg) from 331 C to 336.5 C after 1000 h in argon at 288 C. Increase in Tg, indicating an increase in crosslink density due to aging in both air and argon environments is likely behind the changes in elastic modulus and in creep and recovery behavior.

DTIC

Argon; Creep Properties; High Temperature; Polyimide Resins; Resins

20070033314 Connecticut Univ., Storrs, CT USA

Nano Crystalline Ceramic and Ceramic Coatings Made by Conventional and Solution Plasma Spray

Jordan, Eric H; Gell, Maurice; Aug 1, 2006; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469470; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Ceramic Coatings; Ceramics; Crystallinity; Nanostructures (Devices); Plasmas (Physics); Sprayers

20070033315 Loughborough Univ. of Technology, UK

Processing Nanostructured Structural Ceramics

Binner, Jon; Aug 1, 2006; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469471; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Ceramics; Nanostructures (Devices); Sintering

20070033318 Southwest Research Inst., San Antonio, TX USA
Fuel and Lubricant Effects on Exhaust Emissions from a Light-Duty CIDI Powered Vehicle
Frame, Edwin A; Shaw, Keith A; Sep 2003; 147 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE07-99-C-L053
Report No.(s): AD-A469480; TFLRF-369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effects of fuel and engine lubricant on particulate and gaseous exhaust emissions from a modern, light-duty diesel vehicle were determined. Four engine crankcase lubricants and six fuels were evaluated by operating the test vehicle on a 48-inch single roll chassis dynamometer, utilizing the Federal Test Procedure (FTP-75) for light-duty vehicles and the SFTP-US06 aggressive driving cycle. Lubricants used were both conventional and synthetic formulations, and varied in viscosity from SAE 0W30 to SAE 15W50. The fuels were a prototype ultra-low sulfur diesel, and blends containing various oxygenate compounds. A water macroemulsion fuel was also evaluated.
DTIC
Diesel Engines; Emission; Exhaust Emission; Exhaust Gases; Fuels; Lubricants

20070033401 Fraunhofer Inst. for Ceramic Technology and Sintered Materials, Dresden, Germany
Physics and Technology of Transparent Ceramic Armor: Sintered Al2O3 vs Cubic Materials
Krell, Andreas; Hutzler, Thomas; Klimke, Jens; Aug 1, 2006; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469603; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Aluminum Oxides; Armor; Ceramic Matrix Composites; Ceramics; Grain Size; Sintering; Transmissivity; Transparence

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20070033101 Army War Coll., Carlisle Barracks, PA USA
Algae: America's Pathway to Independence
Custer, James; Mar 30, 2007; 22 pp.; In English
Report No.(s): AD-A469390; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469390

The USA is dependent on foreign oil to meet 63% of its petroleum demand. As China, India, Japan, and Brazil - all major importers - compete with the U.S. for this finite resource, global demand is growing rapidly. The U.S. consumes 25% of the world's oil, but owns only 4% of the world's known oil reserve. Projections indicate U.S. dependency on foreign oil will continue to increase. Vital interests affected by petroleum dependency include uncertainty of supply, influence of tyrants, rising trade deficits, projected shortage of oil reserves, and concerns of global warming. Oil dependency is an unacceptable risk to U.S. national strategy. This paper advocates independence from foreign oil by converting the national transportation fleet to biodiesel derived from algae; a domestically producible, clean burning, regenerative fuel. Biodiesel can be transported and delivered using existing infrastructure, including America's pipelines, tankers, and the 178,000 gas stations. Among the sources for biodiesel, algae may be the least favored option. Yet, they offer innate advantages as the major source of bioenergy.
DTIC
Algae; Energy Policy; Fuels; Oils; United States

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*.

20070033393 Aerospace Testing Alliance, Arnold AFB, TN USA
Lessons Learned to Improve HCF Demonstration Tests
Arnold, Steve; Oct 1, 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Engine Parts; Gas Turbines

20070034089 Southwest Research Inst., San Antonio, TX USA

Investigation of Non-Petroleum Based Fuels

Yost, Douglas M; Schulman, Matthew E; Sep 2005; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE-07-99-C-L053

Report No.(s): AD-A469543; TFLRF-381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A complex fully flexible engine test stand for light-duty diesel engine fuels research has been configured using Variable Valve Actuation by Sturman Industries. Due to the complexity of integrating the control systems, and the need to develop engine maps for all the control parameters, attaining a reliable and controllable test apparatus was the primary result of the effort. Exploration of the available control authority showed the promise in altering engine emissions by varying sources of EGR and controlling fuel injection events. The Variable Valve Actuation engine test stand allows such vast flexibility that fuel/engine optimizations can be performed together. Future efforts should look at the effects of the variable ignition qualities of selected test fuels.

DTIC

Crude Oil; Fuels; Test Stands; Valves

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*.

20070032710 NASA Langley Research Center, Hampton, VA, USA

Lidar and Mission Parameter Trade Study of Space-Based Coherent Wind Measurement Centered on NASA's 2006 GWOS Wind Mission Study Parameters

Kavaya, Michael J.; Frehlich, Rod G.; July 08, 2007; 4 pp.; In English; 14th Coherent Laser Radar Conference, 8-13 Jul. 2007, Snowmass, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 478643.02.02.02.09; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032710

The global measurement of vertical profiles of horizontal vector winds has been highly desired for many years by NASA, NOAA and the Integrated Program Office (IPO) implementing the National Polar-orbiting Operational Environmental Satellite Systems (NPOESS). Recently the global wind mission was one of 15 missions recommended to NASA by the first ever NRC Earth Sciences Decadal Survey. Since before 1978, the most promising method to make this space-based measurement has been pulsed Doppler lidar. The favored technology and technique has evolved over the years from obtaining line-of-sight (LOS) wind profiles from a single laser shot using pulsed CO2 gas laser technology to the current plans to use both a coherent-detection and direct-detection pulsed Doppler wind lidar systems with each lidar employing multiple shot accumulation to produce an LOS wind profile. The idea of using two lidars (hybrid concept) entails coherent detection using the NASA LaRC-developed pulsed 2-micron solid state laser technology, and direct detection using pulsed Nd:YAG laser technology tripled in frequency to 355 nm wavelength.

Derived from text

Optical Radar; Wind Measurement; Wind Profiles; Remote Sensing; Space Based Radar

20070032825 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Optical Links and RF Distribution for Antenna Arrays

Huang, Shouhua; Calhoun, Malcolm; Tjoelker, Robert; Proceedings of the 2006 IEEE International Frequency Control Symposium; June 5, 2006, pp. 637-641; In English; IEEE International Frequency Control Symposium, 5-7 Jun. 2006, Miami, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40275; http://dx.doi.org/10.1109/FREQ.2006.275462

An array of three antennas has recently been developed at the NASA Jet Propulsion Laboratory capable of detecting signals at X and Ka band. The array requires a common frequency reference and high precision phase alignment to correlate received signals. Frequency and timing references are presently provided from a remotely located hydrogen maser and clock through a combination of commercially and custom developed optical links. The selected laser, photodetector, and fiber components have been tested under anticipated thermal and simulated antenna rotation conditions. The resulting stability limitations due to thermal perturbations or induced stress on the optical fiber have been characterized. Distribution of the X

band local oscillator includes a loop back and precision phase monitor to enable correlation of signals received from each antenna.
Author
Antenna Arrays; Radio Frequencies; Optical Fibers; Photometers; Microwave Oscillators; Detection; Thermal Stresses

20070032836 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Coherent Optical Focal Plane Array Receiver for PPM Signals: Investigation and Applications
Fernandez, Michela Munoz; August 15, 2006; 62 pp.; In English; Optics and Photonics Infrared and Photoelectronic Imagers and Detector Devices II, 13-17 Aug. 2006, San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40288

The performance of a coherent optical focal plane array receiver for PPM signals under atmospheric turbulence is investigated and applications of this system are addressed. The experimental demonstration of this project has already been explained in previous publications [1]. This article shows a more exhaustive analysis of the expressions needed to obtain the Bit Error Rate (BER) for the real system under study in the laboratory. Selected experimental results of this system are described and compared with theoretical BER expressions, and array combining gains are presented. Receiver sensitivity in terms of photons per bit (PPB) is examined; BER results are shown as a function of signal to noise ratios, (SNR), as well as a function of photons per symbol, and photons per bit.
Author
Focal Plane Devices; Signal to Noise Ratios; Receivers; Bit Error Rate; Atmospheric Turbulence

20070032863 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Deep Space Network and Lunar Network Communication Coverage of the Moon
Lee, Charles H.; Cheung, Kar-Ming; October 2, 2006; 10 pp.; In English; 57th International Astronautical Congress, 2-6 Oct, 2006, Valencia, Spain; Original contains color illustrations
Report No.(s): IAC-06- B3.4.01; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40266

In this article, we describe the communication coverage analysis for the lunar network and the Earth ground stations. The first part of this article focuses on the direct communication coverage of the Moon from the Earth's ground stations. In particular, we assess the coverage performance of the Moon based on the existing Deep Space Network (DSN) antennas and the complimentary coverage of other potential stations at Hartebeesthoek, South Africa and at Santiago, Chile. We also address the coverage sensitivity based on different DSN antenna scenarios and their capability to provide single and redundant coverage of the Moon. The second part of this article focuses on the framework of the constrained optimization scheme to seek a stable constellation six relay satellites in two planes that not only can provide continuous communication coverage to any users on the Moon surface, but can also deliver data throughput in a highly efficient manner.
Author
Lunar Communication; Deep Space Network; Ground Stations; Constellations

20070032925 NASA Glenn Research Center, Cleveland, OH, USA
RF Performance of Membrane Aperture Shells
Flint, Eirc M.; Lindler, Jason E.; Thomas, David L.; Romanofsky, Robert; September 2007; 19 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): FA9453-06-M-0155; WBS 439432.07.02.03.01
Report No.(s): NASA/TM-2007-214969; AIAA Paper-2007-1831; E-16122; Copyright; Avail.: CASI: A03, Hardcopy

This paper provides an overview of recent results establishing the suitability of Membrane Aperture Shell Technology (MAST) for Radio Frequency (RF) applications. These single surface shells are capable of maintaining their figure with no preload or pressurization and minimal boundary support, yet can be compactly roll stowed and passively self deploy. As such, they are a promising technology for enabling a future generation of RF apertures. In this paper, we review recent experimental and numerical results quantifying suitable RF performance. It is shown that candidate materials possess metallic coatings with sufficiently low surface roughness and that these materials can be efficiently fabricated into RF relevant doubly curved shapes. A numerical justification for using a reflectivity metric, as opposed to the more standard RF designer metric of skin depth, is presented and the resulting ability to use relatively thin coating thickness is experimentally validated with material sample

tests. The validity of these independent film sample measurements are then confirmed through experimental results measuring RF performance for reasonable sized doubly curved apertures. Currently available best results are 22 dBi gain at 3 GHz (S-Band) for a 0.5m aperture tested in prime focus mode, 28dBi gain for the same antenna in the C-Band (4 to 6 GHz), and 36.8dBi for a smaller 0.25m antenna tested at 32 GHz in the Ka-Band. RF range test results for a segmented aperture (one possible scaling approach) are shown as well. Measured antenna system actual efficiencies (relative to the unachievable) ideal for these on axis tests are generally quite good, typically ranging from 50 to 90%.
Author
Apertures; Fabrication; Membrane Structures; Radio Frequencies; General Overviews; Shells (Structural Forms); Antenna Design

20070033052 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Investigating Hastily-Formed Collaborative Networks
Campbell, Joshua S; Durkin, Matthew F; Cooley, Stanley L; Maddocks, Brian K; Mar 2007; 125 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469278; AFIT/GSE/ENY/07-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469278

This research explores both the human and technical aspects of the network centric environment in the context of a major disaster or incident of national significance. The National Incident Management System (NIMS) is viewed by the authors as a social network, and an organizational topology is developed to improve its effectiveness. A rapid Network Deployment Kit (RNDK) using commercial off the shelf (COTS) wireless networking technology is also proposed that facilitates immediate NIMS implementation. The integration of logical and technical analyses forms a comprehensive systems engineering proposal to facilitate collaboration in a net-centric environment. It is envisioned that the methodology used herein to derive and evaluate comprehensive networks proves extendable to other contexts thereby contributing to the netcentric body of knowledge.
DTIC
Emergencies; Management Methods; Management Planning; Networks

20070033065 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Overcoming TCP Degradation in the Presence of Multiple Intermittent Link Failures Utilizing Intermediate Buffering
Harmon, Duane F; Mar 2007; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469308; AFIT/GE/ENG/07-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469308

It is well documented that assumptions made in the popular Transmission Control Protocol's (TCP) development, while essential in the highly reliable wired environment, are incompatible with today's wireless network realities in what we refer to as a challenged environment. Challenged environments severely degrade the capability of TCP to establish and maintain a communication connection with reasonable throughput. This thesis proposes and implements an intermediate buffering scheme, implemented at the transport layer, which serves as a TCP helper protocol for use in network routing equipment to overcome short and bursty, but regular, link failures. Moreover, the implementation requires no modifications to existing TCP implementations at communicating nodes and integrates well with existing routing equipment. In a simulated six-hop network with five modified routers supporting four challenged links, each with only 60% availability, TCP connections are reliably established and maintained, despite the poor link availability, whereas 94% fail using standard routing equipment, i.e., without the TCP helper protocol.
DTIC
Communication Networks; Degradation; Failure; Protocol (Computers)

20070033332 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Use of Trust Vectors in Support of the CyberCraft Initiative
Stevens, Michael; Mar 2007; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469502; AFIT/GIA/ENG/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The CyberCraft Initiative is designing a framework for command and control of future Air Force Cyber-weapon systems, that autonomously operate and defend the Air Force networks and information systems to provide Cyberspace Superiority in support of the defense of the USA. The fundamental research question of the CyberCraft Initiative is 'What is required for a commander to trust a CyberCraft to autonomously defend military information systems?' The Trust Vector model is one

method of integrating trust into the CyberCraft fleet. Trust Vectors define trust and distrust between agents based on three components; current and historical data, intrinsic knowledge of the remote agent's abilities, and recommendations from other agents. This research finds that the Trust Vector model can be modified to integrate trust into the CyberCraft Initiative. Several expansions to the model are proposed, including applying the Trust Vector model to an asynchronous paradigm for data transactions. This research also determines the limits of the utility of historical data for the Trust Vector model.
DTIC
Command and Control; Weapon Systems

20070033334 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Adaptive Gravitational Gossip in Monitoring the Joint Battlespace Infosphere
Aban, E D; Mar 2007; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469504; AFIT/GCS/ENG/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future USAF operations will be heavily dependent on having the 'right information' at the 'right time,' and Joint Battlespace Infospheres (JBIs) are poised to fill that role. To do this, JBIs must be ubiquitous -- always accessible, secure and responsive. Of all the literature written regarding JBIs, the most important problem to solve in order to make JBIs work in mobile scenarios are scalability, reliability and adaptability to changing battlefield conditions. This paper explores the use of SBCast, a novel adaptive probabilistic protocol and a delivery mechanism for JBI updates and as a possible solution towards guaranteeing these qualities. It documents tests of SBCast within a simulation environment configured with parameters based on actual military field operations. From these tests, the paper examines SBCast as an enhancer to JBI's ability for overcoming transient network failures while managing different classes of subscribers by available bandwidth and priorities. By using the feedback from SBCast as a middleware layer controller, JBIs would be able to 'dial up' traffic for parts of the network and 'dial down' traffic in others based on dynamic changes in network congestion or traffic demands.
DTIC
Communication Networks; Computerized Simulation; Protocol (Computers)

20070033379 Naval Postgraduate School, Monterey, CA USA
Riverine Sustainment 2012
Galli, Michael F; Turner, James M; Olson, Kristopher A; Mortensen, Michael G; Wharton, Neil D; Williams, Everett C; Schmitz, Thomas F; Mangaran, Matthew C; Nachmani, Gil; Kiat, Cheng H; Jun 2007; 543 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469560; NPS-97-07-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical report analyzed the Navy's proposed Riverine Force (RF) structure and capabilities for 2012. The Riverine Sustainment 2012 Team (RST) examined the cost and performance of systems of systems which increased RF sustainment in logistically barren environments. RF sustainment was decomposed into its functional areas of supply, repair, and force protection. The functional and physical architectures were developed in parallel and were used to construct an operational architecture for the RF. The RST used mathematical, agent-based and queuing models to analyze various supply, repair and force protection system alternatives. Extraction of modeling data revealed several key insights. Waterborne heavy lift connectors such as the LCU-2000 are vital in the re-supply of the RF when it is operating up river in a non-permissive environment. Airborne heavy lift connectors such as the MV-22 were ineffective and dominated by the waterborne variants in the same environment. Increase in manpower and facilities did appreciably add to the operational availability of the RF. Mean supply response time was the biggest factor affecting operational availability and should be kept below 24 hours to maintain operational availability rates above 80%. Current mortar defenses proposed by the RF are insufficient.
DTIC
Military Operations; Radio Frequencies; Telecommunication; Warfare

20070033395 Army War Coll., Carlisle Barracks, PA USA
Logistics Command and Control within the Combatant Command
LeMasters, Jr , Clark W; Mar 13, 2007; 19 pp.; In English
Report No.(s): AD-A469590; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the project is to determine the correct changes to the organization for logistics command and control within a geographic combatant command and make recommendations for possible organizational realignments. This paper examines the current organization of joint logistics command, control, and execution for a geographic combatant command. The examination includes: (1) Review the logistics issues that make an evaluation of logistics command and control relevant,

(2) Review the geographic combatant commanders authority and responsibilities in the area of logistics, (3) Examine the functions of the current organizations responsible for logistics command and control, including the combatant command J-4, the Deployment and Distribution Operations Center (DDOC), and Service Component logistics staffs, (4) Examine ongoing efforts within the joint logistics community to provide solutions to the logistics command and control requirements. Recommendations are provided to implement changes to the logistics command and control organizations within the combatant command.
DTIC
Command and Control; Logistics; Military Operations

20070034080 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Sub-Surface Navigation Using Very-Low Frequency Electromagnetic Waves
Harner, Alan L; Mar 2007; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469489; AFIT/GE/ENG/07-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research proposes two schemes utilizing very-low frequency (VLF) electromagnetic waves to navigate underground. The ?rst scheme consists of using above-ground beacon transmitters to broadcast VLF signals to an underground mobile receiver which uses methods such as triangulation and trilateration to obtain a position solution. The second scheme consists of using above-ground reference receivers along with an underground mobile receiver to form time-difference- of-arrival measurements of incoming VLF signals of opportunity, such as lightning strike emissions, to calculate a position solution. The objective of this thesis is to develop positioning algorithms and use simulations as a tool to characterize the e?ects that varying parameters such as measurement errors, measurement type, number of measurements, transmitter/ reference receiver location, mobile receiver position, and material constant errors have on the accuracy of a position solution. The results show trends that would still be expected using more complex methods and models.
DTIC
Electromagnetic Radiation; Surface Navigation; Very Low Frequencies

20070034114 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Identifying Knowledge, Skill, and Ability Requirements for 33Sx Officers in Deployed Environments
Simmers, Douglas M; Mar 2007; 122 pp.; In English; Original contains color illustrations
Report No.(s): AD-A467408; AFIT/GIR/ENV/07-M16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Military operations in the past, present, and future are highly dependent on the timely distribution of accurate information; the only thing really changing is the speed and means of which it is dispersed. As we proceed forward in the information age, technology and the men and women responsible for it will play an ever increasing role in getting the right information in the right place at the right time. As the USA Air Force continues to transform into an ever increasing expeditionary service the knowledge, skills, and abilities of Air Force officers must transform as well to meet the evolving needs of combatant commanders. 33Sx officers perform garrison duties in many different capacities; current duty position or past experience thus does not guarantee we have acquired the knowledge, skills and abilities necessary to succeed when and where it matters most. Hence, the purpose of this research is to identify core skill sets in the form of knowledge, skills, and abilities, which are most important to Communication and Information (AFSC 33Sx) Officers to successfully carry out assigned duties in forward operating locations.
DTIC
Communication Networks; Deployment; Education; Identifying; Personnel; Personnel Development; Requirements

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*.

20070032716 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Maximum-Likelihood Algorithm for Reduction of Langmuir Probe Data
Martin, Adam K.; Koelfgen, Syri J.; [2007]; 16 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: Other Sources

The reduction of Langmuir triple and quadruple probe data - the determination of the electron temperature, T(sub e), from

the actual measurements of voltages and currents - requires the solution of an implicit transcendental equation in T(sub c), at every point in time. Random errors or noise in the measurements occasionally precludes solution of the equation, resulting in an indeterminate temperature at those times. We present a method for overcoming this problem that uses the method of maximum likelihood. The experimental uncertainties, assumed to be normally distributed, are used in solving the implicit equation in T(sub e). At every point in time, a likelihood function is calculated, and the temperature which maximizes this function is taken to be the solution, T(sub e). The uncertainty in the resulting measurement is related to the width of the likelihood function. Examples of this technique are shown.
Author
Algorithms; Maximum Likelihood Estimates; Data Reduction; Electrostatic Probes

20070032776 Missouri Univ., Rolla, MO, USA
On the Mutual Coupling between Circular Resonant Slots
Abou-Khousa, M. A.; Kharkovshy, S.; Zoughi, R.; June 27, 2007; 7 pp.; In English; 3rd International Conference on Electromagnetic Near-Field Characterization and Imaging (ICONIC 2007), 27-29 Jun. 2007, Saint Louis, MO, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM06AA06G; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032776

For near- and far-field microwave imaging purposes, array of circular resonant slots can be utilized to sample the electric field at a given reference plane. In general, the sensitivity of such an array is impaired by the existing mutual coupling between the radiating elements or in this case circular slots. The mutual coupling problem imposes a design tradeoff between the resolution of the array and the overall system sensitivity and dynamic range. In this paper, the mutual coupling between circular resonant slots in conducting ground plane is investigated both numerically and experimentally. In particular, the mutual coupling in the E- and H-plane configurations of two identical slots is studied.
Author
Slots; Coupling; Resonant Frequencies; Simulation; Numerical Analysis; Antenna Arrays

20070032833 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Overview of the LISA Phasemeter
Shaddock, Daniel A.; Ware, B.; Halverson, P.; Spero, R. E.; Klipstein, B.; Aug. 28, 2006; 7 pp.; In English; 6th International LISA Symposium, 19-23 Jun. 2006, Greenbelt, MD, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40283

The LISA phasemeter is required to measure the phase of an electrical signal with an error less than 3 (micro)cycles/pHz over times scales from 1 to 1000 seconds. This phase sensitivity must be achieved in the presence of laser phase fluctuations 108 times larger than the target sensitivity. Other challenging aspects of the measurement are that the heterodyne frequency varies from 2 to 20 MHz and the signal contains multiple frequency tones that must be measured. The phasemeter architecture uses high-speed analog to digital conversion followed by a digital phase locked loop. An overview of the phasemeter architecture is presented along with results for the breadboard LISA Phasemeter demonstrating that critical requirements are met.
Author
Analog to Digital Converters; Phase Locked Systems; Errors; Heterodyning; Frequencies; Breadboard Models

20070032834 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Delta-Doped High Purity Silicon UV-NIR CCDs with High QE and Low Dark Current
Hoenk, Michael; Blacksberg, Jordana; Nikzad, Shouleh; Elliott, S. Tom; Holland, Steve; Bebek, Chris; Scowen, Paul; Veach, Todd; August 13, 2006; 19 pp.; In English; Optics and Photonics Infrared and Photoelectronic Imagers and Detector Devices II, 13-17 Aug., San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40290

Delta doping process was developed on p-channel CCDs for MIDEX-Orion and JDEM/SNAP and was applied to large format (2k x4k) CCDs. Delta doping is applied to fully-fabricated CCDs (complete with Al metallization). High QE and low dark current is demonstrated with delta doped p-channel CCDs. In-house AR coating is demonstrated. Advantages include: Delta doping enables high QE and stability across the entire spectral range attainable with silicon. Delta doping is a low

temperature process and is compatible with fully-fabricated detector arrays. Same base device for Orion two channels. High radiation tolerance and no thinning requirements of high purity p-channel. CCDs are additional advantages.
Derived from text
Doped Crystals; Charge Coupled Devices; Dark Current; Radiation Tolerance; Metallizing; Fabrication; Low Currents; Coating

20070032858 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Frequency Dependence of Single-Event Upset in Highly Advanced PowerPC Microprocessors
Irom, Farokh; Farmanesh, Farhad; White, Mark; Kouba, Coy K.; September 1, 2006; 5 pp.; In English; IEEE Transaction on Nuclear Science, RADECS 2006 Workshop, 1 Sep. 2006, Athens, Greece; Original contains color and black and white illustrations
Report No.(s): PA-5 135; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40260

Single-event upset effects from heavy ions were measured for Motorola silicon-on-insulator (SOI) microprocessor with 90 nm feature sizes at three frequencies of 500, 1066 and 1600 MHz. Frequency dependence of single-event upsets is discussed. The results of our studies suggest the single-event upset in registers and D-Cache tend to increase with frequency. This might have important implications for the overall single-event upset trend as technology moves toward higher frequencies.
Author
SOI (Semiconductors); Single Event Upsets; Microprocessors; Heavy Ions

20070032865 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Fabrication and Characterization of Superconducting NbN Nanowire Single Photon Detectors
Stern, Jeffrey A.; Farr, William H.; August 28, 2006; 4 pp.; In English; Applied Superconductivity Conference, 28 Aug. - 1 Sep. 2006, Seattle, WA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40253

We report on the fabrication and characterization of high-speed, single photon detectors using superconducting NbN nanowires at a wavelength of 1064 nm. A 15 by 15 micron detector with a detector efficiency of 40% has been measured. Due to kinetic inductance, the recovery time of such large area detectors is longer than that of smaller or single wire detectors. The recovery time of our detectors (50 ns) has been characterized by measuring the inter-arrival time statistics of our detector.
Author
Superconductivity; Niobium Compounds; Fabrication; Photons; Inductance; Nanowires

20070032867 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A New OEO Design Using Optical Phase Modulation and Modulation Suppression
Dick, G. John; Yu, Nan; June 5, 2006; 6 pp.; In English; IEEE International Frequency Control Symposium, 5-7 Jun. 2006, Miami, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40274

We present the design for a phase-modulated Opto-Electronic Oscillator (OEO) that incorporates asymmetric Mach-Zehnder (AMZ) interferometers as phase demodulators together with PM modulation suppression. The new design promises to obtain in the electro-optical domain the low-noise advantages previously achieved in RF and microwave oscillators by the use of carrier suppression but which have been achieved only to a limited extent in OEO's.
Author
Phase Modulation; Electro-Optics; Oscillators; Interferometers; Microwave Oscillators; Phase Demodulators

20070032879 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Europa Missions: Generic Materials Test Methodology
Willis, Paul B.; February 14, 2006; 21 pp.; In English; Space Technology and Applications International Forum, STAIF-2006, 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40179

This viewgraph presentation discusses: radiation fundamentals, radiation damage, how radiation dosage is determined, fluence testing approaches, ionization damage exposure, displacement damage exposure, Europa energy 'bins', rationale for group flux (energy bins), electron/proton group fluences, electron beam exposure testing, proton sources, reactor exposures,

gamma exposures, preliminary exposure findings, testing caveats, preliminary conclusions, internal discharge, and electron dose depth curves.
CASI
Radiation Damage; Radiation Dosage; Radiation Effects; Ionizing Radiation; Spacecraft Electronic Equipment

20070032990 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA Electronic Parts and Packaging (NEPP) Program: Insertion of New Electronics Technologies
LaBel, Kenneth A.; Sampson, Michael J.; May 2007; 10 pp.; In English; Space Parts Working Group (SPWG) Meeting, 1-2 May 2007, Torrance, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032990

This viewgraph presentation gives an overview of NASA Electronic Parts and Packaging (NEPP) Program's new electronics technology trends. The topics include: 1) The Changing World of Radiation Testing of Memories; 2) Even Application-Specific Tests are Costly!; 3) Hypothetical New Technology Part Qualification Cost; 4) Where we are; 5) Approaching FPGAs as a More Than a 'Part' for Reliability; 6) FPGAs Beget Novel Radiation Test Setups; 7) Understanding the Complex Radiation Data; 8) Tracking Packaging Complexity and Reliability for FPGAs; 9) Devices Supporting the FPGA Need to be Considered; 10) Summary of the New Electronic Technologies and Insertion into Flight Programs Workshop; and 11) Highlights of Panel Notes and Comments
CASI
Electronic Packaging; NASA Programs; Technology Utilization; Components

20070032991 ABSL Space Products, Abington, UK
Reliability Through Life of Internal Protection Devices in Small-Cell ABSL Batteries
Neubauer, Jeremy; Ng, Ka Lok; Bennetti, Andrea; Pearson, Chris; Rao, gopal; April 26, 2007; 21 pp.; In English; 2007 Space Power Workshop, 23-26 Apr. 2007, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews a reliability analysis of small cell protection batteries. The contents include: 1) The s-p Topology; 2) Cell Level Protection Devices; 3) Battery Level Fault Protection; 4) Large Cell Comparison; and 5) Battery Level Testing and Results.
CASI
Electric Batteries; Reliability Engineering; Life (Durability); Electronics

20070033029 Air Force Research Lab., Wright-Patterson AFB, OH USA
How Nano are Nanocomposites (Preprint)
Schafer, Dale W; Justice, Ryan S; Feb 2007; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A469245; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469245

Composite materials loaded with nanometer-sized reinforcing fillers are widely believed to have the potential to push polymer mechanical properties to extreme values. Realization of anticipated properties, however, has proven elusive. The analysis presented here traces this shortfall to the large-scale morphology of the filler as determined by small-angle x-ray scattering, light scattering and electron imaging. We examine elastomeric, thermoplastic and thermoset composites loaded with a variety of nanoscale reinforcing fillers such as precipitated silica, carbon nanotubes (single and multi-walled), and layered silicates. The conclusion is that large-scale disorder is ubiquitous in nanocomposites regardless of the level of dispersion, leading to substantial reduction of mechanical properties (modulus) compared to predictions based on idealized filler morphology.
DTIC
Nanocomposites; Nanostructures (Devices)

20070033032 Air Force Research Lab., Wright-Patterson AFB, OH USA

Polymer Nanocomposites with Prescribed Morphology: Going Beyond Nanoparticle-Filled Polymers (Preprint)

Vaia, Richard A; Maguire, John F; Oct 2006; 19 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A469248; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469248

Polymer nanocomposites (PNCs), i.e., nanoparticles (spheres, rods, and plates) dispersed in a polymer matrix, have garnered substantial academic and industrial interest since their inception, ca. 1990. With respect to the neat matrix, nanoparticle dispersion has been shown to enhance physical (e.g., barrier, erosion resistance, and reduced flammability), thermomechanical (e.g., heat distortion temperature, thermal expansion coefficient, and stiffness), and processing (e.g., surface finish and melt strength) characteristics. Beyond maximization of the nanoparticle dispersion, however, the morphology of these materials is many times uncontrolled, yielding isotropic nanofilled systems, not necessarily spatially 'engineered, designed and tailored' materials. To impact high-technology applications requiring unique electrical, thermal, and optical properties, manufacturing techniques enabling control of the nanoparticle arrangement and distribution must be developed. This paper will examine the status of approaches for directing the hierarchical morphology of nanoparticle dispersions in three dimensions, and beyond uniaxial alignment, using examples from the literature to highlight the potential and issues. Ultimately, two general approaches to this challenge are emerging, namely, external-in (directed patterning of nanoparticle dispersions) and internal-out (mesophase assembly of nanoparticles).

DTIC

Nanocomposites; Nanoparticles; Percolation; Polymers

20070033067 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Nonlinear Time-Variant Response in an Avalanche Photodiode Array Based Laser Detection and Ranging System

Seal, Michael D; Mar 2007; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469310; AFIT/GEO/ENG/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469310

This research effort identifies and models the nonlinear time-variant behavior exhibited by an avalanche photodiode (APD) array based Laser Ranging and Detection (LADAR) system. Based on the original Linear Time-Invariant (LTI) model, the evolution of error in the LADAR signal is examined sequentially from the outgoing pulse through signal digitization. This error evolution shows that the LTI model does not contain a mechanism for causing the observed signal deviations or the failure to meet the Cramer-Rao lower bound for range accuracy. A nonlinear time-variant model is developed based on the interactions of the avalanche photodiodes in the array with the array's voltage regulator. In the refined model, the sum photo-current for the entire array loads the voltage regulator. The resulting reverse bias voltage variations cause the responsivity of each APD to vary in a nonlinear fashion. Because each APD in the array's responsivity depends upon the entire array's photonic loading, each individual APD's response is time variant.

DTIC

Avalanche Diodes; Avalanches; Detection; Laser Beams; Lasers; Nonlinear Systems; Nonlinearity; Optical Radar; Photodiodes; Photons; Rangefinding

20070033112 Air Force Research Lab., Kirkland AFB, NM USA

Experimental and Computational Investigations of a High-Power, Long-Pulse Relativistic Klystron Oscillator (Postprint)

Hendricks, Kyle; Watrous, Jack; Lunginsland, John; Oct 30, 2006; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DF406254; Proj-2301

Report No.(s): AD-A469414; AFRL-DE-PS-TP-2007-1011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469414

A high-power, long-pulse source of high-power microwaves has been investigated experimentally and through a variety of modeling and simulation efforts at the Air Force Research Laboratory. The relativistic klystron oscillator (RKO) is an injection-locked oscillator capable of producing 200ns duration pulses exceeding 1 GW output power at 1270-1275 MHz. Extensive experiments have been closely coupled with computational modeling and simulation to explore a wide range of issues encountered in the operation and diagnostics of the device. The experiment uses coupled 3/4-lambda cavities to modulate the electron beam. Calculations using both HFSS and ICEPIC have been used to reproduce cold test frequency characteristics of the isolated and of the coupled cavities, including the finite conductivity of the RKO walls. Calculations

using reduced physics models and ICEPIC have been used to explore the coupling between the beam and the cavities. A highlight of the modeling efforts is a series of calculations, which for the first time predict cavity saturation voltages at sub-virtual-cathode levels. Previous calculations were either restricted to 1/4-lambda cavities, or showed saturation voltages at the virtual cathode levels. Comparisons between experiment and computation will be presented.
DTIC
Electron Beams; Klystrons; Microwaves; Oscillators; Simulation

20070033114 Defense Advanced Research Projects Agency, Arlington, VA USA
Ultra-Low-Energy Sub-Threshold Circuits: Program Overview
Chandrakasan, Anantha; Apr 10, 2007; 149 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469416; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469416

In this DARPA program, we have developed a robust design methodology to scale power supply voltages to levels as low as 250mV, reducing the energy dissipation of digital computation by an order of magnitude. We have demonstrated both logic (standard cells) and memory. We have explored the use of parallelism to maintain performance at reduced power supply voltages. This concept was demonstrated with a UWB baseband processor. We have developed a DC-DC converter to efficiently deliver sub-threshold voltage and minimize the power dissipation of an arbitrary digital circuit. We have demonstrated 9 test chips in state-of-the-art 65nm, 90nm and 0.18 micrometers CMOS technologies. All test chips were fabricated for free (primarily by TI).
DTIC
Circuits; Electric Potential; Supplying

20070033331 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Thermally Activated, Variable Blazed Grating for Coherent Beam Steering
Johnson, Matthew T; Mar 2007; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469501; AFIT/GEO/ENG/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to perform non-mechanical optical beam steering is of critical importance in laser communication and remote sensing; it is as vital as a phased-array antenna is for RADAR. Directed energy transmission and direction-selective reception increase performance and produce tactical advantage in DoD applications. However, specific geometric features of non-mechanical beam steering devices must be designed in proportion to the wavelength of the monochromatic light to be steered. Also, the ability to handle higher energies by reducing the energy per unit requires large areas of uniform properties on the micrometer scale. These challenges have been addressed in the past using liquid crystals (LC) to produce a peak steering angle of 4 degrees, albeit limited by problems due to the fringing field effect. Recent advances in micro-fabrication techniques, including the synthesis and manipulation of certain electro- and thermo-optic materials, hold new opportunities for efficient beam steering solutions. The objective of this thesis research is to demonstrate thermally controllable beam steering, and enable further investigation of efficiency and response time and their dependence on geometry. The design, fabrication and performance of such a thermally-activated, nonmechanical beam steering device is demonstrated for the first time herein. The elastomeric media, polydimethlyoxane (PDMS), was used as the active, phase-controlling agent. Its temperature-dependent index of refraction was employed in a reflection-mode device by depositing it on a stair-step-approximated, blazed grating. The periodic nature of the device contains the reflected beam within discrete, angular orders. The proofof- concept device is modeled, tested and analyzed to explain its observed performance. Angular control of up to 1.2 degrees has been experimentally demonstrated. This approach promises simplicity of design and fabrication without thelarger,
DTIC
Antennas; Beam Steering; Geometry; Phased Arrays

20070033337 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Material Characterization Improvement in High Temperature Rectangular Waveguide Measurements
Buschelman, Eric A; Mar 2007; 98 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DACA99-99-C-9999
Report No.(s): AD-A469507; AFIT/GE/ENG/07-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research presents a method by which electromagnetic characterization of materials in a partially filled waveguide can be accurately performed. Higher order modes are excited by the geometry, which are not accounted for in most algorithms. A correction must consider the power transmitted by higher-order modes. Modal solutions, using reference plane

independence, for a single top air gap between the material sample and the waveguide wall, are also presented. Characterization is performed on samples of acrylic and rubberized magnetic radar absorbing material. Calculation of the complex permittivity and permeability of shielding material, within 10% of the true value, was achieved by using less than 15 modes. Improvement of real permittivity is the strongest feature of the algorithm. The inclusion of the reference plane independence analysis greatly improves the level of performance. Results are presented in S-band and X-band.
DTIC
Characterization; High Temperature; Measurement; Rectangular Waveguides; Temperature Measurement; Waveguides

20070033343 Academy of Sciences of the Ukraine, Kharkov, Ukraine
Photo-Electron Multiplier on the Basis of Multilayered Semiconductor Structure
Lukin, Konstantin; Oct 1, 2005; 48 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469517; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Photoelectrons; Photomultiplier Tubes; Semiconductors (Materials)

20070034129 Naval Research Lab., Washington, DC USA
The Implementation and Demonstration of Flame Detection and Wireless Communications in a Consumer Appliance to Improve Fire Detection Capabilities
Street, Thomas T; Williams, Frederick W; Jun 8, 2007; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469350; NRL/MR/6180--07-9048; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469350
This report details the development, implementation and demonstration of a toaster oven equipped with flame detection and wireless communication capabilities. The toaster oven has the capability to detect flaming fires and to wirelessly communicate an alarm to local smoke detectors reducing fire detection times and allow greater egress time.
DTIC
Consumers; Detection; Fires; Flames; Wireless Communication

34
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*.

20070032708 NASA Marshall Space Flight Center, Huntsville, AL, USA
Numerical Simulations of Single Flow Element in a Nuclear Thermal Thrust Chamber
Cheng, Gary; Ito, Yasushi; Ross, Doug; Chen, Yen-Sen; Wang, Ten-See; June 25, 2007; 45 pp.; In English; 39th AIAA Thermophysics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy
The objective of this effort is to develop an efficient and accurate computational methodology to predict both detailed and global thermo-fluid environments of a single now element in a hypothetical solid-core nuclear thermal thrust chamber assembly, Several numerical and multi-physics thermo-fluid models, such as chemical reactions, turbulence, conjugate heat transfer, porosity, and power generation, were incorporated into an unstructured-grid, pressure-based computational fluid dynamics solver. The numerical simulations of a single now element provide a detailed thermo-fluid environment for thermal stress estimation and insight for possible occurrence of mid-section corrosion. In addition, detailed conjugate heat transfer simulations were employed to develop the porosity models for efficient pressure drop and thermal load calculations.
Author
Computational Fluid Dynamics; Thrust Chambers; Mathematical Models; Nuclear Propulsion; Numerical Analysis; Computerized Simulation

20070032711 NASA Marshall Space Flight Center, Huntsville, AL, USA

Multiphysics Computational Analysis of a Solid-Core Nuclear Thermal Engine Thrust Chamber

Wang, Ten-See; Canabal, Francisco; Cheng, Gary; Chen, Yen-Sen; June 25, 2007; 41 pp.; In English; 39th AIAA Thermophysics Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The objective of this effort is to develop an efficient and accurate computational heat transfer methodology to predict thermal, fluid, and hydrogen environments for a hypothetical solid-core, nuclear thermal engine - the Small Engine. In addition, the effects of power profile and hydrogen conversion on heat transfer efficiency and thrust performance were also investigated. The computational methodology is based on an unstructured-grid, pressure-based, all speeds, chemically reacting, computational fluid dynamics platform, while formulations of conjugate heat transfer were implemented to describe the heat transfer from solid to hydrogen inside the solid-core reactor. The computational domain covers the entire thrust chamber so that the afore-mentioned heat transfer effects impact the thrust performance directly. The result shows that the computed core-exit gas temperature, specific impulse, and core pressure drop agree well with those of design data for the Small Engine. Finite-rate chemistry is very important in predicting the proper energy balance as naturally occurring hydrogen decomposition is endothermic. Locally strong hydrogen conversion associated with centralized power profile gives poor heat transfer efficiency and lower thrust performance. On the other hand, uniform hydrogen conversion associated with a more uniform radial power profile achieves higher heat transfer efficiency, and higher thrust performance.
Author

Computational Fluid Dynamics; Engine Design; Heat Transfer; Thrust Chambers; Nuclear Propulsion; Mathematical Models

20070032742 NASA Langley Research Center, Hampton, VA, USA

Opposed Jet Burner Extinction Limits: Simple Mixed Hydrocarbon Scramjet Fuels vs Air

Pellett, Gerald L.; Vaden, Sarah N.; Wilson, Lloyd G.; July 08, 2007; 33 pp.; In English; 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 732759.07.06

Report No.(s): AIAA Paper 2007-5664; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032742

Opposed Jet Burner tools have been used extensively by the authors to measure Flame Strength (FS) of laminar non-premixed H2 air and simple hydrocarbon (HC) air counterflow diffusion flames at 1-atm. FS represents a strain-induced extinction limit based on air jet velocity. This paper follows AIAA-2006-5223, and provides new HC air FSs for global testing of chemical kinetics, and for characterizing idealized flameholding potentials during early scramjet-like combustion. Previous FS data included six HCs, pure and N2-diluted; and three HC-diluted H2 fuels, where FS decayed very nonlinearly as HC was added to H2, due to H-atom scavenging. This study presents FSs on mixtures of (candidate surrogate) HCs, some with very high FS ethylene. Included are four binary gaseous systems at 300 K, and a hot ternary system at approx. 600 K. The binaries are methane + ethylene, ethane + ethylene, methane + ethane, and methane + propylene. The first three also form two ternary systems. The hot ternary includes both 10.8 and 21.3 mole % vaporized n-heptane and full ranges of methane + ethylene. Normalized FS data provide accurate means of (1) validating, globally, chemical kinetics for extinction of non-premixed flames, and (2) estimating (scaling by HC) the loss of incipient flameholding in scramjet combustors. The n-heptane is part of a proposed baseline simulant (10 mole % with 30% methane + 60% ethylene) that mimics the ignition of endothermically cracked JP-7 like kerosene fuel, as suggested by Colket and Spadaccini in 2001 in their shock tube Scramjet Fuels Autoignition Study. Presently, we use FS to gauge idealized flameholding, and define HC surrogates. First, FS was characterized for hot nheptane + methane + ethylene; then a hot 36 mole % methane + 64% ethylene surrogate was defined that mimics FS of the baseline simulant system. A similar hot ethane + ethylene surrogate can also be defined, but it has lower vapor pressure at 300 K, and thus exhibits reduced gaseous capacity. The new FS results refine our earlier idealized reactivity scale that shows wide ranging (50 x) diameter-normalized FSs for various HCs. These range from JP-10 and methane to H2 air, which produces an exceptionally strong flame that agrees within approx. 1% of recent 2-D numerically simulations. Finally, we continue advocating the FS approach as more direct and fundamental, for assessing idealized scramjet flameholding potentials, than measurements of unstrained laminar burning velocity or blowout in a Perfectly Stirred Reactor.
Author

Burners; Hydrocarbons; Jet Engine Fuels; Supersonic Combustion Ramjet Engines; Air; Gas Mixtures; Gas Flow

20070032743 NASA Langley Research Center, Hampton, VA, USA

Virtual Diagnostics Interface: Real Time Comparison of Experimental Data and CFD Predictions for a NASA Ares I-Like Vehicle

Schwartz, Richard J.; Fleming, Gary A.; June 10, 2007; 12 pp.; In English; 22nd International Congress on Instrumentation in Aerospace Simulation Facilities (ICIASF), 10-14 Jun. 2007, Pacific Grove, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Virtual Diagnostics Interface technology, or ViDI, is a suite of techniques utilizing image processing, data handling and three-dimensional computer graphics. These techniques aid in the design, implementation, and analysis of complex aerospace experiments. LiveView3D is a software application component of ViDI used to display experimental wind tunnel data in real-time within an interactive, three-dimensional virtual environment. The LiveView3D software application was under development at NASA Langley Research Center (LaRC) for nearly three years. LiveView3D recently was upgraded to perform real-time (as well as post-test) comparisons of experimental data with pre-computed Computational Fluid Dynamics (CFD) predictions. This capability was utilized to compare experimental measurements with CFD predictions of the surface pressure distribution of the NASA Ares I Crew Launch Vehicle (CLV) - like vehicle when tested in the NASA LaRC Unitary Plan Wind Tunnel (UPWT) in December 2006 - January 2007 timeframe. The wind tunnel tests were conducted to develop a database of experimentally-measured aerodynamic performance of the CLV-like configuration for validation of CFD predictive codes.

Author

Ares 1 Launch Vehicle; Computational Fluid Dynamics; Real Time Operation; Wind Tunnel Tests; Data Acquisition; Computer Graphics

20070032754 NASA Dryden Flight Research Center, Edwards, CA, USA

Lunar Return Reentry Thermal Analysis of a Generic Crew Exploration Vehicle Wall Structures

Ko, William L.; Tran, Van T.; Bowles, Jeff; October 2007; 56 pp.; In English

Report No.(s): NASA/TM-2007-214627; H-2768; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032754

Thermostructural analysis was performed on generic crew exploration vehicle (GCEV) heat shielded wall structures subjected to reentry heating rates based on five potential lunar return reentry trajectories. The GCEV windward outer wall is fabricated with a graphite/epoxy composite honeycomb sandwich panel and the inner wall with an aluminum honeycomb sandwich panel. The outer wall is protected with an ablative Avcoat-5026-39H/CG thermal protection system (TPS). A virtual ablation method (a graphical approximation) developed earlier was further extended, and was used to estimate the ablation periods, ablation heat loads, and the TPS recession layer depths. It was found that up to 83 95 percent of the total reentry heat load was dissipated in the TPS ablation process, leaving a small amount (3-15 percent) of the remaining total reentry heat load to heat the virgin TPS and maintain the TPS surface at the ablation temperature, 1,200 F. The GCEV stagnation point TPS recession layer depths were estimated to be in the range of 0.280-0.910 in, and the allowable minimum stagnation point TPS thicknesses that could maintain the substructural composite sandwich wall at the limit temperature of 300 F were found to be in the range of 0.767-1.538 in. Based on results from the present analyses, the lunar return abort ballistic reentry was found to be quite attractive because it required less TPS weight than the lunar return direct, the lunar return skipping, or the low Earth orbit guided reentry, and only 11.6 percent more TPS weight than the low Earth orbit ballistic reentry that will encounter a considerable weight penalty to obtain the Earth orbit. The analysis also showed that the TPS weight required for the lunar return skipping reentry was much more than the TPS weight necessary for any of the other reentry trajectories considered.

Author

Fabrication; Thermal Analysis; Reentry Trajectories; Heat Shielding; Lunar Surface; Reentry Effects; Walls; Honeycomb Structures; Crew Exploration Vehicle

20070032922 NASA Glenn Research Center, Cleveland, OH, USA

Transient Numerical Modeling of Catalytic Channels

Struk, Peter M.; Dietrich, Daniel L.; Miller, Fletcher J.; T'ien, James S.; January 2007; 12 pp.; In English; 2007 ASME International Mechanical Engineering Congress and Exposition, 11-15 Nov. 2007, Seattle, WA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC04AA29A; WBS 698671.01.03.037

Report No.(s): IMECE2007-41680; Copyright; Avail.: Other Sources

This paper presents a transient model of catalytic combustion suitable for isolated channels and monolith reactors. The model is a lumped two-phase (gas and solid) model where the gas phase is quasi-steady relative to the transient solid. Axial

diffusion is neglected in the gas phase; lateral diffusion, however, is accounted for using transfer coefficients. The solid phase includes axial heat conduction and external heat loss due to convection and radiation. The combustion process utilizes detailed gas and surface reaction models. The gas-phase model becomes a system of stiff ordinary differential equations while the solid phase reduces, after discretization, into a system of stiff ordinary differential-algebraic equations. The time evolution of the system came from alternating integrations of the quasi-steady gas and transient solid. This work outlines the numerical model and presents some sensitivity studies on important parameters including internal transfer coefficients, catalytic surface site density, and external heat-loss (if applicable). The model is compared to two experiments using CO fuel: (1) steady-state conversion through an isothermal platinum (Pt) tube and (2) transient propagation of a catalytic reaction inside a small Pt tube. The model requires internal mass-transfer resistance to match the experiments at lower residence times. Under mass-transport limited conditions, the model reasonably predicted exit conversion using global mass-transfer coefficients. Near light-off, the model results did not match the experiment precisely even after adjustment of mass-transfer coefficients. Agreement improved for the first case after adjusting the surface kinetics such that the net rate of CO adsorption increased compared to O2. The CO / O2 surface mechanism came from a sub-set of reactions in a popular CH4 / O2 mechanism. For the second case, predictions improved for lean conditions with increased external heat loss or adjustment of the kinetics as in the first case. Finally, the results show that different initial surface-species distribution leads to different steady-states under certain conditions. These results demonstrate the utility of a lumped two-phase model of a transient catalytic combustor with detailed chemistry.

Author

Mathematical Models; Combustion Chambers; Catalytic Activity; Integrated Circuits; Reactors; Open Channel Flow

20070032927 NASA Glenn Research Center, Cleveland, OH, USA

Comparison Between Simulated and Experimentally Measured Performance of a Four Port Wave Rotor

Paxson, Daniel E.; Wilson, Jack; Welch, Gerard E.; October 2007; 23 pp.; In English; 43rd AIAA Joint Propulsion Conference, 8-12 Jul. 2007, Cincinnati, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.17.02

Report No.(s): NASA/TM-2007-214985; ARL-TR-4202; AIAA Paper-2007-5049; E-16166; Copyright; Avail.: CASI: A03, Hardcopy

Performance and operability testing has been completed on a laboratory-scale, four-port wave rotor, of the type suitable for use as a topping cycle on a gas turbine engine. Many design aspects, and performance estimates for the wave rotor were determined using a time-accurate, one-dimensional, computational fluid dynamics-based simulation code developed specifically for wave rotors. The code follows a single rotor passage as it moves past the various ports, which in this reference frame become boundary conditions. This paper compares wave rotor performance predicted with the code to that measured during laboratory testing. Both on and off-design operating conditions were examined. Overall, the match between code and rig was found to be quite good. At operating points where there were disparities, the assumption of larger than expected internal leakage rates successfully realigned code predictions and laboratory measurements. Possible mechanisms for such leakage rates are discussed.

Author

Computational Fluid Dynamics; Computerized Simulation; Gas Turbine Engines; Wave Rotors; Rotor Blades (Turbomachinery); Ports (Openings); Mechanical Engineering

20070033080 Illinois Univ., Urbana, IL USA

A New Concept for Flutter Suppression Based on Nonlinear Energy Pumping

Bergman, Lawrence A; Vakakis, Alexander F; McFarland, D M; Apr 22, 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0073

Report No.(s): AD-A469348; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469348

The principal goal of this project was the attenuation and elimination, through the use of nonlinear energy sinks (NESs), of limit cycle oscillations (LCOs) that occur in aeroelastic systems. The NES is a fully passive device that is able to drastically modify the global dynamics of a system, despite being a local modification. It was demonstrated, through analysis and simulation, that the implementation of the NES on a Van der Pol oscillator, which is well known to exhibit limit cycle behavior, leads to suppression of the LCO over a wide range of the NES parameter space. Examination of the well-known aeroelastic scenario of a cubically nonlinear rigid wing in a quasi-steady flow field showed, for the first time, that LCO formation is a consequence of a series of resonance captures and escapes, and that the heave mode response is the unique trigger for the pitch

mode LCO. Implementation of the NES on an aeroelastic system revealed that suppression occurs over a broad range of NES parameters in one of three distinct flavors: complete elimination; burst and elimination; and attenuation. All predictions for this configuration were confirmed in a series of wind tunnel tests in the nonlinear aeroelastic test apparatus (NATA) at Texas A&M University. Analysis and simulation indicate an NES with the same total mass distributed among multiple degrees of freedom can be even more effective.
DTIC
Aeroelasticity; Attenuation; Flow Distribution; Flutter; Nonlinearity; Oscillations; Vibration Damping

20070033366 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, France
Calibration of Aeroelastic Prediction Methods: Comparison with Experimental Results on a Single Stage Compressor Blisk
Lombard, Jean-Pierre; Sharma, Virendra; Dupeux, Jerome; Dumas, Michel; Dupont, Christian; Seinturier, Eric; Oct 2005; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469546; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Aeroelasticity; Calibrating; Compressors; High Pressure

20070033367 Rolls-Royce Ltd., Derby, UK
Damping Estimation from Engine Data with Varying Natural Frequencies
Kurt-Elli, Hilmi; Oct 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469547; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Carrier Frequencies; Damping; Engines; Estimates; Resonant Frequencies

20070033378 Free Univ., Brussels, Belgium
Inlet Influence on the Pressure and Temperature Distortion Entering the Compressor of an Air Vehicle
Hendrick, P; Oct 1, 2005; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469559; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Compressors; Distortion; Flow Distortion; Inlet Pressure; Pressure

20070033394 Rolls-Royce Ltd., Derby, UK
Aeromechanical Design of Damped High Pressure Turbine Blades Subject to Low Engine Order Forcing
Elliot, Robert; Sayma, AI; Imregun, M; Oct 1, 2005; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469579; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
High Pressure; Turbine Blades

20070034019 NASA Langley Research Center, Hampton, VA, USA
Wind Tunnel Investigation of the Effects of Surface Porosity and Vertical Tail Placement on Slender Wing Vortex Flow Aerodynamics at Supersonic Speeds
Erickson, Gary E.; October 2007; 157 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 136905.02.04.04.01.04
Report No.(s): NASA/TM-2007-215082; L-19401; No Copyright; Avail.: CASI: A08, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034019
A wind tunnel experiment was conducted in the NASA Langley Research Center (LaRC) Unitary Plan Wind Tunnel (UPWT) to determine the effects of passive surface porosity and vertical tail placement on vortex flow development and interactions about a general research fighter configuration at supersonic speeds. Optical flow measurement and flow visualization techniques were used that featured pressure sensitive paint (PSP), laser vapor screen (LVS), and schlieren, These techniques were combined with conventional electronically-scanned pressure (ESP) and six-component force and moment measurements to quantify and to visualize the effects of flow-through porosity applied to a wing leading edge extension (LEX) and the placement of centerline and twin vertical tails on the vortex-dominated flow field of a 65 cropped delta wing model. Test results were obtained at free-stream Mach numbers of 1.6, 1.8, and 2.1 and a Reynolds number per foot of 2.0 million.

LEX porosity promoted a wing vortex-dominated flow field as a result of a diffusion and weakening of the LEX vortex. The redistribution of the vortex-induced suction pressures contributed to large nose-down pitching moment increments but did not significantly affect the vortex-induced lift. The trends associated with LEX porosity were unaffected by vertical tail placement. The centerline tail configuration generally provided more stable rolling moments and yawing moments compared to the twin wing-mounted vertical tails. The strength of a complex system of shock waves between the twin tails was reduced by LEX porosity.
Author
Aerodynamics; Porosity; Slender Wings; Supersonic Speed; Tail Assemblies; Wind Tunnel Tests; Vortices; Aircraft Models

20070034088 Army Engineer Research and Development Center, Vicksburg, MS USA
Boston Harbor Navigation Channel Improvement Project, Field Data Collection Program Final Report
Tubman, Michael W; Jun 2007; 150 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469604; ERDC/CHL-TR-07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A field data collection program in Boston Harbor, MA, was conducted for the U.S. Army Engineer District, New England, during the late fall and winter of 2004/2005. The purpose of the program was to obtain data needed to validate a numerical hydrodynamic model (ADvanced CIRCulation (ADCIRC) model) of Boston Harbor and adjacent areas. The currents calculated by the verified model were input to a ship simulator used to assess the design of the Boston Harbor navigation improvement project. A total of four water-level recorders and two acoustic profiling current meters were deployed on 10 November 2004. The water-level recorders were located adjacent to a bridge between Chelsea and East Boston in Boston s inner harbor, at the seaward end of Boston North Channel, at Gallops Island, and at the Hull Yacht Club in Allerton Harbor. The current meters were located at the seaward end of Boston North Channel and near the location where Boston's main navigation channel enters the inner harbor. Data from these instruments were supplemented by tide data from a National Oceanic and Atmospheric Administration (NOAA) tide gage in the inner harbor, and NOAA wind measurements at Logan Airport. In addition, daylight current transect surveys using a downward looking acoustic profiling current meter attached to a survey vessel were conducted on 11 November 2004 and 8 February 2005. Five transect survey lines across the main navigation channel were surveyed. All instrumentation was recovered on 7 and 8 February 2005. Maximum-measured ebb tidal currents in the harbor were 0.9 to 3.84 ft/sec. Maximum-measured flood currents were 0.77 to 3.61 ft/sec. In general, the ebb currents were stronger than the flood currents. The data from the current meter deployed at the seaward end of Boston North Channel were analyzed to evaluate the importance of the winddriven and tide-induced residual currents.
DTIC
Data Acquisition; Floods; Harbors; Hydrodynamics; Navigation; Tides

20070034131 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Aerodynamic Performance of the 24 Inch Houck Configuration
Walker, Michael M; Mar 2007; 152 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469313; AFIT/GAE/ENY/07-M30; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469313

Fuel efficiency of aircraft is of great importance to the military and private sector. A more efficient wing design for UAVs would lead to improvements in mission support while reducing fuel costs for the Air Force. An experimental investigation of one candidate design, the Houck Aircraft Configuration, has been conducted in the AFIT low speed wind tunnel. This aircraft shares similarities to other joined-wing aircraft, but includes curved flow-guides of varying spanwise camber connecting the upper and lower wingtips. Experimental results that the addition of flow guides on the 24' Houck Configuration results in a 2.5% reduction in L/D(sub max) at Re =80K and a 0.3% reduction in L/Dmax at Re= 125K. This trend shows a decrease in the performance gap as the Reynolds number increases from 80K to 125K. It is recommended that additional testing at higher Reynolds numbers be performed to determine if an increase in performance can be shown. The designed flow guides proved to be successful in combining the upper and lower wing-tip vortices into a single vortex. The flow guides alter what would be two smaller compact vortices and instead produce a slightly larger, spread out vortex which follows the curve of the flow guide. Ultimately, evidence of improvements in aerodynamic efficiency will need to be shown before other claims of the design are demonstrated to be fully successful.
DTIC
Aerodynamic Characteristics; Aerodynamic Configurations; Reynolds Number; Vortices; Wind Tunnels

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*.

20070033053 Defence Science and Technology Organisation, Edinburgh, Australia
High Grazing Angle and High Resolution Sea Clutter: Correlation and Polarisation Analyses
Dong, Yunhan; Mar 2007; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469280; DSTO-TR-1972; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469280

Spatial and temporal correlations of high grazing angle high resolution sea clutter collected by the DSTO Ingara polarimetric X-band system are studied. It seems that wavelengths of wind waves and swells are retrievable from the range correlation whereas the periods of the waves and swells are recoverable from the azimuthal correlation. The polarimetric behavior of sea clutter is also studied, and it is found that the Bragg scattering is the dominant scattering mechanism of the sea clutter. Quantitative analysis indicates that the best polarization in terms of detecting small targets on the sea surface include double bounce, cross-slant-45- degree, RR and HH polarizations.
DTIC
Angles (Geometry); Clutter; Grazing; High Resolution; Seas

20070033111 Georgia Inst. of Tech., Atlanta, GA USA
Pattern-Theoretic Foundations of Automatic Target Recognition in Clutter
Lanterman, Aaron; Nov 30, 2006; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0340
Report No.(s): AD-A469413; 1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469413

This effort advanced the art of applying Grenander's pattern theory to automatic target recognition (ATR) problems. We extended jump-diffusion ATR algorithms to accommodate unknown infrared camera calibration effects and include more numerically stable diffusion procedures for pose refinement, and developed flexible shape models to accommodate clutter. We also developed performance bounds on estimation and recognition performance for low-frequency radar data, single-image laser radar data, and 3-D 'point cloud' data assembled from multiple sources. Further work explored data fusion using the 'probability hypothesis density' approach.
DTIC
Clutter; Target Recognition

20070033335 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization of a Polymer-Based MEMS Pyroelectric Infrared Detector
Allard, Mark E; Mar 2007; 174 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469505; AFIT/GEO/ENG/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AFRL/MLPJE had developed a novel thermal sensing material termed protein-impregnated-polymer (PIP). Thus far, a proof-of-concept has been demonstrated using a macro-sized pixel (0.64 mm2) as a bolometric detector. In an effort to better characterize this novel thermal sensing material, experimental data was used to determine figures of merit (FOMs) comparative to off-the-shelf thermal detectors. Microelectromechanical (MEMS) pixels were designed and used as the support structure for an inkjet-deposited droplet of the PIP. During the material characterization, two observations were made: PIP is a pyroelectric material, and the polymer (polyvinyl alcohol (PVA)) without the protein was found to be more suited for measurements taken on the micro-scaled pixels. Both PVA and PVA doped with carbon black (PVA-CB) were the materials focused on in this research, with the latter being the material used for FOM characterization. Pyroelectric coefficients for PVA and PVA-CB were found to be 755.11 nC/(cm2 K), and 108.32 nC/(cm2 K), respectively, which are both two orders of magnitude higher than values for current pyroelectric polymers. A responsivity of 1.66 x 10[to the 4th power] V/W, thermal time constant of 3.59 sec, noise equivalent power of 21.3 nW, and a detectivity of 1.93 x 10[to the 5th power] cm Hz(1/2)/W were the FOMs found in this thesis. Although the calculated FOMs are not stellar in comparison to current thermal detector

technology, this material shows much promise. The shortfalls in FOMs could potentially be attributed to a poor pixel design. This thesis plants the scientific seed in cultivating a thermal imaging focal plane array (FPA) using a newly found pyroelectric polymer.
DTIC
Detection; Infrared Detectors; Microelectromechanical Systems; Polymers; Pyroelectricity

20070033342 Air Force Research Lab., Kirkland AFB, NM USA
Advanced Sensor Components for Space-Based Surveillance and Situational Awareness
Apostolova, T; Cardimona, D A; Huang, D H; Le, D T; Alsing, P M; Glass, W; Castillo, C D; Oct 1, 2005; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469516; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Detectors; Situational Awareness; Surveillance

20070033346 Defence Research and Development Canada, Valcartier, Quebec Canada
A Temperature and Emissivity Separation Technique for Thermal Hyperspectral Imagers
Lahaie, Pierre; Oct 1, 2005; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469520; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Emissivity; Imagery

20070033349 Swedish Defence Research Establishment, Linkoeping, Sweden
3-D Imaging of Partly Concealed Targets by Laser Radar
Letalick, Dietmar; Chevalier, Tomas; Larsson, Hakan; Oct 1, 2005; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469523; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Images; Imaging Techniques; Occultation; Optical Radar; Targets

20070033377 Army Communications-Electronics Command, Fort Belvoir, VA USA
U. S. Army NVESD MWIR Polarization Research for Ground Targets
Howe, James D; Buser, Rudolph G; Oct 1, 2005; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469558; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Infrared Detectors; Infrared Radiation; Targets

20070033382 Air Force Research Lab., Hanscom AFB, MA USA
On the Design of SAR Apertures using the Cramer-Rao Bound
Linnehan, Robert; Brady, David; Schindler, John K; Perlovsky, Leonid; Rangaswamy, Muralidhar; Jan 2007; 14 pp.; In English
Contract(s)/Grant(s): Proj-2311
Report No.(s): AD-A469563; AFRL-SN-HS-TP-2007-0002; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In this paper, the Cramer-Rao inequality is applied to the likelihood function of the synthetic aperture radar (SAR) scatterer parameter vector to relate the choice of flight path to estimation performance. Estimation error bounds for the scatterer parameter vector (including height) are developed for multi-dimensional synthetic apertures. These bounds quantify the performance enhancement over a limited sector of the image plane relative to standard-aperture single-pass SAR missions. An efficient means for the design and analysis of SAR waveforms and flight paths is proposed using simulated scattering

models that are limited in size. Comparison of the error bounds to those for standard-aperture SAR show that estimates of scatterer range and cross-range positions are accurate for multi-dimensional aperture SAR, even with the additional estimator for height. Furthermore, multi-dimensional SAR is shown to address the layover problem.
DTIC
Ambiguity; Apertures; Augmentation; Clutter; Cramer-Rao Bounds; Decoupling; Height; Scattering; Synthetic Aperture Radar

20070034016 NASA Langley Research Center, Hampton, VA, USA
Results of On-Orbit Testing of an Extra-Vehicular Infrared Camera Inspection System
Howell, Patricia A.; Cramer, K. Elliott; September 22, 2007; 13 pp.; In English; IV Pan American Conference for Non Destructive Testing, 22-27 Oct. 2007, Buenos Aires, Argentina; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 377816.03.03.05; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034016

This paper will discuss an infrared camera inspection system that has been developed to allow astronauts to demonstrate the ability to inspect reinforced carbon-carbon (RCC) components on the space shuttle as part of extra-vehicular activities (EVA) while in orbit. Presented will be the performance of the EVA camera system coupled with solar heating for inspection of damaged RCC specimens and NDE standards. The data presented was acquired during space shuttle flights STS-121 and STS-115 as well during a staged EVA from the ISS. The EVA camera system was able to detect flatbottom holes as small as 2.54cm in diameter with 25% material loss. Results obtained are shown to be comparable to ground-based thermal inspections performed in the laboratory using the same camera and simulated solar heating. Data on both the time history of the specimen temperature and the ability of the inspection system to image defects due to impact will likewise be presented.
Author
Cameras; Extravehicular Activity; Onboard Equipment; Carbon-Carbon Composites; Space Shuttles; Infrared Inspection; Flight Tests

20070034047 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
DSN Network e-VLBI Calibration of Earth Orientation
Zhang, Liwei Dennis; Steppe, A.; Lanyi, G.; Jacobs, C.; September 1, 2006; 10 pp.; In English; 5th International e-VLBI Workshop, 1 Sep. 2006, Westford, MA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40292

This viewgraph presentation reviews the calibration of the Earth's orientation by using the Deep Space Network (DSN) e Very Large Base Integration (VLBI). The topics include: 1) Background: TEMPO; 2) Background: UT1 Knowledge Error; 3) e-VLBI: WVSR TEMPO Overview; 4) e-VLBI: WVSR TEMPO Turnaround; 5) e-VLBI: WVSR TEMPO R&D Tests; and 6) WVSR TEMPO Test Conclusion.
CASI
Calibrating; Deep Space Network; Earth Orientation; Very Long Base Interferometry

20070034059 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Processing of Mars Exploration Rover Imagery for Science and Operations Planning
Alexander, Douglass A.; Deen, Robert G.; Andres, Paul M.; Zamani, Payam; Mortensen, Helen B.; Chen, Amy C.; Cayanan, Michael K.; Hall, Jeffrey R.; Klochko, Vadim S.; Pariser, Oleg; Stanley, Carol L.; Thompson, Charles K.; Yagi, Gary M.; Journal of Geophysical Research; February 4, 2006; ISSN 0148-0227; Volume 111; 21 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40376; http://dx.doi.org/10.1029/2005je002462

The twin Mars Exploration Rovers (MER) delivered an unprecedented array of image sensors to the Mars surface. These cameras were essential for operations, science, and public engagement. The Multimission Image Processing Laboratory (MIPL) at the Jet Propulsion Laboratory was responsible for the first-order processing of all of the images returned by these cameras. This processing included reconstruction of the original images, systematic and ad hoc generation of a wide variety of products derived from those images, and delivery of the data to a variety of customers, within tight time constraints. A combination of automated and manual processes was developed to meet these requirements, with significant inheritance from prior missions. This paper describes the image products generated by MIPL for MER and the processes used to produce and deliver them.
Author
Roving Vehicles; Mars Exploration; Image Processing; Mars Surface; Cameras

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*.

20070033038 Air Force Research Lab., Kirkland AFB, NM USA
Temperature Effects on the Emission Properties of Yb-Doped Fiber (Postprint)
Newell, T C; Peterson, P; Gavrielides, A; Sharma, M P; Nov 29, 2006; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DF297206; Proj-2301
Report No.(s): AD-A469255; AFRL-DE-PS-JA-2007-1005; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469255

Ytterbium-doped fiber lasers are making impressive leaps in power production. Yet in spite of fibers large surface area to volume ratio which is beneficial for cooling, such power inevitably leads to high core temperatures that in turn affect the laser performance. In this letter, the temperature effects on the emission and fluorescence lifetime of ytterbium doped optical fibers are investigated. From these the temperature dependent emission and absorption cross sections are calculated. A corresponding theoretical treatment presents the necessary conditions to eliminate radiation trapping.
DTIC
Absorption Cross Sections; Doped Crystals; Emission; Fiber Lasers; Lasers; Temperature Effects; Ytterbium

20070033102 Trex Enterprises Coup., Lihue, HI USA
CVC SiC Mirrors for High Energy Laser Applications (Preprint)
Foss, Jr, Colby A; Jul 29, 2005; 8 pp.; In English
Contract(s)/Grant(s): FA9451-04-M-0085; Proj-3005
Report No.(s): AD-A469391; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469391

A series of lightweighted CVC SiC mirror structures were evaluated for characteristic frequency. The lightest structure considered (area density = 4.7 kg/m2) had a first harmonic mode >3500 Hz. Under a thermal load of 100W m-2, the surface distortion was less than 1/10.
DTIC
High Power Lasers; Laser Applications; Mirrors; Silicon Carbides

20070033321 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Modular Mixed Signal VLSI Design Approach for Digital Radar Applications
Brakus, Brian M; Mar 2007; 79 pp.; In English
Contract(s)/Grant(s): DACA99-99-C-9999
Report No.(s): AD-A469484; AFIT/GCE/ENG/07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study explores the idea of building a library of VHDL con gurable components for use in digital radar applications. Con gurable components allows a designer to choose which components he or she needs and con gures those components for a speci c application. By doing this, design time for ASICs and FPGAs is shortened because the components are already designed and tested. This idea is demonstrated with a con gurable dynamic pipelinable fast fourier transform. Many FFT implementations exist, but this implementation is both con gurable and dynamic. Pre-synthesis customization allows the FFT to be tailored to almost any DSP application, and the dynamic property allows the FFT to calculate di erent length FFTs run-time. Three objectives will be accomplished: design and characterization of the aforementioned FFT; analysis of the error involved in the FFT calculation using di erent twiddle factor bit widths; and nally an analysis of all the con gurations for the synthesized design using a 90nm technology library. Speeds of up to 225 MHz have been simulated for a length-1024 FFT using the 90 nm technology.
DTIC
Digital Radar Systems; Digital Systems; Fast Fourier Transformations; Radar; Radar Beams; Signal Generators; Very Large Scale Integration

20070033348 Naval Air Warfare Center, China Lake, CA USA

UAV Infrared Search and Track (IRST)/Eyesafe Laser Range Finder (ELR) System

Hintz, R T; Allen, J; Chen, M; Price, T; Goetz, G; Oct 1, 2005; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Drone Vehicles; Eye (Anatomy); Eye Protection; Infrared Radiation; Laser Damage; Laser Range Finders; Rangefinding; Safety

20070033351 LFK-Lenkflugkoerpersysteme G.m.b.H., Unterschleissheim, Germany

DIRCM FLASH Flight Tests

Molocher, Bernhard; Kaltenecker, Anton; Thum-Jaeger, Andrea; Regensburger, Martin; Formery, Martin; Oct 2005; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469525; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Damage; Flight Tests; Jamming; Lasers; Optical Countermeasures; Optical Tracking

20070033381 Notre Dame Univ., IN USA

Adaptive Optics for Turbulent Shear Layers

Jumper, Eric J; Dec 20, 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0019

Report No.(s): AD-A469562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes aero-optic research at the University of Notre Dame. When a laser beam propagates through a variable-index-of-refraction, turbulent fluid, its wavefront becomes aberrated, reducing associated optical-system performance. For flight Mach numbers as low as 0.3 Mach, turbulence in the flow past the aircraft become important in aberrating wavefronts (aero-optics). This report reviews the mechanisms responsible for these aberrations in free-shear-layer flows, the so-called Weakly-Compressible Model, which identifies the coherent structures in the flow as the major contributor to the flow's aberrating character. The report describes the use of flow control to regularize these coherent structures so as to reduce the bandwidth required by an adaptive-optic system to mitigate their effects. The report describes two historic demonstrations of the combined use of flow control and feed-forward adaptive optics to correct the aberrations imposed on an otherwise collimated laser beam projected through a heated jet and a Mach 0.8 free shear layer, respectively.

DTIC

Adaptive Optics; Laser Beams; Shear Layers; Turbulence

20070034133 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Portable Diode Pumped Femtosecond Lasers

Jones, David A; Mar 2007; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469292; AFIT/GAP/ENP/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469292

This thesis discusses the work to make ultrashort pulsed lasers smaller and more economical. While sharing many of the basic properties of normal beam optics there are some specific properties in both creating and exploiting those pulses that must be understood. The discussion will focus on mode locking as the primary way of producing ultrashort pulses. Particular attention will be paid to intracavity group velocity dispersion and how to correct it inside the cavity. The discussion then turns to the basis of our work including initial cavity design and component selection with focus on the specific crystals used in the solid state laser. The rest of the experiment setup is based on evolution of the designs in order to get the systems lasing and then mode locked. Results from the work on the small cavity systems are compared to data taken from a commercial titanium-sapphire laser with emphasis on current measurement techniques. Overall conclusions include the impact of both equipment and the crystals used in the solid state cavity to generate ultrashort pulses. While not fully successful, the groundwork has been laid for future research.

DTIC

Pulsed Lasers; Semiconductor 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*.

20070032733 Emergent Space Technologies, Inc., USA
Zero Gyro Kalman Filtering in the presence of a Reaction Wheel Failure
Hur-Diaz, Sun; Wirzburger, John; Smith, Dan; Myslinski, Mike; [2007]; 18 pp.; In English; 2007 AAS/AIAA Astrodynamics Specialist Conferene, 19-23 Aug. 2007, Mackinac Island, MI, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS5-50000
Report No.(s): AAS 07-338; Copyright; Avail.: CASI: A03, Hardcopy

Typical implementation of Kalman filters for spacecraft attitude estimation involves the use of gyros for three-axis rate measurements. When there are less than three axes of information available, the accuracy of the Kalman filter depends highly on the accuracy of the dynamics model. This is particularly significant during the transient period when a reaction wheel with a high momentum fails, is taken off-line, and spins down. This paper looks at how a reaction wheel failure can affect the zero-gyro Kalman filter performance for the Hubble Space Telescope and what steps are taken to minimize its impact.
Author
Failure; Kalman Filters; Reaction Wheels; Gyroscopes; Dynamic Models

20070032822 NASA Glenn Research Center, Cleveland, OH, USA
Characteristics of the Swirling Flow Generated by an Axial Swirler
Fu, Yongqiang; Jeng, San-Mou; Tacina, Robert; June 06, 2005; 10 pp.; In English; ASME TurboExpo 2005: Power for Land, Sea and Air, 6-9 Jun. 2005, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NNC04GA11G
Report No.(s): GT2005-68728; Copyright; Avail.: Other Sources

An experimental investigation was conducted to study the aerodynamic characteristics of the confined, non-reacting, swirling flow field. The flow was generated by a helicoidal axial-vaned swirler with a short internal convergent-divergent venturi, which was confined within 2-inch square test section. A series of helicoidal axial-vaned swirlers have been designed with tip vane angles of 40 deg., 45 deg., 50 deg., 55 deg., 60 deg. and 65 deg.. The swirler with the tip vane angle of 60 deg. was combined with several simulated fuel nozzle insertions of varying lengths. A two-component Laser Doppler Velocimetry (LDV) system was employed to measure the three-component mean velocities and Reynolds stresses. Detailed data are provided to enhance understanding swirling flow with different swirl degrees and geometries and to support the development of more accurate physicaVnumerica1 models. The data indicated that the degree of swirl had a clear impact on the mean and turbulent flow fields. The swirling flow fields changed significantly with the addition of a variety of simulated fuel nozzle insertion lengths
Author
Flow Distribution; Swirling; Combustion Efficiency; Propellant Combustion

38
QUALITY ASSURANCE AND RELIABILITY

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

20070032981 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Resolution Millimeter Wave Inspecting of the Orbiter Acreage Heat Tiles of the Space Shuttle
Case, J. T.; Khakovsky, S.; Zoughi, r.; Hepburn, F.; May 02, 2007; 36 pp.; In English; 2007 IEEE Instrumentation and Measurement Technology Conference (ITMC 2007), 2-3 May 2007, Warsaw, Poland; Original contains color illustrations
Contract(s)/Grant(s): NNM6AA06G; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032981

Presence of defects such as disbonds, delaminations, impact damage, in thermal protection systems can significantly reduce safety of the Space Shuttle and its crew. The physical cause of Space Shuttle Columbia's catastrophic failure was a breach in its thermal protection system, caused by a piece of external tank insulating foam separating from the external tank and striking the leading edge of the left wing of the orbiter. There is an urgent need for a rapid, robust and life-circle oriented

nondestructive testing (NDT) technique capable of inspecting the external tank insulating foam as well as the orbiter's protective (acreage) heat tiles and its fuselage prior and subsequent to a launch. Such a comprehensive inspection technique enables NASA to perform life-cycle inspection on critical components of the orbiter and its supporting hardware. Consequently, NASA Marshall Space Flight Center initiated an investigation into several potentially viable NDT techniques for this purpose. Microwave and millimeter wave NDT methods have shown great potential to achieve these goals. These methods have been successfully used to produce images of the interior of various complex, thick and thin external tank insulating foam structures for real focused reflectometer at operating frequency from 50-100 GHz and for synthetic aperture techniques at Ku-band (12-18 GHz) and K-band (18-26 GHz). Preliminary results of inspecting heat tile specimens show that increasing resolution of the measurement system is an important issue. This paper presents recent results of an investigation for the purpose of detecting anomalies such as debonds and corrosion in metal substrate in complex multi-sectioned protective heat tile specimens using a real focused 150 GHz (D-band) reflectometer and wide-band millimeter wave holography at 33-50, GHz (Q-band).

Author

Holography; Millimeter Waves; Nondestructive Tests; Reflectometers; Tiles; Fault Detection

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20070032868 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Structural Feasibility Analysis of a Robotically Assembled Very Large Aperture Optical Space Telescope

Wilkie, William Keats; Williams, R. Brett; Agnes, Gregory S.; Wilcox, Brian H.; April 23, 2007; 20 pp.; In English; 48th Structures, Structural Dynamics and Materials Conference, 23 Apr. 2007, Waikiki, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40258

This paper presents a feasibility study of robotically constructing a very large aperture optical space telescope on-orbit. Since the largest engineering challenges are likely to reside in the design and assembly of the 150-m diameter primary reflector, this preliminary study focuses on this component. The same technology developed for construction of the primary would then be readily used for the smaller optical structures (secondary, tertiary, etc.). A reasonable set of ground and on-orbit loading scenarios are compiled from the literature and used to define the structural performance requirements and size the primary reflector. A surface precision analysis shows that active adjustment of the primary structure is required in order to meet stringent optical surface requirements. Two potential actuation strategies are discussed along with potential actuation devices at the current state of the art. The finding of this research effort indicate that successful technology development combined with further analysis will likely enable such a telescope to be built in the future.

Author

Structural Analysis; Hubble Space Telescope; Reflectors; Feasibility Analysis; Apertures

20070032936 NASA Dryden Flight Research Center, Edwards, CA, USA

Displacement Theories for In-Flight Deformed Shape Predictions of Aerospace Structures

Ko, William L.; Richards, W. L.; Tran, Van t.; October 2007; 82 pp.; In English; Original contains color and black and white illustrations

Report No.(s): NASA/TP-2007-214612; H-2652; No Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032936

Displacement theories are developed for a variety of structures with the goal of providing real-time shape predictions for aerospace vehicles during flight. These theories are initially developed for a cantilever beam to predict the deformed shapes of the Helios flying wing. The main structural configuration of the Helios wing is a cantilever wing tubular spar subjected to bending, torsion, and combined bending and torsion loading. The displacement equations that are formulated are expressed in terms of strains measured at multiple sensing stations equally spaced on the surface of the wing spar. Displacement theories for other structures, such as tapered cantilever beams, two-point supported beams, wing boxes, and plates also are developed. The accuracy of the displacement theories is successfully validated by finite-element analysis and classical beam theory using input-strains generated by finite-element analysis. The displacement equations and associated strain-sensing system (such as

fiber optic sensors) create a powerful means for in-flight deformation monitoring of aerospace structures. This method serves multiple purposes for structural shape sensing, loads monitoring, and structural health monitoring. Ultimately, the calculated displacement data can be visually displayed to the ground-based pilot or used as input to the control system to actively control the shape of structures during flight.
Author
Displacement; Aircraft Structures; Finite Element Method; Structural Members; Shapes

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*.

20070032859 Washington Univ., WA, USA
The Mars Microbeam Raman Spectrometer (MMRS): From Concept to Category-1 Proposal
Jolliff, Bradley L.; April 20, 2006; 22 pp.; In English; Mars Exploration Program Analysis Group, 19 Apr. 2006, Monrovia, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40261

Laser Raman Spectroscopy is flexible and can be deployed in many ways. The Mars Microbeam Raman Spectrometer (MMRS) is tailored for rover-based mobility platform and for Mars fundamental science objectives. The MMRS was initiated by science requirements to determine mineralogy, mineral chemistry, and molecular phase identification, including organics. MMRS is ready for any near term mission to Mars and the Moon. Science is the driving force for development.
Derived from text
Raman Spectroscopy; Mars Missions; Laser Spectroscopy; Mineralogy; Microbeams; Minerals

20070032952 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sensor Web Interoperability Testbed Results Incorporating Earth Observation Satellites
Frye, Stuart; Mandl, Daniel J.; Alameh, Nadine; Bambacus, Myra; Cappelaere, Pat; Falke, Stefan; Derezinski, Linda; Zhao, Piesheng; [2007]; 5 pp.; In English; IPSN 2007: Data Sharing and Interoperability on the World Wide Web, 24 Apr. 2007, Cambridge, MA, USA; Copyright; Avail.: CASI: A01, Hardcopy

This paper describes an Earth Observation Sensor Web scenario based on the Open Geospatial Consortium s Sensor Web Enablement and Web Services interoperability standards. The scenario demonstrates the application of standards in describing, discovering, accessing and tasking satellites and groundbased sensor installations in a sequence of analysis activities that deliver information required by decision makers in response to national, regional or local emergencies.
Author
Earth Observations (From Space); Web Services; Interoperability; Artificial Satellites

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*.

20070032705 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Spatial Resolution Thermal Infrared Remote Sensing Data for Analysis of the Atlanta, Georgia, Urban Heat Island Effect and Its Impacts on the Environment
Quattrochi, Dale A.; June 24, 2007; 1 pp.; In English; 32nd International Symposium on Remote Sensing of Environment/ International Society for Remote Sensing of Environment, 24-29 Jun. 2007, San Jose, Costa Rica; No Copyright; Avail.: Other Sources; Abstract Only

The twenty-first century is the first ‘urban century’ according to the United Nations Development Program. The focus of cities reflects awareness of the growing percentage of the world’s population that lives in urban areas. In environmental terms, cities are the original producers of many of the global problems related to waste disposal, air and water pollution, and associated environmental and ecological challenges. Expansion of cities, both in population and areal extent, is a relentless

process. In 2000, approximately 3 billion people representing about 40% of the global population, resided in urban areas. Urban population will continue to rise substantially over the next several decades according to UN estimates, and most of this growth will Occur in developing countries. The UN estimates that by 2025, 60% of the world's population will live in urban areas. As a consequence, the number of'megacities' (those cities with populations of 10 million inhabitants or more) will increase by 100 by 2025. Thus, there is a critical need to understand urban areas and what their impacts are on environmental, ecological and hydrologic resources, as well as on the local, regional, and even global climate. One of the more egregious side effects of urbanization is the increase in surface and air temperatures that lead to deterioration in air quality. In the USA, under the more stringent air quality guidelines established by the U.S. Environmental Protection Agency in 1997, nearly 300 counties in 34 states will not meet these new air quality standards for ground level ozone. Mitigation of the urban heat island (UHI) effect is actively being evaluated as a possible way to reduce ground ozone levels in cities and assist states in improving air quality. Foremost in the analysis of how the UHI affects air quality and other environmental factors is the use of remote sensing technology and data to characterize urban land covers in sufficient detail to quantifiably measure the impact of increased urban heating on air quality. The urban landscape impacts surface thermal energy exchanges that determine development of the UHI. This paper will illustrate how we are using high spatial remote sensing data collected over the Atlanta, Georgia metropolitan area in conjunction with other geographic information, to perform a detailed urban land cover classification and to determine the contribution of these land covers to the urban heat island effect. Also, the spatial arrangement of the land covers and the impact on urban heating from these selected patterns of development are evaluated. Additionally, this paper will show how these data are being used as inputs to improve air quality modeling for Atlanta, including potential benefits from UHI mitigation.

Author

Cities; Heat Islands; High Resolution; Remote Sensing; Spatial Resolution; Environment Pollution; Thermal Energy; Infrared Detectors; Atlanta (GA)

20070032725 NASA Marshall Space Flight Center, Huntsville, AL, USA

SERVIR: From Space to Village. A Regional Monitoring and Visualization System For Environmental Management Using Satellite Applications For Sustainable Development

Sever, Tom; Stahl, H. Philip; Irwin, Dan; Lee, Daniel; [2007]; 6 pp.; In English; Optics and Laser Applications in Medicine and Environmental Monitoring for Sustainable Development International Commission of Optics (ICO), 19-24 Nov. 2007, Ghana; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032725

NASA is committed to providing technological support and expertise to regional and national organizations for earth science monitoring and analysis. This commitment is exemplified by NASA's long-term relationship with Central America. The focus of these efforts has primarily been to measure the impact of human development on the environment and to provide data for the management of human settlement and expansion in the region. Now, NASA is planning to extend and expand this capability to other regions of the world including Africa and the Caribbean. NASA began using satellite imagery over twenty-five years ago to locate important Maya archeological sites in Mesoamerica and to quantify the affect of deforestation on those sites. Continuing that mission, NASA has partnered with the U.S. Agency for International Development (USAID), the World Bank, the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) and the Central American Commission for Environment and Development (CCAD) to develop SERVIR (Sistema Regional de Visualizacion y Monitoreo), for the Mesoamerican Biological Corridor. SERVIR has become one of the most important aspects of NASA's geospatial efforts in Central America by establishing a common access portal for information that affects the lives, livelihood and future of everyone in the region. SERVIR, most commonly referred to as a regional visualization and monitoring system, is a scientific and technological platform that integrates satellite and other geospatial data sets to generate tools for improved decision-making capabilities. It has a collection of data and models that are easily accessible to earth science managers, first responders, NGO's (Non-Government Organizations) and a host of others. SERVIR is currently used to monitor and forecast ecological changes as well as provide information for decision support during severe events such as forest fires, red tides,and tropical storms. Additionally, SERVIR addresses the nine societal benefit areas of the Global Earth Observation System (GEOSS): disasters, ecosystems, biodiversity, weather, water, climate, health, agriculture and energy.

Author

Earth Observations (From Space); Ecosystems; Environment Management; Remote Sensing; Tropical Regions

20070032732 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Exploring NASA and ESA Atmospheric Data Using GIOVANNI, the Online Visualization and Analysis Tool

Leptoukh, Gregory; April 23, 2007; 6 pp.; In English; ENVISAT Symposium, 23-27 Apr. 2007, Montreux, Switzerland; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Giovanni, the NASA Goddard online visualization and analysis tool (http://giovanni.gsfc.nasa.gov) allows users explore various atmospheric phenomena without learning remote sensing data formats and downloading voluminous data. Using NASA MODIS (Terra and Aqua) and ESA MERIS (ENVISAT) aerosol data as an example, we demonstrate Giovanni usage for online multi-sensor remote sensing data comparison and analysis.

Author

European Space Agency; Remote Sensing; On-Line Systems; Earth Sciences; Multisensor Applications; Earth Atmosphere; Scientific Visualization

20070032756 NASA Stennis Space Center, Stennis Space Center, MS, USA

Coral Reef Remote Sensing using Simulated VIIRS and LDCM Imagery

Estep, Leland; Spruce, Joseph P.; [2007]; 1 pp.; In English; 2008 Ocean Sciences Meeting, 2-7 Mar. 2008, Orlando, FL, USA Contract(s)/Grant(s): NNS04AB54T; No Copyright; Avail.: Other Sources; Abstract Only

The Rapid Prototyping Capability (RPC) node at NASA Stennis Space Center, MS, was used to simulate NASA next-generation sensor imagery over well-known coral reef areas: Looe Key, FL, and Kaneohe Bay, HI. The objective was to assess the degree to which next-generation sensor systems the Visible/Infrared Imager/Radiometer Suite (VIIRS) and the Landsat Data Continuity Mission (LDCM) might provide key input to the National Oceanographic and Atmospheric Administration (NOAA) Integrated Coral Observing Network (ICON)/Coral Reef Early Warning System (CREWS) Decision Support Tool (DST). The DST data layers produced from the simulated imagery concerned water quality and benthic classification map layers. The water optical parameters of interest were chlorophyll (Chl) and the absorption coefficient (a). The input imagery used by the RPC for simulation included spaceborne (Hyperion) and airborne (AVIRIS) hyperspectral data. Specific field data to complement and aid in validation of the overflight data was used when available. The results of the experiment show that the next-generation sensor systems are capable of providing valuable data layer resources to NOAA's ICON/CREWS DST.

Author

Coral Reefs; Landsat Satellites; Remote Sensing; Simulation; Rapid Prototyping; Infrared Imagery; Radiometers; Light (Visible Radiation); Early Warning Systems; Oceanography

20070032874 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Aquarius/SAC-D Mission Overview

Sen, Amit; Kim, Yunjin; Caruso, Daniel; Lagerloef, Gary; Colomb, Raul; Yueh, Simon; LeVine, David; September 11, 2006; 10 pp.; In English; SPIE Europe Remote Sensing Conference, 11-16 Sep. 2006, Stockholm, Sweden; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40239

Aquarius/SAC-D is a cooperative international mission developed between the National Aeronautics and Space Administration (NASA) of USA of America (USA) and the Comision Nacional de Actividades Espaciales (CONAE) of Argentina. The overall mission objective is to contribute to the understanding of the total Earth system and the consequences of the natural and man-made changes in the environment of the planet. Major themes are: ocean surface salinity, water cycle, climate, natural hazards and cryosphere.

Author

Cryospheres; Remote Sensing; NASA Programs; Hydrology; Ice Environments; Hazards

20070032904 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA's Earth Science Data Systems Standards Process Experiences

Ullman, Richard E.; Enloe, Yonsook; July 23, 2007; 4 pp.; In English; IGARSS 2007, 23-27 Jul. 2007, Barcelona, Spain; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA has impaneled several internal working groups to provide recommendations to NASA management on ways to evolve and improve Earth Science Data Systems. One of these working groups is the Standards Process Group (SPC). The SPG is drawn from NASA-funded Earth Science Data Systems stakeholders, and it directs a process of community review and evaluation of proposed NASA standards. The working group's goal is to promote interoperability and interuse of NASA Earth

Science data through broader use of standards that have proven implementation and operational benefit to NASA Earth science by facilitating the NASA management endorsement of proposed standards. The SPC now has two years of experience with this approach to identification of standards. We will discuss real examples of the different types of candidate standards that have been proposed to NASA's Standards Process Group such as OPeNDAP's Data Access Protocol, the Hierarchical Data Format, and Open Geospatial Consortium's Web Map Server. Each of the three types of proposals requires a different sort of criteria for understanding the broad concepts of 'proven implementation' and 'operational benefit' in the context of NASA Earth Science data systems. We will discuss how our Standards Process has evolved with our experiences with the three candidate standards.
Author
Data Systems; Earth Sciences; NASA Programs; Standards; Protocol (Computers)

20070032909 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Using Satellite Remote Sensing Data in a Spatially Explicit Price Model
Brown, Molly E.; Pinzon, Jorge E.; Prince, Stephen D.; [2007]; 38 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS5-02041; Copyright; Avail.: CASI: A03, Hardcopy

Famine early warning organizations use data from multiple disciplines to assess food insecurity of communities and regions in less-developed parts of the World. In this paper we integrate several indicators that are available to enhance the information for preparation for and responses to food security emergencies. The assessment uses a price model based on the relationship between the suitability of the growing season and market prices for coarse grain. The model is then used to create spatially continuous maps of millet prices. The model is applied to the dry central and northern areas of West Africa, using satellite-derived vegetation indices for the entire region. By coupling the model with vegetation data estimated for one to four months into the future, maps are created of a leading indicator of potential price movements. It is anticipated that these maps can be used to enable early warning of famine and for planning appropriate responses.
Author
Remote Sensing; Food; Mathematical Models; Costs; Satellite Imagery; Sociology; Vegetation

20070032916 NASA Langley Research Center, Hampton, VA, USA
GIFTS SM EDU Level 1B Algorithms
Tian, Jialin; Gazarik, Michael J.; Reisse, Robert A.; Johnson, David G.; [2007]; 12 pp.; In English; SPIE Europe Remote Sensing 2007, 17-20 Sep. 2007, Florence, Italy; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) SensorModule (SM) Engineering Demonstration Unit (EDU) is a high resolution spectral imager designed to measure infrared (IR) radiances using a Fourier transform spectrometer (FTS). The GIFTS instrument employs three focal plane arrays (FPAs), which gather measurements across the long-wave IR (LWIR), short/mid-wave IR (SMWIR), and visible spectral bands. The raw interferogram measurements are radiometrically and spectrally calibrated to produce radiance spectra, which are further processed to obtain atmospheric profiles via retrieval algorithms. This paper describes the GIFTS SM EDU Level 1B algorithms involved in the calibration. The GIFTS Level 1B calibration procedures can be subdivided into four blocks. In the first block, the measured raw interferograms are first corrected for the detector nonlinearity distortion, followed by the complex filtering and decimation procedure. In the second block, a phase correction algorithm is applied to the filtered and decimated complex interferograms. The resulting imaginary part of the spectrum contains only the noise component of the uncorrected spectrum. Additional random noise reduction can be accomplished by applying a spectral smoothing routine to the phase-corrected spectrum. The phase correction and spectral smoothing operations are performed on a set of interferogram scans for both ambient and hot blackbody references. To continue with the calibration, we compute the spectral responsivity based on the previous results, from which, the calibrated ambient blackbody (ABB), hot blackbody (HBB), and scene spectra can be obtained. We now can estimate the noise equivalent spectral radiance (NESR) from the calibrated ABB and HBB spectra. The correction schemes that compensate for the fore-optics offsets and off-axis effects are also implemented. In the third block, we developed an efficient method of generating pixel performance assessments. In addition, a random pixel selection scheme is designed based on the pixel performance evaluation. Finally, in the fourth block, the single pixel algorithms are applied to the entire FPA.
Author
Fourier Transformation; Imaging Techniques; Remote Sensors; Algorithms; Imaging Spectrometers; Geosynchronous Orbits

20070032919 NASA Langley Research Center, Hampton, VA, USA

Digital Signal Processing Techniques for the GIFTS SM EDU

Tian, Jialin; Reisse, Robert A.; Gazarik, Michael J.; [2007]; 2 pp.; In English; 2007 AMOS: 8th Annual Advanced Maui Optical and Space Surveillance Technologies Conference, 12-15 Sep. 2007, Maui, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) Sensor Module (SM) Engineering Demonstration Unit (EDU) is a high resolution spectral imager designed to measure infrared (IR) radiance using a Fourier transform spectrometer (FTS). The GIFTS instrument employs three Focal Plane Arrays (FPAs), which gather measurements across the long-wave IR (LWIR), short/mid-wave IR (SMWIR), and visible spectral bands. The raw interferogram measurements are radiometrically and spectrally calibrated to produce radiance spectra, which are further processed to obtain atmospheric profiles via retrieval algorithms. This paper describes several digital signal processing (DSP) techniques involved in the development of the calibration model. In the first stage, the measured raw interferograms must undergo a series of processing steps that include filtering, decimation, and detector nonlinearity correction. The digital filtering is achieved by employing a linear-phase even-length FIR complex filter that is designed based on the optimum equiripple criteria. Next, the detector nonlinearity effect is compensated for using a set of pre-determined detector response characteristics. In the next stage, a phase correction algorithm is applied to the decimated interferograms. This is accomplished by first estimating the phase function from the spectral phase response of the windowed interferogram, and then correcting the entire interferogram based on the estimated phase function. In the calibration stage, we first compute the spectral responsivity based on the previous results and the ideal Planck blackbody spectra at the given temperatures, from which, the calibrated ambient blackbody (ABB), hot blackbody (HBB), and scene spectra can be obtained. In the post-calibration stage, we estimate the Noise Equivalent Spectral Radiance (NESR) from the calibrated ABB and HBB spectra. The NESR is generally considered as a measure of the instrument noise performance, and can be estimated as the standard deviation of calibrated radiance spectra from multiple scans. To obtain an estimate of the FPA performance, we developed an efficient method of generating pixel performance assessments. In addition, a random pixel selection scheme is developed based on the pixel performance evaluation. This would allow us to perform the calibration procedures on a random pixel population that is a good statistical representation of the entire FPA. The design and implementation of each individual component will be discussed in details. Author

Digital Techniques; Imaging Spectrometers; Signal Processing; Geosynchronous Orbits; Remote Sensors; Fourier Transformation

20070032946 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Research Issues in Image Registration for Remote Sensing

Eastman, Roger D.; LeMoigne, Jacqueline; Netanyahu, Nathan S.; [2007]; 8 pp.; In English; Computer Vision and Pattern Recognition (CVPR) Workshop on Image Registration and Fusion, 23 Jun. 2007, Minneapolis, MN, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Image registration is an important element in data processing for remote sensing with many applications and a wide range of solutions. Despite considerable investigation the field has not settled on a definitive solution for most applications and a number of questions remain open. This article looks at selected research issues by surveying the experience of operational satellite teams, application-specific requirements for Earth science, and our experiments in the evaluation of image registration algorithms with emphasis on the comparison of algorithms for subpixel accuracy. We conclude that remote sensing applications put particular demands on image registration algorithms to take into account domain-specific knowledge of geometric transformations and image content.

Author

Image Processing; Remote Sensing; Pattern Registration; Earth Sciences; Data Processing

20070032975 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Combined Active and Passive Remote Sensing of Hurricane Ocean Winds

Yueh, Simon H.; November 2, 2006; 4 pp.; In English; International Pan Ocean Remote Sensing Conference, 2-4 Nov. 2006, Busan, Korea, Republic of; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources ONLINE: http://hdl.handle.net/2014/40356

The synergism of active and passive microwave techniques for hurricane ocean wind remote sensing is explored. We performed the analysis of Windsat data for Atlantic hurricanes in 2003-2005. The polarimetric third Stokes parameter observations from the Windsat 10, 18 and 37 GHz channels were collocated with the ocean surface winds from the Holland wind model, the QuikSCAT wind vectors and the Global Data Assimilation System (GDAS) operated by the National Center

for Environmental Prediction (NCEP). The collocated data were binned as a function of wind speed and wind direction, and were expanded by sinusoidal series of the relative azimuth angles between wind and observation directions. The coefficients of the sinusoidal series, corrected for atmospheric attenuation, have been used to develop an empirical geophysical model function (GMF). The Windsat GMF for extreme high wind compares very well with the aircraft radiometer and radar measurements.
Author
Remote Sensing; Wind Measurement; Ocean Surface; Ground Wind; Hurricanes; Radar Measurement; Wind Velocity; Wind Direction

20070033301 Watkins-Johnson Co., Palo Alto, CA USA
Asbestos Survey for the Supplemental Remedial Investigation
Mar 1993; 241 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAA15-90-D-0018
Report No.(s): AD-A469449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Watkins-Johnson Environmental, Inc. (WJE, formerly R.L. Stollar and Associates, Inc.) performed an asbestos survey and bulk sampling of materials in buildings and fortifications not previously investigated during the Presidio Installation%Wide Asbestos Survey. Twenty eight structures were investigated during the asbestos survey and 67 bulk samples were collected and submitted for analyses. The survey was conducted in accordance with procedures outlined in TM 5612, Asbestos Control. Assessment of friable asbestos containing materials (ACM) was made using worksheets outlined in the Guide for Asbestos Hazard Assessment in U.S. Army Facilities (CERL- Environmental Engineering Team, 1988). From damage/risk exposure values obtained from these worksheets, recommended management corrective actions were determined. Recommended actions based on the risk and exposure calculations are summarized in Table 4.3 (Assessment Index Summary).
DTIC
Asbestos; Surveys; Toxic Hazards

20070033316 Little (Arthur D.), Inc., Cambridge, MA USA
Environmental Baseline Survey for Proposed Lease and/or Transfer Fort Devens - Basewide. Volume 2 of 2:
Mar 1995; 371 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469474; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An Environmental Baseline Survey (EBS) was undertaken to make a determination of the suitability to lease Building P-5 at Fort Devens, Massachusetts. The proposed lease is for the period of one year to the Massachusetts Government Land Bank. Building P-5 consists of two floors (approximately 9,217 square feet of space). The first floor will be occupied by the by the Massachusetts Government Landbank and used for administrative purposes. The second floor will be subleased to a Native American organization to function as the United Native American Cultural Center. The EBS followed the protocols outlined in current Department of Defense (DoD) Guidance. This included records review, review of aerial photographs, and a physical inspection of the proposed lease parcel and adjacent areas. Sampling was conducted for asbestos contaning materials only in the proposed lease parcel. Other environmental sampling was not deemed necessary for this parcel. This EBS is a supplement to the Final Community Environmental Response Facilitation Act (CERFA) Report for the Fort Devens Facility, Fort Devens, Massachusetts, April 1994.
DTIC
Asbestos; Environment Management; Environmental Surveys; Hazardous Materials

20070033386 Pennsylvania State Univ., University Park, PA USA
Chemically Advanced Nanolithography
Weiss, Paul S; Jun 2007; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-02-1-0386; Proj-M065
Report No.(s): AD-A469567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Invented a new technique for patterning - microdisplacement printing - that solves the pattern dissolution issues inherent in microcontact printing. Worked out the kinetics and mechanism of displacement. Modeled displacement and showed that displacement kinetics follow a universal form. Commercialized molecules used for displacement. Developed a special resist stack that improves line edge roughness and produces highly optimized parent structures for molecular rulers. This was previously the limitation of the technique. Investigated failure modes both quantitatively and microscopically, targeting and analyzing failures by type and with intelligent design of test structures to elucidate the contributions and origins of different

failure modes. Automated molecular ruler deposition, greatly enhancing the precision of the process. Demonstrated sacrificial layers and generations using molecular-ruler nanolithography. Used sacrificial layers to create daughter and parent structures of equal height. This can also be used to eliminate Au from the processing for compatibility with semiconductor processing. Created a method for ultrahigh resolution nanoimprint masters using molecular rulers on quartz. Demonstrated an all self-assembly method of molecular-ruler nanolithography by creating parents with shadow sphere nanolithography.
DTIC
Lithography; Nanofabrication; Nanotechnology

20070034092 Army Construction Engineering Research Lab., Champaign, IL USA
Geophysical Archeological Survey at Poverty Point State Historic Site (16WC5) West Carroll Parish, Louisiana
Britt, Tad; Hargrave, Michael; Simms, Janet; Sep 2002; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469531; ERDC-SR-02-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A near-surface geophysical survey was conducted at three locations portions of Mound E, West Sector, and Southwest Sector at the Poverty Point site (16WC5), Louisiana, during 21-22 June 2001. Technologies employed included: magnetic field gradiometry, electrical resistivity, electro-magnetic in-phase/conductivity and ground penetrating radar. The gradiometer and resistivity results clearly indicate that these two geophysical approaches have the potential to greatly enhance research strategies and guide data recovery efforts within specific locations at the site. Problems in the manner in which certain resistivity datasets were collected and/or processed prevent their use in interpretations for all areas surveyed. The conductivity results generally reflect the topography of the surface expression of the site but did not yield the detailed data that were anticipated. Additional resistivity and conductivity surveys are needed to address the user/equipment problems encountered in this study. The ground penetrating radar results were inconclusive due to the high proportion of clay particles in the loess sediments and it is recommended that this technology not be applied to the site until further refinements are made to this technology to address the unique site-specific conditions.
DTIC
Archaeology; Geophysics; Surveys

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*.

20070032704 NASA Marshall Space Flight Center, Huntsville, AL, USA
Liquid Metal Pump Technologies for Nuclear Surface Power
Polzin, Kurt A.; June 24, 2007; 7 pp.; In English; American Nuclear Society (ANS) Space Nuclear Conference (SNC) 2007, 24-28 Jun. 2007, Boston, MA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032704

Multiple liquid metal pump options are reviewed for the purpose of determining the technologies that are best suited for inclusion in a nuclear reactor thermal simulator intended to rest prototypical space nuclear surface power system components. Conduction, induction and thermoelectric electromagnetic pumps are evaluated based on their performance characteristics and the technical issues associated with incorporation into a reactor system. A thermoelectric electromagnetic pump is selected as the best option for use in NASA-MSFC's Fission Surface Power-Primary Test Circuit reactor simulator based on its relative simplicity, low power supply mass penalty, flight heritage, and the promise of increased pump efficiency over those earlier pump designs through the use of skutterudite thermoelectric elements.
Author
Electromagnetic Pumps; Liquid Metals; Spacecraft Power Supplies; Space Power Reactors

20070032873 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Development of a New Generation of High-Temperature Thermoelectric Unicouples for Space Applications
Caillat, Thierry; Gogna, P.; Sakamoto, J.; Jewell, A.; Cheng, J.; Blair, R.; Fleurial, J. -P.; Ewell, R.; August 29, 2006; 19 pp.; In English; Direct Thermal-to-Electrical Energy Conversion ONR/DARPA, 29 Aug. - 1 Sep. 2006, San Diego, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40238

RTG's have enabled surface and deep space missions since 1961: a) 26 flight missions without any RTG failures; and b)

Mission durations in excess of 25 years. Future NASA missions require RTG s with high specific power and high efficiency, while retaining long life (> 14 years) and high reliability, (i.e. 6-8 W/kg, 10-15% efficiency). JPL in partnership with NASA-GRC, NASA-MSFC, DOE, Universities and Industry is developing advanced thermoelectric materials and converters to meet future NASA needs.
Derived from text
Radioisotope Batteries; Thermoelectric Generators; Power Efficiency; Space Missions; Deep Space; High Temperature; Thermoelectric Materials

45
ENVIRONMENT POLLUTION

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

20070032953 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Characterizing Aerosols over Southeast Asia using the AERONET Data Synergy Tool
Giles, David M.; Holben, Brent N.; Eck, Thomas F.; Slutsker, Ilya; Slutsker, Ilya; Welton, Ellsworth, J.; Chin, Mian; Kucsera, Thomas; Schmaltz, Jeffery E.; Diehl, Thomas; Singh, Ramesh P.; Boonjawat, Jariya; Snidvongs, Arond; Le, Huy V.; [2007]; 1 pp.; In English; ASIA Oceania Geosciences Society (AOGS) 4th Annual Meeting, 30 Jul. - 4 Aug. 2007, Bangkok, Thailand
Contract(s)/Grant(s): NAS5-02041; Copyright; Avail.: Other Sources; Abstract Only

Biomass burning, urban pollution and dust aerosols have significant impacts on the radiative forcing of the atmosphere over Asia. In order to better quanti\@ these aerosol characteristics, the Aerosol Robotic Network (AERONET) has established over 200 sites worldwide with an emphasis in recent years on the Asian continent - specifically Southeast Asia. A total of approximately 15 AERONET sun photometer instruments have been deployed to China, India, Pakistan, Thailand, and Vietnam. Sun photometer spectral aerosol optical depth measurements as well as microphysical and optical aerosol retrievals over Southeast Asia will be analyzed and discussed with supporting ground-based instrument, satellite, and model data sets, which are freely available via the AERONET Data Synergy tool at the AERONET web site (http://aeronet.gsfc.nasa.gov). This web-based data tool provides access to groundbased (AERONET and MPLNET), satellite (MODIS, SeaWiFS, TOMS, and OMI) and model (GOCART and back trajectory analyses) databases via one web portal. Future development of the AERONET Data Synergy Tool will include the expansion of current data sets as well as the implementation of other Earth Science data sets pertinent to advancing aerosol research.
Author
Aerosols; Air Pollution; Data Bases; Biomass Burning; Earth Sciences; Trajectory Analysis; Spectrum Analysis; MODIS (Radiometry); Imaging Spectrometers; Total Ozone Mapping Spectrometer

20070033050 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Precise Calculation of Complex Radioactive Decay Chains
Harr, Logan J; Mar 2007; 104 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469273; AFIT/GNE/ENP/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA469273

This thesis documents a new approach to investigate the gamma radiation activity of the fission products of three different fuels (U-235, U-238, and U-239) exposed to three different incident neutron energy spectra (thermal, fast spectrum, and high energies). An application of the exponential moments function is used with a transmutation matrix in the calculation of complex radioactive decay chains to achieve greater precision than can be attained through current methods. The result of this research is a code which can calculate the decay products from complex radioactive decay chains with a high degree of precision while quantifying the uncertainty in gamma activity due to uncertainties in the isotope properties.
DTIC
Chains; Fission Products; Fuels; Gamma Rays; Radioactive Decay

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*.

20070032718 NASA Marshall Space Flight Center, Huntsville, AL, USA
Plasmapause Equatorial Shape Determination via the Minimum L Algorithm: Description and Evaluation
Wang, Cuilan; Newman, Timothy S.; Gallagher, Dennis; [2007]; 27 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-12109; Copyright; Avail.: Other Sources

Algorithms for determination of the equatorial shape of the plasmapause using NASA IMAGE Extreme Ultraviolet (EUV) imagery are considered. Focus is on the Minimum L Algorithm, which operates without human intervention given a single EUV image in which the plasmasphere silhouette boundary has been identified. For each line of sight (LOS) through pixels on the plasmasphere silhouette boundary, the algorithm first finds all magnetic dipole field lines intersected by the LOS and then returns as the plasmasphere's boundary the field line with the minimum L value. An analysis of the reasonableness, applicability, and accuracy of the algorithm is presented, and it is contrasted with the well-known Edge Algorithm [Roelof and Skinner, 2000]. A revised version of the Edge Algorithm is also introduced. Application of all three algorithms to real EUV imagery is demonstrated.
Author
Algorithms; Extreme Ultraviolet Radiation; Plasmapause; Numerical Analysis; Equatorial Atmosphere; Geodesy

20070032722 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effect of Oblique Electromagnetic Ion Cyclotron Waves on Relativistic Electron Scattering: CRRES Based Calculation
Gamayunov, K. V.; Khazanov, G. V.; July 31, 2007; 37 pp.; In English
Contract(s)/Grant(s): UPN 370-16-10; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032722

We consider the effect of oblique EMIC waves on relativistic electron scattering in the outer radiation belt using simultaneous observations of plasma and wave parameters from CRRES. The main findings can be summarized as follows: 1. In 1comparison with field-aligned waves, intermediate and highly oblique distributions decrease the range of pitch-angles subject to diffusion, and reduce the local scattering rate by an order of magnitude at pitch-angles where the principle absolute value of n = 1 resonances operate. Oblique waves allow the absolute value of n > 1 resonances to operate, extending the range of local pitch-angle diffusion down to the loss cone, and increasing the diffusion at lower pitch angles by orders of magnitude; 2. The local diffusion coefficients derived from CRRES data are qualitatively similar to the local results obtained for prescribed plasma/wave parameters. Consequently, it is likely that the bounce-averaged diffusion coefficients, if estimated from concurrent data, will exhibit the dependencies similar to those we found for model calculations; 3. In comparison with field-aligned waves, intermediate and highly oblique waves decrease the bounce-averaged scattering rate near the edge of the equatorial loss cone by orders of magnitude if the electron energy does not exceed a threshold (approximately equal to 2 - 5 MeV) depending on specified plasma and/or wave parameters; 4. For greater electron energies_ oblique waves operating the absolute value of n > 1 resonances are more effective and provide the same bounce_averaged diffusion rate near the loss cone as fiel_aligned waves do.
Author
Electromagnetic Radiation; Ion Cyclotron Radiation; Pitch (Inclination); Plasmas (Physics); Magnetic Storms; Electron Scattering

20070032947 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MHD Flow Visualization of Magnetopause and Polar Cusps Vortices
Collado-Vega, Y. M.; Kessel, R. L.; Shao, X.; Boller, R. A.; August 24, 2007; 1 pp.; In English; American Geophysical Union Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Detailed analysis of Wind, Geotail, and Cluster data shows how magnetopause boundary and polar cusps vortices associated with high speed streams can be a carrier of energy flux to the Earth's magnetosphere. For our analysis time interval, March 29 . - April 5 2002, the Interplanetary Magnetic Field (IMF) is primarily northward and MHD simulations of vortices along the flanks within nine hours of the time interval suggest that a Kelvin Helmholtz (KH) instability is likely present. Vortices were classified by solar wind input provided by the Wind satellite located 70-80 RE upstream from Earth. We present statistics for a total of 304 vortices found near the ecliptic plane on the magnetopause flanks, 273 with northward IMF and

31 with southward IMF. The vortices generated under northward IMF were more driven into the dawnside than into the duskside, being substantially more ordered on the duskside. Most of the vortices were large in scale, up to 10 RE, and with a rotation axis closely aligned with the Z(sub GSE) direction. They rotated preferentially clockwise on the dawnside, and. counter-clockwise on the duskside. Those generated under southward IMF were less ordered, fewer in number, and also smaller in diameter. Significant vortex activity occurred on the nightside region of the magnetosphere for these southward cases in contrast to the northward IMF cases on which most of the activity was driven onto the magnetopause flanks. Magnetopause crossings seen by the Geotail spacecraft for the time interval were analyzed and compared with the MHD simulation to validate our results. Vortices over the polar cusps are also being analyzed and the simulation results will be compared to the multi-point measurements of the four Cluster satellites.
Author
Interplanetary Magnetic Fields; Magnetohydrodynamic Flow; Magnetohydrodynamics; Polar Cusps; Vortices; Solar Terrestrial Interactions; Earth Magnetosphere

20070032965 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Io: Loki Patera as a Magma Sea
Matson, Dennis L.; Davies, Ashley Gerard; Veeder, Glenn J.; Rathbun, Julie A.; Johnson, Torrence V.; Castillo, Julie C.; Journal Of Geophysical Research; September 2, 2006; ISSN 0148-0227; Volume 111; 21 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40382; http://dx.doi.org/10.1029/2006JE002703

We develop a physical model for Loki Patera as a magma sea. We calculate the total volume of magma moving through the Loki Patera volcanic system every resurfacing cycle (approx.540 days) and the resulting variation in thermal emission. The rate of magma solidification at times reaches 3 x 10(exp 6) kg per second, with a total solidified volume averaging 100 cu km per year. A simulation of gas physical chemistry evolution yields the crust porosity profile and the timescale when it will become dense enough to founder in a manner consistent with observations. The Loki Patera surface temperature distribution shows that different areas are at different life cycle stages. On a regional scale, however, there can be coordinated activity, indicated by the wave of thermal change which progresses from Loki Patera's SW quadrant toward the NE at a rate of approx.1 km per day. Using the observed surface temperature distribution, we test several mechanisms for resurfacing Loki Patera, finding that resurfacing with lava flows is not realistic. Only the crustal foundering process is consistent with observations. These tests also discovered that sinking crust has a 'heat deficit' which promotes the solidification of additional magma onto the sinking plate ('bulking up'). In the limiting case, the mass of sinking material can increase to a mass of approx.3 times that of the foundering plate. With all this solid matter sinking, there is a compensating upward motion in the liquid magma. This can be in excess of 2 m per year. In this manner, solid-liquid convection is occurring in the sea.
Author
Io; Magma; Fluid Flow; Volcanology; Surface Temperature; Volcanoes; Thermal Emission; Temperature Distribution

20070033062 Army Engineer Research and Development Center, Vicksburg, MS USA
Translational Response of Toe-Restrained Retaining Walls to Earthquake Ground Motions Using CorpsWallSlip (CWSlip)
Ebeling, Robert M; Chase, Amos; White, Barry C; Jun 2007; 273 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469305; ERDC/ITL-TR-07-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469305

This research report describes the engineering formulation and corresponding software developed for the translational response of rockfounded retaining walls buttressed at their toe by a reinforced concrete slab to earthquake ground motions. The PC software CorpsWallSlip (sometimes referred to as CWSlip) was developed to perform an analysis of the permanent sliding displacement response for each proposed retaining wall section to either a user-specified earthquake acceleration time-history via a Complete Time-History Analysis or to user-specified peak ground earthquake response values via a Simplified Sliding Block Analysis. The resulting engineering methodology and corresponding software is applicable to a variety of retaining walls that are buttressed at their toe by a structural feature (e.g., navigation walls retaining earth, spillway chute walls, spillway discharge channel walls, approach channel walls to outlet works structures, highway and railway relocation retaining walls, and floodwall channels). CorpsWallSlip is particularly applicable to L-walls and T-walls (usually referred to as cantilever retaining walls). It may also be used to predict permanent seismically induced displacements on retaining walls without a toe restraint. Companion PC software, CorpsWallRotate, was developed to perform an analysis of permanent wall rotation. Both CorpsWallSlip and CorpsWallRotate software perform engineering calculations that help the engineer in assessment of the tendency for a retaining wall to slide or to rotate during earthquake shaking. Formal

consideration of the permanent seismic wall displacement in the seismic design process for Corps-type retaining structures is given in Ebeling and Morrison (1992).
DTIC
Composite Materials; Computer Programs; Concretes; Displacement; Earthquakes; Retaining; Walls

20070033311 Science Applications International Corp., San Diego, CA USA
Global Ground Truth Data Set with Waveform and Improved Arrival Data
Bondar, Istvan; Kohl, Ben; Bergman, Eric; McLaughlin, Keith; Israelsson, Hans; Kung, Yu-Long; Given, Jeff; Engdahl, Eric R; Sep 29, 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8718-O4-C-OO2O; Proj-1010
Report No.(s): AD-A469462; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main objective of this three-year research project is to produce a quality-controlled global GTO-5 event set, accompanied with waveform and groomed arrival time data sets. Our efforts are directed toward developing and refining methodologies for generating new ground-truth(GT) events through multiple-event location analysis. To accomplish this goal, we have developed the hybrid HDC-RCA (hypocentroidal decomposition and reciprocal cluster analysis) methodology. The HDC analysis determines accurate event location patterns relative to a provisional cluster centroid using regional and telesesmic phases. The RCA analysis then determines the accurate location of the cluster centroid using local phases only. RCA accomplishes this by keeping the event and station patterns fixed and relocates the station centroid using the events as fictitious stations. Because both relative station and relative event patterns are fixed and multiple events are typically recorded at each station, solving for the cluster hypocentroid represents an over determined inversion problem that is robust with respect to strong local seismic-velocity biases.
DTIC
Ground Truth; Waveforms

20070033354 Columbia Univ., Palisades, NY USA
A Study of Long-Range Seismic Profile Data in Western China
Xie, Jiakang; Jun 2007; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA-01-00-C-0048; Proj-CB
Report No.(s): AD-A469529; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pn Spectra are collected from three PASSCAL seismic experiments in the Tibetan Plateau (TP) over four path groups. The first and second path groups run southward from the eastern Tarim Basin to stations in north and south central Tibet. The third and fourth path groups form two NNE-oriented profiles in the eastern TP. Events recorded by the first 2 path groups also are recorded by the Khyrghistan network (KNET) to the west. A comparison of Pn spectra averaged over both path groups and KNET reveal that mantle lid under the TB attenuates P waves more severely than central Asia, particularly at high frequencies (> 1 Hz). Apparent Q(sub 0) and eta (Pn Q at 1 Hz and its frequency dependence, respectively) are estimated with a simplified geometrical spreading. Over path group 1 that heavily samples northern TB, Q(sub 0) and eta are estimated to be 183 +/- 33 and 0.3 +/- 0.1, respectively. Over path groups 2 and 3 that sample either a mixture of northern and southern Tibet or eastern Tibet, the estimated Q(sub 0) and eta are between approx. 250 and 270 and 0.0 and 0.1, respectively. Over the fourth path group that samples the easternmost TB the respective estimates are 374 +/- 51 and 0.3 +/- 0.1. A comparison of Pn attenuations in continental regions suggest that they are similar in the easternmost TB, Central Asia, Scandinavia, and the Canadian shield. Northern Tibet has the highest attenuation at all frequencies. Pn attenuation under southern Tibet is similar to the shield regions at low frequencies (</= 1Hz), and similar to northern Tibet at higher frequencies (up to 4 Hz). It appears that a southward increase in the lid temperature causes increases in both Pn velocity and low-frequency Pn Q, but causes no change in high-frequency Pn Q. This phenomenon may be best explained by a propagation mechanism in which Pn traverses the lid as a single, deep refraction at low frequencies, and as multiply bounced and scattered ('whispering-gallery') rays at high frequencies.
DTIC
Attenuation; China; Earthquakes; Measurement; Nuclear Explosions; Plateaus; Seismic Waves; Spectra

20070034026 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Annual Cycles of Multiyear Sea Ice Coverage of the Arctic Ocean: 1999-2003
Kwok, R.; Journal of Geophysical Research; November 10, 2004; Volume 109; 13 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40364; http://dx.doi.org/10.1029/2003JC002238

For the years 1999-2003, we estimate the time-varying perennial ice zone (PIZ) coverage and construct the annual cycles

of multiyear (MY, including second year) ice coverage of the Arctic Ocean using QuikSCAT backscatter, MY fractions from RADARSAT, and the record of ice export from satellite passive microwave observations. An area balance approach extends the winter MY coverage from QuikSCAT to the remainder of the year. From these estimates, the coverage of MY ice at the beginning of each year is 3774 x 10(exp 3) sq km (2000), 3896 x 10(exp 3) sq km (2001), 4475 x 10(exp 3) sq km (2002), and 4122 x 10(exp 3) sq km (2003). Uncertainties in coverage are approx.150 x 10(exp 3) sq km. In the mean, on 1 January, MY ice covers approx.60% of the Arctic Ocean. Ice export reduces this coverage to approx.55% by 1 May. From the multiple annual cycles, the area of first-year (FY) ice that survives the intervening summers are 1192 x 10(exp 3) sq km (2000), 1509 x 10(exp 3) sq km (2001), and 582 x 10(exp 3) sq km (2002). In order for the MY coverage to remain constant from year to year, these replenishment areas must balance the overall area export and melt during the summer. The effect of the record minimum in Arctic sea ice area during the summer of 2002 is seen in the lowest area of surviving FY ice of the three summers. In addition to the spatial coverage, the location of the PIZ is important. One consequence of the unusual location of the PIZ at the end of the summer of 2002 is the preconditioning for enhanced export of MY ice into the Barents and Kara seas. Differences between the minimums in summer sea ice coverage from our estimates and passive microwave observations are discussed.
Author
Sea Ice; Arctic Regions; Cycles; Arctic Ocean; Variations

20070034029 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Multiangle Imaging Spectroradiometer (MISR) Global Aerosol Optical Depth Validation Based on 2 Years of Coincident Aerosol Robotic Network (AERONET) Observations
Kahn, Ralph A.; Gaitley, Barbara J.; Martonchik, John V.; Diner, David J.; Crean, Kathleen A.; Holben, Brent; Journal of Geophysical Research; March 9, 2005; ISSN 0148-0227; Volume 110; In English; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40362; http://dx.doi.org/10.1029/2004JD004706

Performance of the Multiangle Imaging Spectroradiometer (MISR) early postlaunch aerosol optical thickness (AOT) retrieval algorithm is assessed quantitatively over land and ocean by comparison with a 2-year measurement record of globally distributed AERONET Sun photometers. There are sufficient coincident observations to stratify the data set by season and expected aerosol type. In addition to reporting uncertainty envelopes, we identify trends and outliers, and investigate their likely causes, with the aim of refining algorithm performance. Overall, about 2/3 of the MISR-retrieved AOT values fall within [0.05 or 20% x AOT] of Aerosol Robotic Network (AERONET). More than a third are within [0.03 or 10% x AOT]. Correlation coefficients are highest for maritime stations (approx.0.9), and lowest for dusty sites (more than approx.0.7). Retrieved spectral slopes closely match Sun photometer values for Biomass burning and continental aerosol types. Detailed comparisons suggest that adding to the algorithm climatology more absorbing spherical particles, more realistic dust analogs, and a richer selection of multimodal aerosol mixtures would reduce the remaining discrepancies for MISR retrievals over land; in addition, refining instrument low-light-level calibration could reduce or eliminate a small but systematic offset in maritime AOT values. On the basis of cases for which current particle models are representative, a second-generation MISR aerosol retrieval algorithm incorporating these improvements could provide AOT accuracy unprecedented for a spaceborne technique.
Author
Aerosols; MISR (Radiometry); Robotics; Biomass Burning; Climatology; Dust; Correlation Coefficients

20070034034 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Contrasts in Sea Ice Deformation and Production in the Arctic Seasonal and Perennial Ice Zones
Kwok, K.; Journal of Geophysical Research; August 16, 2006; ISSN 0148-0227; Volume 111; 14 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40365; http://dx.doi.org/10.1029/2005JC003246

Four years (1997-2000) of RADARSAT Geophysical Processor System (RGPS) data are used to contrast the sea ice deformation and production regionally, and in the seasonal (SIZ) and perennial (PIZ) ice zones. Ice production is of seasonal ice in openings during the winter. Three-day estimates of these quantities are provided within Lagrangian elements initially 10 km on a side. A distinct seasonal cycle is seen in both zones with these estimates highest in the late fall and with seasonal minimums in the midwinter. Regional divergence over the winter could be up to 30%. Spatially, the highest deformation is seen in the SIZ north of coastal Alaska. Both ice deformation and production are higher in the SIZ: deformation-related ice

production in the SIZ (approx.0.5 m) is 1.5-2.3 times that of the PIZ (approx.0.3 m): this is connected to ice strength and thickness. Atmospheric forcing and boundary layer structure contribute to only the seasonal and interannual variability. Seasonal ice growth in ice fractures accounts for approx.25-40% of the total ice production of the Arctic Ocean. Uncertainties in these estimates are discussed. By itself, this deformation-ice production relationship could be considered a negative feedback when thickness is perturbed. However, the overall effect on ice production in the face of increasing seasonal and thinner/weaker ice coverage could be modified by local destabilization of the water column promoting overturning of warmer water due to increased brine rejection; and the upwelling of the pynocline associated with increased occurrence of large shear motion in sea ice. Divergence is shown to be negligibly correlated to cyclonic motion in summer and winter in both ice zones. Author

Sea Ice; Annual Variations; Geophysics; Arctic Regions; Ice

20070034035 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Using Satellite Data to Characterize the Temporal Thermal Behavior of an Active Volcano: Mount St. Helens, WA

Vaughan, R. Greg; Hook, Simon J.; Geophysical Research Letters; October 17, 2006; ISSN 0094-8276; Volume 33; 4 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40372; http://dx.doi.org/10.1029/2006GL027957

ASTER thermal infrared data over Mt. St Helens were used to characterize its thermal behavior from Jun 2000 to Feb 2006. Prior to the Oct 2004 eruption, the average crater temperature varied seasonally between -12 and 6 C. After the eruption, maximum single-pixel temperature increased from 10 C (Oct 2004) to 96 C (Aug 2005), then showed a decrease to Feb 2006. The initial increase in temperature was correlated with dome morphology and growth rate and the subsequent decrease was interpreted to relate to both seasonal trends and a decreased growth rate/increased cooling rate, possibly suggesting a significant change in the volcanic system. A single-pixel ASTER thermal anomaly first appeared on Oct 1, 2004, eleven hours after the first eruption - 10 days before new lava was exposed at the surface. By contrast, an automated algorithm for detecting thermal anomalies in MODIS data did not trigger an alert until Dec 18. However, a single-pixel thermal anomaly first appeared in MODIS channel 23 (4 um) on Oct 13, 12 days after the first eruption - 2 days after lava was exposed. The earlier thermal anomaly detected with ASTER data is attributed to the higher spatial resolution (90 m) compared with MODIS (1 m) and the earlier visual observation of anomalous pixels compared to the automated detection method suggests that local spatial statistics and background radiance data could improve automated detection methods.

Author

MODIS (Radiometry); Radiance; Visual Observation; Temperature Effects; Spatial Resolution; Spatial Distribution; Volcanoes

20070034061 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Preface to Special Section: Validation of Atmospheric Infrared Sounder Observations

Fetzer, Eric J.; Journal Of Geophysical Research; May 13, 2006; ISSN 0148-0227; Volume 111; 4 pp.; In English; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40378; http://dx.doi.org/10.1029/2005JD007020

The papers described below demonstrate that the AIRS calibrated radiances and retrieved geophysical products generally meet or exceed the prelaunch specifications. The retrieved quantities show little variation in uncertainty as a function of cloud amount. However, AIRS retrieval yield is a rapidly decreasing function of cloud amount; at about 80% cloudiness essentially no infrared radiances are used in the retrieval processes. Also, AIRS performance has not been demonstrated for all conditions and products. Calibrated and forward calculated radiances meet performance specifications for conditions varying from the cold poles to warm tropics. The retrieval system performs well over extrapolar land in the free troposphere (~2-15 km above the surface) and over extrapolar oceans at all tropospheric altitudes. The AIRS retrieval algorithms have not been optimized for polar winter conditions, so no such results are presented in these papers.

Author

Infrared Instruments; Calibrating; Radiance; Geophysics; Infrared Radiation; Cloud Cover; Functional Design Specifications

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070032720 NASA Marshall Space Flight Center, Huntsville, AL, USA

Transport in the Subtropical Lowermost Stratosphere during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment

Pittman, Jasna V.; Weinstock, Elliot M.; Oglesby, Robert J.; Sayres, David S.; Smith, Jessica B.; Anderson, James G.; Cooper, Owen R.; Wofsy, Steven C.; Xueref, Irene; Gerbig, Cristoph; Daube, Bruce C.; Richard, Erik C.; Ridley, Brian A.; Weinheimer, Andrew J.; Lowenstein, Max; Hans-Jurg, Jost; Lopez, Jimena P.; Mahoney, Michael J.; Thompson, Thomas L.; Hargrove, William W.; Hoffman, Forrest M.; [2007]; 23 pp.; In English

Contract(s)/Grant(s): NGT5-3040; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://dx.doi.org/10.1029/2006JD007851

We use in situ measurements of water vapor (H2O), ozone (O3), carbon dioxide (CO2), carbon monoxide (CO), nitric oxide (NO), and total reactive nitrogen (NOy) obtained during the CRYSTAL-FACE campaign in July 2002 to study summertime transport in the subtropical lowermost stratosphere. We use an objective methodology to distinguish the latitudinal origin of the sampled air masses despite the influence of convection, and we calculate backward trajectories to elucidate their recent geographical history. The methodology consists of exploring the statistical behavior of the data by performing multivariate clustering and agglomerative hierarchical clustering calculations and projecting cluster groups onto principal component space to identify air masses of like composition and hence presumed origin. The statistically derived cluster groups are then examined in physical space using tracer-tracer correlation plots. Interpretation of the principal component analysis suggests that the variability in the data is accounted for primarily by the mean age of air in the stratosphere, followed by the age of the convective influence, and last by the extent of convective influence, potentially related to the latitude of convective injection (Dessler and Sherwood, 2004). We find that high-latitude stratospheric air is the dominant source region during the beginning of the campaign while tropical air is the dominant source region during the rest of the campaign. Influence of convection from both local and nonlocal events is frequently observed. The identification of air mass origin is confirmed with backward trajectories, and the behavior of the trajectories is associated with the North American monsoon circulation.

Author

Anvil Clouds; Stratosphere; Tropical Regions; Geophysics; Transport Theory; Cirrus Clouds

20070032724 Meteorological Coll., Kashiwa, Japan

Monthly Report of the Meteorological Satellite Center: June 2007

July 2007; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the June 2007 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20070032829 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

AIRS Observations of DomeC in Antarctica and Comparison with Automated Weather Stations (AWS)

Aumann, Hartmut H.; Gregorich, Dave; Broberg, Steve; October 5, 2006; 8 pp.; In English; ITOVS (ITWG) 2006 Annual Meeting, 3-10 Oct. 2006, Maratea, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40272

We compare the surface temperatures at Dome Concordia (DomeC) deduced from AIRS data and two Automatic Weather Stations at Concordia Station: AWS8989 , which has been in operation since December 1996, and AWS.it, for which data are available between January and November 2005. The AWS8989 readings are on average 3 K warmer than the AWS.it readings, with a warmer bias in the Antarctic summer than in the winter season. Although AIRS measures the skin brightness

temperature, while the AWS reports the temperature of the air at 3 meter above the surface, the AIRS measurements agree well with the AWS.it readings for all data and separately for the summer and winter seasons, if data taken in the presence of strong surface inversions are filtered out. This can be done by deducing the vertical temperature gradient above the surface directly from the AIRS temperature sounding channels or indirectly by noting that extreme vertical gradients near the surface are unlikely if the wind speed is more than a few meters per second. Since the AIRS measurements are very well calibrated, the agreement with AWS.it is very encouraging. The warmer readings of AWS8989 are likely due to thermal contamination of the AWS8989 site by the increasing activity at Concordia Station. Data from an AWS.it quality station could be used for the evaluation of radiometric accuracy and stability of polar orbiting sounders at low temperatures. Unfortunately, data from AWS.it was available only for a limited time. The thermal contamination of the AWS8989 data makes long-term trends deduced from AWS8989 and possibly results about the rapid Antarctic warming deduced from other research stations on Antarctica suspect. AIRS is the first hyperspectral infrared sounder designed in support of weather forecasting and climate research. It was launched in May 2002 on the EOS Aqua spacecraft into a 704 km altitude polar sun-synchronous orbit. The lifetime of AIRS, estimated before launch to be at least 5 years is, based on the latest evaluation, limited by the amount of attitude control gas on the EOS Aqua spacecraft, which is expected to last through 2015.
Author
Automatic Weather Stations; Weather Forecasting; Infrared Instruments; Temperature Measurement; Atmospheric Temperature; Atmospheric Sounding; Aqua Spacecraft; Temperature Gradients

20070032866 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Relationship Between Rainfall and Soil Moisture Based on AMSR-E Data
Jin, Kyoung-Wook; Njoku, Eni; Chan, Steven; September 6, 2006; 10 pp.; In English; Joint NASA/AMSR Science Team Meeting, 6-8 Sep 2006, La Jolla, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40259

Rainfall over land is a primary uncertainty source and limitation for the soil moisture retrieval. Discerning the signal emitted by the surface from emission of a raining atmosphere is extremely complicated. Results show some insights of the relationship between precipitation and soil moisture according to spatio-temporal scales We are working on investigating consistency between the retrieved soil moisture data and the model data (NARR) to study how satellite-based soil moisture observations can contribute to simulate improved large-scale soil moisture estimation through data assimilation.
Derived from text
Rain; Soil Moisture; Assimilation; Precipitation; Hydrology; Energy Budgets

20070032880 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Version 5 Release Status and Plans: AIRS Science Team
Friedman, Steven Z.; March 2006; 16 pp.; In English; AIRS Science Team Meeting, 7-10 Mar. 2006, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40178

This viewgraph presentation reviews the development of version 5 of Atmospheric Infrared Sounder (AIRS) software. The overarching goal for version 5 is to enhance AIRS software to expand its utility for climate research and to improve the impact on weather forecasting.
CASI
Infrared Instruments; Software Engineering; Computer Programming; Forecasting

20070032889 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Vertical Moist Thermodynamic Structure and Spatial-Temporal Evolution of the MJO in AIRS Observations
Tian, Baijun; Waliser, Duane E.; Fetzer, Eric J.; Lambrigtsen, Bjorn H.; Yung, Yuk L.; Wang, Bin; Journal of the Atmospheric Sciences; October 2006; Volume 63, Issue 10, pp. 2462-2485; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40296; http://dx.doi.org/10.1175/JAS3782.1

The atmospheric moisture and temperature profiles from the Atmospheric Infrared Sounder (AIRS)/Advanced Microwave Sounding Unit on the NASA Aqua mission, in combination with the precipitation from the Tropical Rainfall Measuring Mission (TRMM), are employed to study the vertical moist thermodynamic structure and spatial-temporal evolution of the Madden-Julian oscillation (MJO). The AIRS data indicate that, in the Indian Ocean and western Pacific, the temperature anomaly exhibits a trimodal vertical structure: a warm (cold) anomaly in the free troposphere (800-250 hPa) and a cold (warm)

anomaly near the tropopause (above 250 hPa) and in the lower troposphere (below 800 hPa) associated with enhanced (suppressed) convection. The AIRS moisture anomaly also shows markedly different vertical structures as a function of longitude and the strength of convection anomaly. Most significantly, the AIRS data demonstrate that, over the Indian Ocean and western Pacific, the enhanced (suppressed) convection is generally preceded in both time and space by a low-level warm and moist (cold and dry) anomaly and followed by a low-level cold and dry (warm and moist) anomaly. The MJO vertical moist thermodynamic structure from the AIRS data is in general agreement, particularly in the free troposphere, with previous studies based on global reanalysis and limited radiosonde data. However, major differences in the lower-troposphere moisture and temperature structure between the AIRS observations and the NCEP reanalysis are found over the Indian and Pacific Oceans, where there are very few conventional data to constrain the reanalysis. Specifically, the anomalous lower-troposphere temperature structure is much less well defined in NCEP than in AIRS for the western Pacific, and even has the opposite sign anomalies compared to AIRS relative to the wet/dry phase of the MJO in the Indian Ocean. Moreover, there are well-defined eastward-tilting variations of moisture with height in AIRS over the central and eastern Pacific that are less well defined, and in some cases absent, in NCEP. In addition, the correlation between MJO-related mid-tropospheric water vapor anomalies and TRMM precipitation anomalies is considerably more robust in AIRS than in NCEP, especially over the Indian Ocean. Overall, the AIRS results are quite consistent with those predicted by the frictional Kelvin-Rossby wave/conditional instability of the second kind (CISK) theory for the MJO.

Author

Madden-Julian Oscillation; Atmospheric Moisture; Atmospheric Temperature; Temperature Profiles; Infrared Instruments; Thermodynamics; Precipitation; Anomalies

20070032950 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Flood and Landslide Applications of Near Real-time Satellite Rainfall Products

Hong, Yang; Adler, Robert F.; Negri, Andrew; Huffman, George J.; Natural Hazards; March 22, 2007; ISSN 0921-030X, pp. 285-294; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://dx.doi.org/10.1007/s11069-006-9106-x

Floods and associated landslides are one of the most widespread natural hazards on Earth, responsible for tens of thousands of deaths and billions of dollars in property damage every year. During 1993-2002, over 1000 of the more than 2,900 natural disasters reported were due to floods. These floods and associated landslides claimed over 90,000 lives, affected over 1.4 billion people and cost about $210 billion. The impact of these disasters is often felt most acutely in less developed regions. In many countries around the world, satellite-based precipitation estimation may be the best source of rainfall data due to lack of surface observing networks. Satellite observations can be of essential value in improving our understanding of the occurrence of hazardous events and possibly in lessening their impact on local economies and in reducing injuries, if they can be used to create reliable warning systems in cost-effective ways. This article addressed these opportunities and challenges by describing a combination of satellite-based real-time precipitation estimation with land surface characteristics as input, with empirical and numerical models to map potential of landslides and floods. In this article, a framework to detect floods and landslides related to heavy rain events in near-real-time is proposed. Key components of the framework are: a fine resolution precipitation acquisition system; a comprehensive land surface database; a hydrological modeling component; and landslide and debris flow model components. A key precipitation input dataset for the integrated applications is the NASA TRMM-based multi-satellite precipitation estimates. This dataset provides near real-time precipitation at a spatial-temporal resolution of 3 hours and 0.25deg x 0.25deg. By careful integration of remote sensing and in-situ observations, and assimilation of these observations into hydrological and landslide/debris flow models with surface topographic information, prediction of useful probabilistic maps of landslide and floods for emergency management in a timely manner is possible. Early results shows that the potential exists for successful application of satellite precipitation data in improving/developing global monitoring systems for flood/landslide disaster preparedness and management. The scientific and technological prototype can be first applied in a representative test-bed and then the information deliverables for the region can be tailored to the societal and economic needs of the represented affected countries.

Author

Floods; Landslides; Satellite Observation; Remote Sensing; Rain; Precipitation; Disasters; Hazards; Hydrology Models

20070032956 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Assimilated Ozone from EOS-Aura: Evaluation of the Tropopause Region and Tropospheric Columns

Stajner, Ivanka; Wargan, Krzysztof; Pawson, Steven; Hayashi, Hiroo; Chang, Lang-Ping; Hudman, Rynda C.; Foidevaux, Lucien; Livesey, Mathaniel; Levelt, Pieternel; Stubi, Rene; [2007]; 26 pp.; In English; Copyright; Avail.: Other Sources

Measurements from NASA's EOS Aura satellite provide a lot of information about ozone using complementary

instruments. For example, the Ozone Monitoring Instrument (OMI) is used to obtain information about integrated ozone overhead with high horizontal resolution and almost global coverage. In contrast, the Microwave Limb Sounder (MLS) provides sparse measurements of vertically resolved ozone profiles at high altitudes. Neither provides a full picture of the ozone distribution throughout the atmosphere. In our study these measurements are blended into a NASA computer model that predicts detailed distribution of atmospheric ozone. The addition of MLS and OMI data was found to improve the representation of atmospheric ozone in the model. Some improvements are in the troposphere, which is the lowest atmospheric layer affected by the weather and important for air quality. The next atmospheric layer above is the stratosphere with the largest ozone concentrations that form the ozone layer that protects us from ultraviolet rays. Large improvements from the addition of MLS and OMI data into the model were seen in the transition zone between the troposphere and the stratosphere. This is a hard region for models to capture correctly because of drastic changes in ozone concentrations with altitude and uncertainties in winds that used to determine ozone distribution in the model. In this transition region blending of Aura satellite data provides a useful constraint. This transition region is the key not only for determining the distribution on atmospheric ozone, but also to answer the question how the ozone gets into different parts of the atmosphere, especially as the air moves between the stratosphere and the troposphere.
Author
Ozone; Meteorological Parameters; Atmospheric Composition; Air Quality; Gas Composition; Microwave Sounding

20070032964 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Biases in Total Precipitable Water Vapor Climatologies from Atmospheric Infrared Sounder and Advanced Microwave Scanning Radiometer
Fetzer, Eric J.; Lambrigtsen, Bjorn H.; Eldering, Annmarie; Aumann, Hartmut H.; Chahine, Moustafa T.; Journal Of Geophysical Research; April 26, 2006; ISSN 0148-0227; Volume 111; 14 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40384; http://dx.doi.org/10.1029/2005JD006598

We examine differences in total precipitable water vapor (PWV) from the Atmospheric Infrared Sounder (AIRS) and the Advanced Microwave Scanning Radiometer (AMSR-E) experiments sharing the Aqua spacecraft platform. Both systems provide estimates of PWV over water surfaces. We compare AIRS and AMSR-E PWV to constrain AIRS retrieval uncertainties as functions of AIRS retrieved infrared cloud fraction. PWV differences between the two instruments vary only weakly with infrared cloud fraction up to about 70%. Maps of AIRS-AMSR-E PWV differences vary with location and season. Observational biases, when both instruments observe identical scenes, are generally less than 5%. Exceptions are in cold air outbreaks where AIRS is biased moist by 10-20% or 10-60% (depending on retrieval processing) and at high latitudes in winter where AIRS is dry by 5-10%. Sampling biases, from different sampling characteristics of AIRS and AMSR-E, vary in sign and magnitude. AIRS sampling is dry by up to 30% in most high-latitude regions but moist by 5-15% in subtropical stratus cloud belts. Over the northwest Pacific, AIRS samples conditions more moist than AMSR-E by a much as 60%. We hypothesize that both wet and dry sampling biases are due to the effects of clouds on the AIRS retrieval methodology. The sign and magnitude of these biases depend upon the types of cloud present and on the relationship between clouds and PWV. These results for PWV imply that climatologies of height-resolved water vapor from AIRS must take into consideration local meteorological processes affecting AIRS sampling.
Author
Climatology; Water Vapor; Stratus Clouds; Infrared Instruments; Microwave Radiometers; Bias

20070033036 Army Research Lab., White Sands Missile Range, NM USA
PDA-Based Backup System for Generating Marine Corps Artillery Meteorological Messages. Addendum
Jameson, Terry C; Sauter, David; Jun 2007; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469253; ARL-TN-279; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469253

A personal digital assistant (PDA) based application has been developed as a backup system to allow the computation of artillery meteorological messages (see ARL-TN-244 for a discussion of meteorological messages). An inherent part of the message creation is the availabi y of upper atmospheric meteorological data, which is either extrapolated from a surface observation or, in the case of wind vectors, computed via the visual tracking of a pilot balloon (PIBAL). However, in the event of clouds, PIBAL failure, or even the loss of visual contact with the PIBAL, it is possible that insufficient data is available to compute the upper atmospheric wind vectors. In these situations, upper atmosp ric climatological data can be used to

augment the PIBAL data (if any) to create a (hopefully) more representative meteorological message(s). This addendum details the algorithms and logic used to incorporate the climatological data in the event there is insufficient PIBAL data.
DTIC
Algorithms; Artillery; Message Processing; Messages; Meteorological Parameters

20070033307 Army Engineer Research and Development Center, Vicksburg, MS USA
Environmental Consequences of the Failure of the New Orleans Levee System During Hurricane Katrina; Microbiological Analysis
Fredrickson, Herbert; Furey, John; Foote, Chris; Richmond, Margaret; Jun 2007; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469456; ERDC/EL-TR-07-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multiple failures of the levee system protection for the City of New Orleans in the aftermath of Hurricane Katrina in August 2005 led to the flooding of the metropolitan area. The flood waters and sediments contained some dissolved and entrained chemical and microbial contaminants. Subsequent pumping of flood water from the city to the adjacent environment and the ongoing removal of sediment and sediment-coated debris are potential mechanisms to distribute these contaminants to the local environment. The recalcitrant hydrocarbon benzo[a]pyrene (BaP) was used as an indicator of hydrophobic organic contaminants and microbial and sterol indicators of fecal material to assess sources and sinks of these classes of contaminants. These data provided a basis for contaminant transport and fate models. Additionally, this report specifically focuses on the violet Marsh area outside the levee from the Lower Ninth Ward of New Orleans and on the Chalmette area of St. Bernard Parish, looking at potential environmental impacts.
DTIC
Environmental Surveys; Failure; Hurricanes; Microbiology

20070034027 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Satellite Observations of Spatial and Interannual Variability of Lightning and Radar Reflectivity
Durden, S. L.; Meagher, J. P.; Haddad, Z. S.; Geophysical Research Letters; September 25, 2004; ISSN 0094-8276; Volume 31; 4 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40363; http://dx.doi.org/10.1029/2004GL020384

The authors use satellite data to examine the relationship between lightning and upper-level radar reflectivity. They find correlations between average flash rates and upper-level reflectivities over both land and ocean, although both flash rates and reflectivities are much lower over ocean than land. Analysis of the data using Empirical Orthogonal Functions (EOFs) shows similar EOFs for averaged lightning and reflectivity. In contrast, the EOFs of the anomalies of lightning and reflectivity have different spatial patterns; however, both have principal component time series that are correlated with the Southern Oscillation Index and, hence, El Nino. Differences in behavior of the lightning and reflectivity anomaly EOFs and principal components suggest that El Nino plays a smaller role in lightning anomaly than precipitation anomaly.
Author
Reflectance; Lightning; Orthogonal Functions; Satellite Observation; Time Series Analysis; Variability

20070034030 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
EOS Microwave Limb Sounder Observations of 'Frozen-in' Anticyclonic Air in Arctic Summer
Manney, G. L.; Livesey, N. J.; Jimenez, C. J.; Pumphrey, H. C.; Santee, M. L.; MacKenzie, I. A.; Waters, J. W.; Geophysical Research Letters; March 23, 2006; ISSN 0094-8276; Volume 33; 4 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40361; http://dx.doi.org/10.1029/2005GL025418

A previously unreported phenomenon, a 'frozen-in' anticyclone (FrIAC) after the 2005 Arctic spring vortex breakup, was discovered in Earth Observing System (EOS) Microwave Limb Sounder (MLS) long-lived trace gas data. A tongue of low-latitude (high-N2O, low-H2O) air was drawn into high latitudes and confined in a tight anticyclone, then advected intact in the summer easterlies through late August. A similar feature in O3 disappeared by early April as a result of chemical processes. The FrIAC was initially advected upright at nearly the same speed at all levels from approx.660 to 1300 K (approx.25-45 km); increasing vertical wind shear after early June tilted the FrIAC and weakened it at higher levels. The associated feature in PV disappeared by early June; transport calculations fail to reproduce the remarkable persistence of the FrIAC, suggesting deficiencies in summer high-latitude winds. The historical PV record suggests that this phenomenon may have occurred several times before. The lack of a persistent signature in O3 or PV, along with its small size and rapid motion,

make it unlikely that a FrIAC could have been reliably identified without hemispheric daily longlived trace gas profiles such as those from EOS MLS.
Author
Earth Observing System (EOS); Trace Elements; Chemical Reactions; Arctic Regions; Anticyclones; Polar Regions; Vortices

20070034036 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Forecast, Measurement, and Modeling of an Unprecedented Polar Ozone Filament Event over Mauna Loa Observatory, Hawaii
Tripathi, Om Prakash; Leblanc, Thierry; McDermid, I. Stuart; Lefevre, Frank; Marchand, Marion; Hauchecorne, Alain; Journal of Geophysical Research; October 21, 2006; ISSN 0148-0227; Volume 111; 10 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40373; http://dx.doi.org/10.1029/2006jd007177

In mid-March 2005 the northern lower stratospheric polar vortex experienced a severe stretching episode, bringing a large polar filament far south of Alaska toward Hawaii. This meridional intrusion of rare extent, coinciding with the polar vortex final warming and breakdown, was followed by a zonal stretching in the wake of the easterly propagating subtropical main flow. This caused polar air to remain over Hawaii for several days before diluting into the subtropics. After being successfully forecasted to pass over Hawaii by the high-resolution potential vorticity advection model Modele Isentrope du transport Meso-echelle de l'Ozone Stratospherique par Advection (MIMOSA), the filament was observed on isentropic surfaces between 415 K and 455 K (17-20 km) by the Jet Propulsion Laboratory stratospheric ozone lidar measurements at Mauna Loa Observatory, Hawaii, between 16 and 19 March 2005. It was materialized as a thin layer of enhanced ozone peaking at 1.6 ppmv in a region where the climatological values usually average 1.0 ppmv. These values were compared to those obtained by the three dimensional Chemistry-Transport Model MIMOSA-CHIM. Agreement between lidar and model was excellent, particularly in the similar appearance of the ozone peak near 435 K (18.5 km) on 16 March, and the persistence of this layer at higher isentropic levels for the following three days. Passive ozone, also modeled by MIMOSA-CHIM, was at about 3-4 ppmv inside the filament while above Hawaii. A detailed history of the modeled chemistry inside the filament suggests that the air mass was still polar ozone- depleted when passing over Hawaii. The filament quickly separated from the main vortex after its Hawaiian overpass. It never reconnected and, in less than 10 days, dispersed entirely in the subtropics.
Author
Atmospheric Composition; Climatology; Remote Sensing; Ozone; Vortex Breakdown; Air Masses

20070034060 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
To What Extent Can Raindrop Size Be Determined by a Multiple-Frequency Radar?
Meagher, Jonathan P.; Haddad, Ziad S; Journal of Applied Meteorology and Climatology; April 2006; Volume 45, No. 4, pp. 529-536; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40377

In this paper, an analytical treatment of the atmospheric remote sensing problem of determining the raindrop size distribution (DSD) with a spaceborne multifrequency microwave nadir-looking radar system is presented. It is typically assumed that with two radar measurements at different frequencies one ought to be able to calculate two state variables of the DSD: a bulk quantity, such as the rain rate, and a distribution shape parameter. To determine if this nonlinear problem can indeed be solved, the DSD is modeled as a Gamma distribution and quadratic approximations to the corresponding radar-rain relations are used to examine the invertibility of the resulting system of equations in the case of two as well as three radar frequencies. From the investigation, it is found that for regions of DSD state space multiple solutions exist for two or even three different frequency radar measurements. This should not be surprising given the nonlinear coupled nature of the problem.
Author
Raindrops; Size Distribution; Radar Measurement; Multispectral Radar; Meteorological Radar; Drop Size; Remote Sensing

20070034064 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Antarctic Circumpolar Current Transport Variability during 2003-05 from GRACE
Zlotnicki, Victor; Wahr, John; Fukumori, Ichiro; Song, Yuhe T.; Journal of Physical Oceanography; February 2007; Volume 37, No. 2, pp. 230-244; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40371; http://dx.doi.org/10.1175/JPO3009.1

Gravity Recovery and Climate Experiment (GRACE) gravity data spanning January 2003-November 2005 are used as proxies for ocean bottom pressure (BP) averaged over 1 month, spherical Gaussian caps 500 km in radius, and along paths

bracketing the Antarctic Circumpolar Current's various fronts. The GRACE BP signals are compared with those derived from the Estimating the Circulation and Climate of the Ocean (ECCO) ocean modeling-assimilation system, and to a non-Boussinesq version of the Regional Ocean Model System (ROMS). The discrepancy found between GRACE and the models is 1.7 cm<subscript>H2O (1 cm<subscript>H2O approx. 1 hPa), slightly lower than the 1.9 cmH2O estimated by the authors independently from propagation of GRACE errors. The northern signals are weak and uncorrelated among basins. The southern signals are strong, with a common seasonality. The seasonal cycle GRACE data observed in the Pacific and Indian Ocean sectors of the ACC are consistent, with annual and semiannual amplitudes of 3.6 and 0.6 cmH2O (1.1 and 0.6 cm<subscript>H2O with ECCO), the average over the full southern path peaks (stronger ACC) in the southern winter, on days of year 197 and 97 for the annual and semiannual components, respectively; the Atlantic Ocean annual peak is 20 days earlier. An approximate conversion factor of 3.1 Sv (Sv equiv 10(exp 6)cu m/s) of barotropic transport variability per cm<subscript>H2O of BP change is estimated. Wind stress data time series from the Quick Scatterometer (QuikSCAT), averaged monthly, zonally, and over the latitude band 40(deg)- 65(deg)S, are also constructed and subsampled at the same months as with the GRACE data. The annual and semiannual harmonics of the wind stress peak on days 198 and 82, respectively. A decreasing trend over the 3 yr is observed in the three data types.
Author
Gravitation; Ocean Bottom; Time Series Analysis; Antarctic Regions; Wind Shear; Ocean Models; Climate

20070034093 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Multi-Objective Decision-Making Model for Resources Allocation in Humanitarian Relief
Park, Seungbae; Mar 2007; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469512; AFIT/GOR/ENS/07-20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis addresses the critical resource allocation in the initial days of a disaster relief operation. One of the most important and essential components of relief operations is the allocation of scarce resources to accomplish the relief efforts. Every operation for disaster relief needs various critical resources whether they are personnel, equipment, supplies, or simply finances. Several research efforts for disaster relief have suggested methods to allocate scarce resources across a variety of competing objectives and programs in a disaster relief operation. Many of those efforts focused on optimizing a mathematical programming model subject to budget constraints. However, capturing the values of the decision-maker(s) in such a model is relatively under explored. The lack of clear organizational values contributes to the inconsistency in practice and hinders effective resources allocation across the disaster relief system. The purpose of this study is to develop a multi-objective decision-making (MODM) model to incorporate the decision-maker(s) value trade-offs in the disaster relief resources allocation problem. The notional model is based on a hurricane and flood scenario and the decision window for the resource allocation is the critical first 72 hours after the initial damage assessment has been made. The value focused thinking (VFT) process is used to capture the value trade-offs and the resulting value hierarchy is optimized via a mathematical programming model to solve the multi-objective resource allocation problem.
DTIC
Decision Making; Disasters; Resources Management

20070034113 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Will GOES-R Go Without?
Iannotta, Ben; Aerospace America; July 2007; ISSN 0740-722X; Volume 45, No. 7, pp. 40-44; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

For more than a decade, US. and European weather scientists and satellite engineers have been developing a new class weather instruments. Called hyperspectral sounders, these devices profile the temperature and water content of the atmosphere at different altitudes by splitting Earths infrared emissions into thousands of spectral bands. The goal is to make the data trustworthy enough that forecasters can feed it into their mathematical models of the atmosphere-models on which they must rely in building their forecasts. Better sounding data would improve hurricane intensity predictions and precipitation forecasts, and would give farmers more advance warning of damaging frost, says Rajani Cuddapah, the hyperspectral team manager at BAE Systems in Nashua, N.H. The company is hoping to build a hyperspectral satellite sensor. At the moment, forecasters still rely largely on sounding data gleaned by dropping sensors out of aircraft or releasing weather balloons from the ground, sounding experts say. However, hyperspectral sounders have been successfully tested on aircraft, and US. forecasters are cautiously incorporating small amounts of sounder data from a NASA LEO instrument that has been operating since 2002. That sensor is AIRS, the Atmospheric Infrared Sounder, the 2,382-channel hyperspectral instrument that rides on NASA's polar-orbiting Aqua environmental satellite. Last October, Europe launched its own infrared sounder, called the Infrared Atmospheric Sounding Interferometer (IASI), aboard the first MetOp polar-orbiting weather satellite. That instrument is still

in its commissioning phase, and the first data are expected to be released over the summer, says Eva Oriol, the MetOp mission manager for ESA. The ultimate destination for hyperspectral sounders, however, is not LEO. Advocates want to get them on future generations of geostationary weather satellites. Those spacecraft orbit at 36,000 km, and their key advantage is that they remain stationary relative to the Earth. The U.S. National Oceanic and Atmospheric Administration operates geostationary satellites over the Atlantic and Pacific Oceans. The European Organization for the Exploitation of Meteorological Satellites, or EUMETSAT, focuses on Europe and Africa.
Derived from text
Sounding; Atmospheric Temperature; Infrared Interferometers; GOES Satellites; Atmospheric Sounding; Atmospheric Models

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*.

20070032962 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Intraseasonal Variability of the Equatorial Indian Ocean Observed from Sea Surface Height, Wind, and Temperature Data
Fu, Lee-Lueng; Journal of Physical Oceanography; February 27, 2007; Volume 37, pp. 188-202; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40369; http://dx.doi.org/10.1175/JPO3006.1

The forcing of the equatorial Indian Ocean by the highly periodic monsoon wind cycle creates many interesting intraseasonal variabilities. The frequency spectrum of the wind stress observations from the European Remote Sensing Satellite scatterometers reveals peaks at the seasonal cycle and its higher harmonics at 180, 120, 90, and 75 days. The observations of sea surface height (SSH) from the Jason and Ocean Topography Experiment (TOPEX)/Poseidon radar altimeters are analyzed to study the ocean's response. The focus of the study is on the intraseasonal periods shorter than the annual period. The semiannual SSH variability is characterized by a basin mode involving Rossby waves and Kelvin waves traveling back and forth in the equatorial Indian Ocean between 10(deg)S and 10(deg)N. However, the interference of these waves with each other masks the appearance of individual Kelvin and Rossby waves, leading to a nodal point (amphidrome) of phase propagation on the equator at the center of the basin. The characteristics of the mode correspond to a resonance of the basin according to theoretical models. The theory also calls for similar modes at 90 and 60 days.
Author
Indian Ocean; Shear Stress; Remote Sensing; Ocean Surface; Wind Shear; Satellite Observation

20070032973 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Atlantic to Mediterranean Sea Level Difference Driven by Winds near Gibraltar Strait
Menemenlis, Dimitris; Fukumori, Ichiro; Lee, Tong; Journal of Physical Oceanography; May 17, 2006; Volume 37, Issue 2, pp. 359-376; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40383; http://dx.doi.org/10.1175/JPO3015.1

Observations and numerical simulations show that winds near Gibraltar Strait cause an Atlantic Ocean to Mediterranean Sea sea level difference of 20 cm peak to peak with a 3-cm standard deviation for periods of days to years. Theoretical arguments and numerical experiments establish that this wind-driven sea level difference is caused in part by storm surges due to alongshore winds near the North African coastline on the Atlantic side of Gibraltar. The fraction of the Moroccan coastal current offshore of the 284-m isobath is deflected across Gibraltar Strait, west of Camarinal Sill, resulting in a geostrophic surface pressure gradient that contributes to a sea level difference at the stationary limit. The sea level difference is also caused in part by the along-strait wind setup, with a contribution proportional to the along-strait wind stress and to the length of Gibraltar Strait and adjoining regions and inversely proportional to its depth.
Author
Wind Shear; Coastal Currents; Atlantic Ocean; Mediterranean Sea; Oceanographic Parameters; Pressure Gradients; Straits; Gibraltar

20070034010 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Correlations Between Sea-Surface Salinity Tendencies and Freshwater Fluxes in the Pacific Ocean

Li, Zhen; Adamec, David; [2007]; 20 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Temporal changes in sea-surface salinity (SSS) from 21 years of a high resolution model integration of the Pacific Ocean are correlated with the freshwater flux that was used to force the integration. The correlations are calculated on a 1 x10 grid, and on a monthly scale to assess the possibility of deducing evaporation minus precipitation (E-P) fields from the salinity measurements to be taken by the upcoming Aquarius/SAC-D mission. Correlations between the monthly mean E-P fields and monthly mean SSS temporal tendencies are mainly zonally-oriented, and are highest where the local precipitation is relatively high. Nonseasonal (deviations from the monthly mean) correlations are highest along mid-latitude storm tracks and are relatively small in the tropics. The response of the model's surface salinity to surface forcing is very complex, and retrievals of freshwater fluxes from SSS measurements alone will require consideration of other processes, including horizontal advection and vertical mixing, rather than a simple balance between the two.

Author

Correlation; Fresh Water; Ocean Surface; Pacific Ocean; Salinity; Ocean Models

20070034032 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Spacebased Observations of Oceanic Influence on the Annual Variation of South American Water Balance

Liu, W. Timothy; Xie, Xiaosu; Tang, Wenqing; Zlotnicki, Victor; Geophysical Research Letter; April 27, 2006; ISSN 0094-8276; Volume 33; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40367; http://dx.doi.org/10.1029/2006GL025683

The mass change of South America (SA) continent measured by the Gravity Recovery and Climate Experiment (GRACE) imposes a constraint on the uncertainties in estimating the annual variation of rainfall measured by Tropical Rain Measuring Mission (TRMM) and ocean moisture influx derived from QuikSCAT data. The approximate balance of the mass change rate with the moisture influx less climatological river discharge, in agreement with the conservation principle, bolsters not only the credibility of the spacebased measurements, but supports the characterization of ocean's influence on the annual variation of continental water balance. The annual variation of rainfall is found to be in phase with the mass change rate in the Amazon and the La Plata basins, and the moisture advection across relevant segments of the Pacific and Atlantic coasts agrees with the annual cycle of rainfall in the two basins and the Andes mountains.

Author

Water Balance; Annual Variations; Gravitation; Climatology; Oceans

20070034033 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Application of the Convolution Formalism to the Ocean Tide Potential: Results from the Gravity and Recovery and Climate Experiment (GRACE)

Desai, S. D.; Yuan, D. -N.; Journal of Geophysical Research; June 17, 2006; ISSN 0148-0227; Volume 111; 13 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40366; http://dx.doi.org/10.1029/2005JC003361

A computationally efficient approach to reducing omission errors in ocean tide potential models is derived and evaluated using data from the Gravity Recovery and Climate Experiment (GRACE) mission. Ocean tide height models are usually explicitly available at a few frequencies, and a smooth unit response is assumed to infer the response across the tidal spectrum. The convolution formalism of Munk and Cartwright (1966) models this response function with a Fourier series. This allows the total ocean tide height, and therefore the total ocean tide potential, to be modeled as a weighted sum of past, present, and future values of the tide-generating potential. Previous applications of the convolution formalism have usually been limited to tide height models, but we extend it to ocean tide potential models. We use luni-solar ephemerides to derive the required tide-generating potential so that the complete spectrum of the ocean tide potential is efficiently represented. In contrast, the traditionally adopted harmonic model of the ocean tide potential requires the explicit sum of the contributions from individual tidal frequencies. It is therefore subject to omission errors from neglected frequencies and is computationally more intensive. Intersatellite range rate data from the GRACE mission are used to compare convolution and harmonic models of the ocean tide potential. The monthly range rate residual variance is smaller by 4-5%, and the daily residual variance is smaller by as much as 15% when using the convolution model than when using a harmonic model that is defined by twice the number of parameters.

Author

Ocean Models; Climate; Errors; Gravitation; Tides

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*.

20070032998 Naval Medical Research Center, Silver Spring, MD USA
Human Infection with Rickettsia honei, Thailand
Jiang, Ju; Sangkasuwan, Vichai; Lerdthusnee, Kriangkrai; Sukwit, Suchitra; Chuenchitra, Tippawan; Rozmajzl, Patrick J; Eamsila, Chirapa; Jones, James W; Richards, Allen L; Sep 2005; 4 pp.; In English
Report No.(s): AD-A469012; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469012

The original Thai tick typhus isolate, TT-118, was obtained from a mixed pool of Ixodes sp. and Rhipicephalus sp. larval ticks from Rattus rattus trapped in Chiangmai Province, Thailand, in 1962 (1) and has recently been determined to be a strain of Rickettsia honei, the etiologic agent of Flinders Island spotted fever (2). No isolate has been associated with Thai tick typhus in humans, and TT-118 was found only to be moderately pathogenic for guinea pigs and gerbils (1). However, evidence of spotted fever rickettsiosis has been seen in Thailand; this evidence comes from 2 reports of a total of 11 cases, 3 cases from Chiangmai and 8 cases from the Thailand-Burma border. All 11 patients had signs and symptoms characteristic of spotted fever rickettsiosis, and their sera were reactive to spotted fever group (SFG) rickettsial antigens, including those derived from TT-118 (3,4). Additional proof of the presence of spotted fever rickettsiae in Thailand derives from rodent (5) and human (6,7) serosurveys. In addition, spotted fever agents have been demonstrated in Thai ticks by using molecular biology techniques to detect rickettsiae (8 10). Collectively, these reports indicate that SFG rickettsiae and rickettsioses exist within Thailand. However, at the time of this writing, detection of an SFG rickettsia from a human source had not been reported in Thailand. DTIC
Infectious Diseases; Thailand

20070033000 Loma Linda Veterans Association for Research and Education, Loma Linda, CA USA
Molecular Genetic and Gene Therapy Studies of the Musculoskeletal System
Mohan, Subburaman; Feb 2007; 223 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-2-0021
Report No.(s): AD-A469196; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469196

The proposed research projects focuses on bone health, including relevance to the musculoskeletal system in battlefield performance and in battlefield injury. We have utilized state-of-the-art molecular genetic and gene therapy technologies to address fundamental questions in bone biology with particularly emphasis on attempting to clarify gene function for those genes that are involved in digit tip regeneration, bone size, skeletal repair and anabolic response to mechanical loading. The molecular genetic approaches have utilized various knockout mouse models and whole genome microarray analysis for evaluation of gene functions. The gene therapy approaches have utilized various viral and non-viral vectors to transfer gene of interest to treat localized and systemic skeletal deficits. We have successfully accomplished nearly all of the objectives proposed for the past year. The four core facilities funded by this project have contributed enormously to the success of our research activities. Our research activities during the past year have lead to 5 publications and 2 abstracts. We believe that our successful completion of proposed studies will provide a foundation of knowledge 1) that will allow the identification of genes that are involved in regulating skeletal repair, regeneration, and/or as well anabolic response to mechanical stress and 2) that will provide proof of principles in animal models for successful gene therapy applications to accelerate endosteal bone formation and healing of skeletal injuries.
DTIC
Gene Therapy; Genetics; Musculoskeletal System

20070033002 State Univ. of New York at Buffalo, Amherst, NY USA
Prostate Can Men: The Effect of Body Habitus and Physical Activity
Crespo, Carlos J; Feb 2006; 91 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0252
Report No.(s): AD-A469203; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469203

Prostate cancer kills more Puerto Rican men than the combined cancer mortality rates of the lung, trachea and bronchus.

The most extensively studied risk factors for prostate cancer include age, race/ethnicity, family history, diet, androgen metabolism, alcohol consumption, obesity, physical activity and smoking. Of these, age, race and family history are well documented but poorly understood risk factors. The fact that prostate cancer rates change in migrant populations and vary dramatically in ethnically similar populations residing in different geographic locations strongly suggest that environmental factors can greatly influence the risk of this cancer. The purpose of this investigation is therefore, to study the relationship of physical activity and body habitus with prostate cancer mortality among Puerto Rican men. This study uses an observational longitudinal design with a random sample of 9,824 Puerto Rican men aged 35-79 years at baseline (1964) who were part of the Puerto Rico Heart Health Program (PRHHP). The Puerto Rico Heart Health Program provides a unique epidemiological cohort of men who took part in multiple examinations including extensive information on lifestyle, diet, body composition, exercise, and smoking habits. Survival analyses will be used to study the relationship between prostate cancer mortality and physical inactivity and obesity with approximately 35 years of follow up data. This research is to generate new knowledge of how sedentary lifestyles or excess body weight are related to prostate cancer mortality, and to increase our knowledge of prostate cancer in a population where prostate cancer is the number one killer. Additionally, once prostate cancer mortality is identified, other exposures such as diet, smoking and alcohol intake can also be studied.
DTIC
Cancer; Mortality; Prostate Gland

20070033003 Walter and Eliza Hall Inst. of Medical Research, Melbourne, Australia
Breast Stem Cell Markers and Tumor Stem Cells in BRCA1, BRCA2 and Non-BRCA 1/2 Women
Lindeman, Geoffrey J; Visvade, Jane E; Sambrook, Joseph; Vaillant, Francois; Forrest, Natasha; Aug 2006; 11 pp.; In English
Contract(s)/Grant(s): W81XWH-05-1-0506
Report No.(s): AD-A469204; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469204

It is believed that certain breast tumors originate in either a breast stem or progenitor cell. Notably, tumors that arise in women carrying a BRCA1 gene mutation often exhibit a basal phenotype that may reflect their origin in the breast stem cell. We therefore hypothesized that the breast stem cell pool is aberrant in breast tissue of BRCA1 (or BRCA2)carriers versus noncarriers and that it becomes progressively and distinctively expanded in older carriers. To evaluate this concept, we performed a pilot study in which we obtained archival samples from breast tissue from the Kathleen Cuningham Foundation Consortium for Research into Familial Breast Cancer (kConFab). We first derived and analyzed subpopulations of breast tissue for the expression of putative stem cell markers and investigated means to derive short-term in vitro cultures. Our preliminary findings indicate that it is possible to identify distinct subpopulations in normal breast tissue and tissue derived from BRCAmutations carriers. These studies our now being extended to study putative stem and progenitor populations using reduction mammoplasties and prophylatic mastectomy specimens.
DTIC
Breast; Cancer; Cells (Biology); Females; Genes; Mammary Glands; Markers; Stem Cells; Tumors

20070033004 Jackson (Henry M.) Foundation, Rockville, MD USA
Avian Influenza/Pandemic Influenza Program
Hapner, Ralph W; Sep 2006; 7 pp.; In English
Contract(s)/Grant(s): W81XWH-06-2-0040
Report No.(s): AD-A469205; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469205

The Henry M. Jackson Foundation will provide space, personnel, equipment and to support surveillance and efforts in support of the Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) research related to avian influenza and pandemic influenza preparedness and response. The Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) has been charged to manage a $39M congressional supplement for Avian/Pandemic Influenza. Time is of the essence and Congress expects improved DoD surveillance systems to be in place early. The urgency imposed on us by Congress and the even greater urgency of having an enhanced surveillance system in place before, not after, the pandemic start is critical. The Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) central hub will initiate a plan to provide funding, personnel resources, the centralized management for coordination and reporting related to the DoD efforts for improving global surveillance and efforts in support

of research related to avian influenza/pandemic influenza. The results of these efforts will be coordinated with the Unified Combatant Commands and other military and civilian organizations/agencies.
DTIC
Birds; Influenza; Medical Science

20070033005 Stanford Univ., Stanford, CA USA
Characterizing Candidate Oncogenes at 8q21 in Breast Cancer
Kao, Jessica; Mar 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0424
Report No.(s): AD-A469206; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469206

DNA amplification is a cardinal feature of cancer and plays an important role in tumor progression by altering the gene expression program. These amplified regions are associated with oncogenes of known and unknown identity. By utilizing array comparative genomic hybridization technology to map DNA copy number changes at high resolution we have identified a recurrent region of high-level amplification at the 8q21 locus that is clinically significant in breast cancer by our preliminary analysis and has yet to be associated with a known oncogene. We have narrowed down this region to two annotated genes with unknown function. In this study we have: (1) created stable cell lines expressing shRNA constructs that will express an siRNA causing inhibition of each candidate oncogene respectively. (2) begun to generate overexpression vectors for each candidate oncogene. (3) raised antibodies to each of the candidate oncogene to further characterize the protein of each candidate oncogenes. Ultimately this novel oncogene may serve as a new drug target.
DTIC
Breast; Cancer; Mammary Glands; Oncogenes; Tumors

20070033006 Florida Atlantic Univ., Boca Raton, FL USA
Oral Administration of N-Acetyl-D-Glucosamine Polymer Particles Down-Regulates Airway Allergic Responses
Shibata, Yoshimi; Mar 2007; 71 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0004
Report No.(s): AD-A469207; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469207

This is an annual report of the 4th grant year. PI and 2 Research Associates moved to the current Institute in 2003 from East Carolina University. The project was re-started in December 2004 with approval of no-cost extension until 5/23/2008. In this grant period, we found that administration of chitin particles resulted in less likely inhibit the production of IL-10. Although chitin particles induce peritoneal macrophages catalytically active COX-2 in vitro, intraperitoneal administration induces peritoneal macrophages catalytically inactive COX-2. COX-2, cyclooxygenase, is necessary enhancing prostaglandin E2 (PGE2) release. Both IL-10 and PGE2 enhance allergic responses. We have also planned to establish a method producing chitin particles at 500 1,000 gram per batch.
DTIC
Acetic Acid; Allergic Diseases

20070033007 Washington Univ., Saint Louis, MO USA
Noninvasive Localization of Prostate Cancer via Diffusion Sensitive MRI
Xu, Junqian; Mar 2007; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0210
Report No.(s): AD-A469208; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469208

Diffusion tensor magnetic resonance imaging (DTI) measurements of prostate cancer (PCa) were performed in vivo, in patients undergoing radical prostatectomy, and ex vivo, in the same patients' prostatectomy specimens. For the first time, the imaging data were co-registered to histological sections of the prostatectomy specimens, thereby enabling unambiguous characterization of diffusion parameters in cancerous and benign tissues. Through image co-registration and histological analysis, we have shown that increased cellularity, and thence decreased luminal spaces, in peripheral zone PCa leads to about 40 % and 50 % apparent diffusion coefficient (ADC) decrease compared to benign peripheral zone tissues in vivo and ex vivo, respectively. In contrast, no significant diffusion anisotropy differences between the cancerous and noncancerous peripheral zone tissues were observed. The bundled fibromuscular tissues in prostate, such as stromal tissues in benign prostatic

hyperplasia (BPH), exhibited high diffusion anisotropy facilitating the differentiation of PCa from BPH in central gland. A tissue classification method, combining DTI and T2w images, was proposed to provide more specific PCa detection. An ADC threshold for PCa was also established to provide unsupervised PCa localization. The PCa identified using this method correlate well with histologically identified PCa foci.
DTIC
Anisotropy; Cancer; Diffusion; Imaging Techniques; Magnetic Resonance; Position (Location); Prostate Gland; Sensitivity

20070033008 Physical Sciences, Inc., Andover, MA USA
Characterization of Fluorescence in the Marine Environment
Mazel, Charles H; Jun 14, 2007; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-C-0130
Report No.(s): AD-A469209; PSI-1377/TR-2222; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469209

The overall goal or this project was to explore for and document the fluorescence or marine organisms, primarily on the seafloor, but also in the water column. We wish to determine the nature and distribution, both geographic and taxonomic, of the effect. The information gained has potential application to mapping and assessment of the sea floor, to studies of fundamental processes in marine biology, and to discovery of novel fluorescing proteins.
DTIC
Fluorescence; Marine Biology; Marine Environments; Organisms; Proteins

20070033009 Army Center for Environmental Health Research, Fort Detrick, MD USA
Global Alterations in Gene Expression During Organophosphate Pesticide Intoxication and Recovery: Interim Report
Szilagyi, Maria; Gehman, Elizabeth; Lapenotiere, Hugh; Lewis, John; Clegg, Eric; Jackson, David A; Apr 2006; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469210; USAMRICD-TR-06-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469210

The effects of low-level, transient exposures to organophosphate pesticides (OPP) and chemically related nerve agents (e.g., sarin, soman, tabun) remain difficult to detect. Because Caenorhabditis elega is relatively resistant to OPP lethality, studies in this nematode provide an opportunity to observe alterations in global gene expression following OPP exposure that cannot be readily observed in less resistant organisms. It may be possible to highlight changes in gene expression that might be important in low-level, transient exposures. Conventional culture techniques for C. elegans use bacteria as food source. The presence of the bacteria may confound interpreting the effects of a test substance if the substance is metabolized by the bacteria. Further, it can be difficult to purify worm nucleic acids away from those of the bacteria for analysis. We developed a liquid medium, CeHR medium, to facilitate the propagation of worms in the absence of bacteria. We exposed cultures of worms in CeHR medium to 2 doses of dichlorvos under 3 exposure protocols. In the first, worms were exposed continuously throughout the experiment. In the second and third, worms were exposed for 2 or 8 h, the dichlorvos was washed out of the culture, and the worms were allowed to recover. We then harvested RNA for global gene expression studies.
DTIC
Gene Expression; Genes; Intoxication; Nerves; Organic Phosphorus Compounds; Pesticides

20070033010 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA
Analyzing Protein Changes in Guinea Pig Tissue Lysates Using Non-guinea Pig Specific Antibodies: Procedures for Western Blotting and Examples Using 16 Individual Antibodies for Common CNS Proteins
Johnson, Erik A; Daugherty, Kelly S; May 2006; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469211; USAMRICD-TR-06-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469211

Behavioral studies investigating chemical weapon nerve agent (CWNA) exposure often utilize guinea pigs because their levels of carboxylesterase enzymes are similar to humans (Maxwell et al. 1987; Shih and McDonough 1999; Shih and McDonough 2000; de Groot et al. 2001). However, the guinea pig model does present a significant problem when trying to correlate behavioral and protein changes due to the absence of guinea pig-specific antibodies. We have developed a procedure to determine the specificity of commercially available, non-guinea pig-specific antibodies in guinea pig lysates. Common Western blotting techniques were used to compare immunostaining patterns of tissue lysates between a known species, rat, and the guinea pig using antibodies to several common CNS proteins. Of the sixteen antibodies tested, nine revealed the exact

same banding patterns as their rat lysate controls, five had similar banding patterns but required further characterization and two revealed no immunoreactivity. This report outlines the procedure for characterizing the immunoreactivity of these antibodies for use in guinea pig tissue lysates and identifies nine CNS proteins that can be labeled in this manner. This procedure should be of benefit to all investigators using the guinea pig behavioral model who wish also to investigate any underlying protein changes.
DTIC
Antibodies; Central Nervous System; Guinea Pigs; Proteins

20070033011 Food and Drug Administration, Laurel, MD USA
Prevention of Disease in Ferrets Fed an Inactivated Whole Cell Campylobacter jejuni Vaccine
Burr, Donald H; Rollins, David; Lee, Lanfong H; Pattarini, Dawn L; Walz, Steven S; Tian, Jing-Hui; Pace, John L; Bourgeois, A L; Walker, Richard I; Mar 29, 2005; 8 pp.; In English
Report No.(s): AD-A469212; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469212

Ferrets were used to demonstrate the potential of a killed whole cell vaccine prepared from Campylobacter jejuni to protect against disease. C. jejuni strain 81 176 was grown in BHI broth, formalin-fixed, and resuspended in PBS to a concentration of 1010 cells per ml. This vaccine (CWC) or live organisms were delivered orally with a nasogastric tube into anesthetized animals treated to reduce gastric acidity and intestinal motility. When 5 1010 CFU of the vaccine strain (Lior serotype 5) or one of two other serotypes, CGL-7 (Lior 4) or BT44 (Lior 9), was used to challenge the ferrets, all of the animals developed a mucoid diarrhea. If the animals had been challenged with 5 109 CFU of the homologous strain 1 month before challenge with 1010 CFU, 80 100% protection against disease was seen. This protection was also obtained after an initial exposure to the 81 176 strain followed by challenge with either of the heterologous strains. CWC was used to see if protection demonstrated with the live organisms could be produced with the non-living preparation. When 109 cells of CWC was given as two doses 7 days apart with or without 25 g of a coadministered mucosal adjuvant, LTR192G, only 40 60% of the animals were protected. If the regimen was changed to four doses given 48 h apart, 80% of the animals were free of diarrhea after subsequent challenge. Increasing the number of cells in the four dose regimen to 1010 cells did not improve protection. Animals given four doses of 1010 cells combined with LTR192G were subsequently challenged with 1010 cells of the homologous strain or the heterologous strain CGL-7. The CWC protected against both strains. Serum IgG antibody titers determined by ELISA showed little increase following the CWC four dose vaccination regimen, compared to animals given one dose of the live organism.
DTIC
Animals; Antibodies; Bacteria; Diseases; Health; Intestines; Prevention; Vaccines; Viruses

20070033014 Illinois Univ., Chicago, IL USA
1-Alpha Hydroxyvitamin D(5) as a Chemotherapeutic and Possibly Chemopreventive Agent
Das Gupta, Tapas K; Mar 2007; 241 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9223
Report No.(s): AD-A469217; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469217

We hypothesized that novel vitamin D analog 1α(OH)D5 (D5) will induce differentiation of dedifferentiated cells and prevent progression of malignancy in women with breast cancer. In 1999-2000, completed preclinical studies in rats showed D5 has no serious toxicity; high doses led to reversible hypercalcemic effect. In 2000-2001, we completed preclinical toxicity studies in dogs and D5 synthesis. In vitro studies suggested D5 has no effect on normal breast tissues. In 2001-2002, mechanistic studies performed and reported. In 2002-2003, in vitro studies suggested differential effect of D5 on ER+ vs. ER- cells and that VDR may partially mediate D5's action. Clinical trial protocols updated for UIC IRB and FDA. In 2003-2004, clinical protocol updated and approved by UIC IRB. Lutheran General Hospital removed from protocol. In 2004, preclinical toxicity studies completed. IND application submitted for FDA approval. FDA approved clinical protocol, withholding patient enrollment, pending clarification of drug product stability data since FDA chemists found several presumed deficiencies in study results. In 2006 pre-IND meeting, FDA approved stability study protocol. Contract was issued to complete required studies, which are underway, with results submitted to FDA. DOD has decided no further cash extension will be allowed and project is to be terminated.
DTIC
Breast; Calciferol; Cancer; Chemotherapy; Drugs; Health; Mammary Glands

20070033017 Health Research, Inc., Buffalo, NY USA

Role of Proinflammatory Cytokines in Thermal Activation of Lymphocyte Recruitment to Breast Tumor Microvessels

Qing, Chen; Mar 2007; 150 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0354

Report No.(s): AD-A469221; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469221

The tumor microvasculature is a barrier to immunotherapy because of its failure to express adhesion molecules necessary for recruitment of tumor-reactive lymphocytes. Immune cells are frequently excluded from the intratumoral region of primary tumors including breast cancer. Our studies demonstrate that fever-range thermal therapy increases lymphocyte trafficking selectively in tumor sites and secondary lymphoid organs, but not in extralymphoid organs. Intravital microscopy studies and short term homing assays allow us to observe thermal enhanced lymphocyte-endothelial interactions in vivo. Underlying mechanism was detected focusing on the trafficking molecules which control egress of blood-borne lymphocytes into tissues. Heat treatment enhanced intravascular expression of intercellular adhesion molecule-1 (ICAM-1) in tumor microvessels and high endothelial venules in lymphoid organs. This induced ICAM-1 expression is functional linked with thermal activated lymphocyte-endothelial interaction and lymphocyte homing. Neutralization of proinflammatory cytokines IL-6, but not TNF or IL-1 beta, suppresses thermal induction of ICAM-1-dependent lymphocyte recruitment. Soluble gp130 also prevented ICAM-1 induction, indicating that thermal activities in vascular targets are dependent on an IL-6 trans-signaling mechanism. These results support the hypothesis that IL-6-dependent signaling mechanisms activate tumor immunity through stimulation of heightened trafficking of lymphocyte subsets to tumor sites and lymphoid organs during fever-range thermal therapy.

DTIC

Blood Vessels; Breast; Cancer; Cardiovascular System; Lymphocytes; Mammary Glands; Thermodynamic Properties; Tumors

20070033018 McGill Univ., Montreal, Quebec Canada

Mammary Gland Tumor Development in Transgenic Mice Overexpressing Different Isoforms of the CDP/Cux Transcription Factor

Cadieux, Chantal; Mar 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0294

Report No.(s): AD-A469226; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469226

Short CDP/Cux isoforms were found to be overexpressed in breast cancer cell lines, in human breast tumors and in uterine leiomyomas, suggesting that these proteins play a key role in tumor development and progression. My project consists in analyzing the effect of these CDP/Cux isoforms on mammary gland development and tumorigenesis. Also, I will work on the identification of targets of CDP/Cux that mediate its oncogenic properties. So far, I have shown that overexpressing short CDP/Cux isoforms lead to abnormal development of the mammary gland. Furthermore, overexpressing p75, p110 or p200 CDP/Cux leads to the development of mammary gland tumors in mice. These tumors seem to be of basal origin, suggesting that CDP/Cux promotes tumorigenesis in a precursor cell. Breast tumor patients with similar types of disease have very low chances of survival, since no specific treatment is currently available for them. Thus, my research project will enable us to gain a better understanding of the biological functions of each CDP/Cux isoform in mammary gland development and tumorigenesis, which could possibly lead to new therapeutic targets for the treatment of basal breast cancers.

DTIC

Breast; Cancer; Mammary Glands; Mice; Tumors

20070033023 Stevens Inst. of Tech., Hoboken, NJ USA

A Wireless Testbed Development for a Telediagnosis and Telemammography Network

Yao, Yu-Dong; man, Hong; Tureli, Uf; Jan 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0326

Report No.(s): AD-A469239; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469239

In this research training program undergraduates in electrical and computer engineering learning the role of engineering in the cure of breast cancer specifically developing communications networks and imaging processing techniques for the early detection and diagnosis of breast cancer. Providing mammographic services to women in underserved areas via telemammography is very important. With remote computer-aided breast cancer detection and diagnosis it has the advantage

of higher penetration of women for cancer screening. Through this training program the trainees learn the process of breast cancer diagnosis and the role of mammography understand the role of wireless communications in telemammographic services.
DTIC
Breast; Cancer; Education; Mammary Glands

20070033024 Colorado Univ., Aurora, CO USA
The Role of Akt and its Substrates in Resistance of Breast Cancer to Trastuzumab
Young, Christian D,; Mar 2007; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0423
Report No.(s): AD-A469240; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469240

The ability of Trastuzumab, a drug for treatment of HER2 overexpressing breast cancer, to induce apoptosis in HER2 overexpressing breast cancer lines was investigated. Particular attention was paid to the role of Akt downregulation by Trastuzumab and the resulting upregulation of pro-apoptotic Akt substrates. Trastuzumab was found to induce very little apoptosis and a few Akt substrates investigated Bad and FKHR were not affected by Trastuzumab treatment. Additional studies investigated the affect of Trastuzumab on the upregulation of the GLUT1 glucose transporter in HER2 overexpressing breast cancer cells. Trastuzumab inhibited the Cobalt-dependent induction of GLUT1. This indicates Trastuzumab may have affects on hypoxic tumors because Cobalt stimulation mimics a cell's response to hypoxia which results in induction of GLUT1 which in turn accelerates aerobic or anaerobic glycolysis for tumor growth and survival.
DTIC
Breast; Cancer; Mammary Glands; Substrates

20070033025 Cincinnati Univ., OH USA
Investigation of a Putative Estrogen-Imprinting Gene, Phosphodiesterase Type IV Variant (PDE4D4), in Determining Prostate Cancer Risk
Tang, Wan-Yee; Apr 2007; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0373
Report No.(s): AD-A469241; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469241

Estrogens are known to play a role in the initiation and progression of prostate cancer. Recently environmental factors such as xenoestrogens have been reported on their prevalence of prostate diseases or cancers. Estrogen imprinting of the prostate gland is believed to associate with an increased incidence of prostatic lesions including inflammation epithelial hyperplasia squamous metaplasia dysplasia and adenocarcinoma. And DNA methylation may be one of the possible mechanisms of the prostate reprogramming. By using one of the global methylation profiling techniques MSRF a gene called phosphodiesterase type IV variant 4 (PDE4D4) was shown to be hypomethylated following neonatal exposure to estradiol (EB) or bisphenol A (BPA). We further confirmed the persistence of PDE4D4 promoter hypomethylation and gene up-regulation in the adult life by using bisulfite genomic sequencing and real-time PCR. PDE4D4 has function of cAMP-degradation to maintain the second messenger cAMP in a narrow range of concentrations that is critical for growth and differentiation of the hormone target cells by activating several downstream signaling molecules. Taken together these findings supported that PDE4D4 dysregulation via CpG island hypomethylation at its promoter regions in early life by EB or BPA can alter its expression and activity of the gene. Present data also suggested that PDE4D4 can be used as a biomarker for prostate cancer assessment.
DTIC
Cancer; Enzyme Activity; Estrogens; Prostate Gland; Risk

20070033026 Kentucky Univ., Lexington, KY USA
Reconstruction, Enhancement, Visualization, and Ergonomic Assessment for Laparoscopic Surgery
Seales, W B; Feb 1, 2007; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-2-0015
Report No.(s): AD-A469242; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469242

The goal of this work is to develop and test new technologies that will break down the barriers that block more surgeons

from attaining and continuing to practice (without injury or pain) high levels of skill in minimally invasive surgery (MIS). This project will develop new technology by concentrating on three major research thrusts: Smart Image: the project will develop and evaluate new approaches for extrading fusing and presenting information cues from imagery and other data sources; Configurable Display: the project will develop new approaches for presenting existing data (video CT data) and extracted cues (3D reconstruction haptic cues etc.) to the user within a flexible configurable display environment; Ergonomic Assessment: the project will use existing technology and build new techniques as needed to acquire crucial ergonomic data relative to key factors of patient position technology configuration and instrument design.
DTIC
Augmentation; Display Devices; Human Factors Engineering; Surgery

20070033027 Baylor Coll. of Medicine, Houston, TX USA
p190-B, A Novel RhoGAP, In Mammary Gland Development and Breast Cancer Progression
Vargo-Gogola, Tracy; Rosen, Jeffrey M; Sep 2006; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0325
Report No.(s): AD-A469243; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469243

We have examined the effects of loss and gain of p190-B RhoGAP function on embryonic and postnatal mammary gland development respectively. Using inducible p190-B overexpressing mice we have shown that p190-B plays an essential role in the developing mammary gland by regulating both mammary epithelial cell behavior and the microenvironment. lnteresbngly overexpression of p190-B during pregnancy results in hyperplastic lesions suggesting that p190-B may affect breast tumorigenesis. P190-B is also required for embryonic mammary gland development because homozygous deletion of p190-B results in smaller buds with diminished mesenchyme. interactions between the p190-B and IGF-IR signaling pathways affect both embryonic and postnatal mammary gland development. Finally using inducible p190-B overexpressing McF-7 human breast cancer cells we have demonstrated a novel role for p190-B as a regulator of mitosis and cytokinesis. Overexpression of pI 90-B leads to failed cytokinesis multinucleation and potentially genomic instability. We propose that this may be one mechanism by which p190-B contributes to breast tumorigenesis.
DTIC
Breast; Cancer; Mammary Glands; Neoplasms

20070033028 Washington Univ., Seattle, WA USA
Patient Safety Center Organization
Sinanan, Mika N; Jun 2006; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-2-0056
Report No.(s): AD-A469244; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469244

With patient safety and improved outcomes as its focus, the Institute for Surgical and Interventional Simulation (ISIS) is dedicated to the training of medical professionals in technical and procedural skills, and research and development of emerging simulation technologies and educational strategies. ISIS is a collaborative Instituted on the University of Washington School of Medicine. It connects fifteen departments within the School of Medicine, the School of Nursing, the Biorobotics Laboratory, the Human Interface Technology Lab, and the Center of Videoendoscopic Surgery. It offers educational opportunities across the spectrum of medicine, including practicing physicians, residents, medical students, nurses, and other medical professions. This model has applicability in civilian and military settings, as expertise from both can be combined into comprehensive simulation programs. ISIS and the Anderson Simulation Center at Madigan Army Medical Center (MAMC) represent an excellent opportunity to demonstrate the benefits of such a relationship.
DTIC
Education; Medical Personnel; Patients; Project Management; Safety; Simulation; Surgery

20070033031 Loma Linda Veterans Association for Research and Education, Redlands, CA USA
Molecular Genetic Studies of Bone Mechanical Strain and of Pedigrees with Very High Bone Density
Mohan, Subburaman; Nov 2006; 91 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0744
Report No.(s): AD-A469247; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469247

The primary goal of the proposed work on bone mechanical strain focuses on identifying the genes and their functions

involved in mediating the anabolic skeletal response to mechanical stress. Two hypotheses have been proposed: 1) Quantitative trait loci analysis using the four point bending technique in two strains of mice exhibiting extreme differences in loading response will lead to identification of chromosomal locations of genes involved in variation in skeletal response to mechanical loading. 2) Application of microarray and tyrosine phosphorylation studies using bone cells derived from inbred strains of mice exhibiting extreme differences to loading response and physiologically relevant fluid flow shear strain will lead to identification of key signaling genes and their pathways that contribute to variation in bone cell response to mechanical strain. During the last funding period we proposed several specific objectives for each of the above-mentioned hypothesis. We have made considerable progress in accomplishing all of the specific objectives. Our work during this reporting period has resulted in two published manuscripts and three abstracts. We believe that successful accomplishment of the proposed studies will provide a better understanding of the molecular mechanisms involved in identifying the genes and their function as related to mechanical stress.
DTIC
Bone Mineral Content; Bones; Genes; Genetics; Stress Analysis

20070033033 Vanderbilt Univ., Nashville, TN USA
Laminin-5 gamma2 Chain in Breast Cancer Metastasis
Liu, Shanshan; Feb 2007; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0308
Report No.(s): AD-A469249; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469249

To metastasize, cancer cells have to break through basement membrane (BM). Laminin-5 is one of the most abundant BM proteins. It consists of three chains alpha3, beta3 and gamma2. DIII domain, a functional EGFR ligand will be released from Ln-5 2 chain by MMPs processing. It has been suggested by our lab that DIII domain may facilitate cancer progression by preventing anoikis. There are paradoxical data in regard of the role of Ln-5 in cancer progression. For example, both the increased and decreased expression levels of Ln-5 subchains are reported in the literature. The fact that gamma2 chain exists in two different forms (as a secreted monomer, or as a part of the Ln-5 heterotrimer) leads us to hypothesize that those two forms may play different roles in cancer progression. In this proposal we will determine if the expression of Ln-5gamma2 monomer is positively correlated with breast cancer cell line tumorigenecity. In addition, we will determine the role of Ln-5gamma2 chain in cancer progression when it is in the context of Ln-5 heterotrimer.
DTIC
Breast; Cancer; Mammary Glands; Metastasis; Monomers

20070033035 Nebraska Univ., Omaha, NE USA
MT 2A Phosphorylation by PKC Mu/PKD Influences Chemosensitivity to Cisplatin in Prostate Cancer
Kethandapatti, Balaji C>; Jaagi, Meena; SMith, David J; Zhang, Wenguang; Du, Cheng; Smith, Lynette M; Galich, Anton; Nov 2006; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0045
Report No.(s): AD-A469252; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469252

The metallothioneins (MT) are a family of small molecular weight trace metal and free radical scavenging proteins well established to play a role in resistance to chemotherapy and radiation in human cancer. MT gene expression is up regulated in response to the presence of heavy metal ions such as zinc. We have previously established a physiological in vitro cell line model of MT induction using Zn, which is significantly associated with resistance to cisplatin chemotherapy in PC. In this report, our data demonstrates that treatment with TPEN, a Zn specific chelator, significantly improves sensitivity to cisplatin in prostate cancer cells.
DTIC
Cancer; Chelation; Chemotherapy; Phosphorylation; Prostate Gland

20070033037 Georgetown Univ., Washington, DC USA
Periscopic Spine Surgery
Cleary, Kevin R; Jan 2006; 119 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0078
Report No.(s): AD-A469254; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469254

The Periscopic Spine Surgery project was envisioned to lay the ground work for developing the physician assist systems

of the future. These systems will incorporate robotics, tracking, and visualization to improve the precision of instrument placement and manipulation in minimally invasive procedures. This project has enabled the Georgetown team to become a world leader in the emerging fields of computer aided surgery and medical robotics. Our goal will continue to be to develop systems to add the physician in these demanding minimally invasive procedures with the ultimate aim of improving patient care. Key research accomplishments included: 1. Investigated methods for slice to volume registration of CT fluoroscopy images to provide image guidance for lung biopsy. 2. Completed an approved swine study in the CT procedure room demonstrating the feasibility of electromagnetic position sensing for image guidance. 3. Completed an initial accuracy study of electromagnetic position sensing in the CyberKnife suite and showed that relatively good accuracy could be obtained even with the LINAC (radiation beam) turned on. 4. Developed the software architecture and software implementation for an open source image-guided surgery toolkit. 5. Completed an initial study of workflow in the interventional suite for spinal nerve blocks.
DTIC
Architecture (Computers); Computer Aided Design; Electromagnetism; Health; Physicians; Robotics; Spine; Surgery

20070033041 Georgetown Univ., Washington, DC USA
Periscopic Spine Surgery
Cleary, Kevin R; Jan 2007; 117 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0078
Report No.(s): AD-A469259; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469259

The Periscopic Spine Surgery project was envisioned to lay the ground work for developing the physician assist systems of the future. These systems will incorporate robotics, tracking, and visualization to improve the precision of instrument placement and manipulation in minimally invasive procedures. This project has enabled the Georgetown team to become a world leader in the emerging fields of computer aided surgery and medical robotics. Our goal will continue to be to develop systems to add the physician in these demanding minimally invasive procedures with the ultimate aim of improving patient care. Key research accomplishments included: 1. Developed a novel end-effector and automated registration technique for instrument guidance during minimally invasive procedures using a portable needle driver robot. 2. Developed a prototype exoskeleton for shoulder therapy during rehabilitation. 3. Completed a clinical trial on sensorimotor adaptation using a forearm-based robotics system. 4. Developed an open source software architecture and implementation for rapid prototyping of imageguided surgery systems. 5. Completed an image-guided system for more accurate transbronchial biopsy based on electromagnetic tracking of instruments.
DTIC
Architecture (Computers); Computer Aided Design; Health; Robotics; Spine; Surgery

20070033042 Texas Univ., Austin, TX USA
Structure-Based Design of Inhibitors to the Cytotoxin Ricin
Robertus, Jon; Apr 2007; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-C-0088
Report No.(s): AD-A469261; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469261

Ricin is a cytotoxin and a known bioterrorist weapon. The Army is pursuing anti-ricin vaccines but plans to develop an efficacious antidote to the toxin for cases where vaccination is not appropriate. The goal of this project is use the X-ray structure of ricin A chain (RTA) as a template for inhibitor design. Computer modeling and X-ray screening aid in the design process. Inhibitors which bind to the RTA substrate specificity site have been identified. A platfdrm 9-deazaguanine has been shown to bind in the RTA active site and act as a weak inhibitor. However efforts to derivatize and diversify the platform via triazole %click' chemistry have met with unanticipated difficulties. None of the new compounds exhibits greatly improved inhibitory properties. A virtual screen of available compounds suggests catechols may provide a novel platform for future work.
DTIC
Inhibitors; Toxins and Antitoxins

20070033044 Chicago Medical School, Chicago, IL USA

Biohazard Detoxification Method Utilizing Magnetic Particles

Rosengart, Axel J; May 2007; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0403

Report No.(s): AD-A469264; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469264

We are developing a novel, integrated system based on superparamagnetic, biocompatible nanospheres for selective and rapid detoxification of biological, chemical, or radioactive toxins from humans. After intravascular injection, the circulating nanospheres would bind to blood-borne toxins due to selective receptors attached to the nanosphere surface. After circulation, a suitable artery or vein is accessed with a small, hand held magnetic filter unit. The blood is purified of the toxin-loaded nanospheres within the unit and the clean blood is returned to the body. The concentrated toxins can now be disposed or submitted for assay or forensics. At the end of the funding period we have accomplished several key technological goals. A) We have a reproducible procedure for producing PEGylated PLGA/PLA nanospheres of discrete size in a range of 100 nm to 500 nm. We have finalized and are in the process of publishing our in vitro work which identifies the biocompatibility and non-toxicity of the designer spheres. B) Further, we have developed a prototype magnetic separator suitable for ambulatory usage and tested its performance in vitro flow models.

DTIC

Biological Hazards; Biological Weapons; Hazards; Magnetic Fields; Separators

20070033046 Vanderbilt Univ., Nashville, TN USA

Understanding the Mechanism through which Matrix Metalloproteinases (MMPs) Contribute to Breast Cancer-Associated Osteolytic Lesions

Thiolly, Sophie; Mar 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0320

Report No.(s): AD-A469268; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469268

Bone metastasis is a common event during breast cancer progression. Matrix metalloproteinases (MMPs) are often overexpressed in breast cancer and play an important role in tumor progression. Metastatic breast cancer is typically osteolytic and we hypothesize that specific stromal and tumor MMPs contribute to the growth and the development of osteolytic lesions. To address the role of individual stromal MMPs in vivo we used an intratibial model that recapitulates breast tumor induced osteolysis. We demonstrated that stromal MMP-2 is required for mammary tumor growth in bone by contributing to the proliferation and the survival of the tumor. Developing our understanding of the roles of specific MMPs in breast induced-bone osteolysis will hopefully open the way for new therapeutics.

DTIC

Breast; Cancer; Lesions; Mammary Glands

20070033069 California Univ., Los Angeles, CA USA

Integrating Molecular Imaging Approaches to Monitor Prostate Targeted Suicide and Anti-angiogenic Gene Therapy

Sato, Makoto; Feb 2005; 76 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0094

Report No.(s): AD-A469316; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469316

To develop safe and efficient gene therapy protocol for advanced stages of prostate cancer, we aimed to combine the selective suicide and anti-angiogenic gene therapy approaches into an effective targeted treatment for prostate cancer. We propose to incorporate a strong and tissue-specific two-step transcriptional amplification(TSTA) system to mediate prostate-targeted thymidine kinase (sr39tk) gene expression in prostate cancer cells. This targeted vector can be also utilized as a positron emission tomography (PET) reporter. We have shown that the TSTA-sr39tk adenoviral vector, in combination with prodrug ganciclovir, efficiently killed tumor cells whereas it exhibited minimal liver toxicity compared to CMV-sr39tk vector in human prostate tumor xenografed mice model. In addition, the anti-angiogenic adenoviral vectors expressing TSP1 and ADAMTS1 exhibited a strong inhibitory effect on the initial development of hormone refractory prostate cancer CWR22Rv1 cell lines in nudemice. We foresee that anti-angiogenic adenoviral vectors, in combination with the prostate targeted TSTAvector, will be an excellent therapeutic option for advanced stages of prostate cancer.

DTIC

Cancer; Gene Therapy; Imaging Techniques; Prostate Gland

20070033079 Naval Medical Research Center, Silver Spring, MD USA

Scrub Typhus Vaccine Candidate Kp r56 Induces Humoral and Cellular Immune Responses in Cynomolgus Monkeys

Chattopadhyay, Suchismita; Jiang, Ju; Chan, Teik-Chye; Manetz, T S; Chao, Chien-Chung; Ching, Wei-Mei; Richards, Allen L; Mar 28, 2005; 10 pp.; In English

Report No.(s): AD-A469347; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469347

A truncated recombinant 56-kDa outer membrane protein of the Karp strain of Orientia tsutsugamushi (Kp r56) was evaluated in cynomolgus monkeys (Macaca fascicularis) for immunogenicity and safety as a vaccine candidate for the prevention of scrub typhus. This recombinant antigen induced strong humoral and cellular immune responses in two monkeys and was found to be well tolerated. Antigen-specific immunoglobulin M (IgM) and IgG were produced to almost maximal levels within 1 week of a single immunization. Peripheral blood mononuclear cells from vaccinated animals showed an induction of antigen-specific proliferation and gamma interferon production. The Kp r56 was not as efficient as infection with live organisms in preventing reinfection but was able to reduce the inflammation produced at the site of challenge. This report describes the results of the first systematic study of the immunogenicity of a recombinant scrub typhus vaccine candidate in a nonhuman primate model.

DTIC

Immunity; Monkeys; Physiological Responses; Typhus; Vaccines

20070033081 Indiana Univ.-Purdue Univ., Indianapolis, IN USA

Development and Pre-Clinical Evaluation of a Novel Prostate-Restricted Replication Competent Adenovirus-Ad-IU-1

Gardner, Thomas A; May 2005; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0077

Report No.(s): AD-A469349; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469349

Recently we generated a prostate specific chemic promoter, called PSES, by combining the active prostate specific enhancers from prostate specific antigen (PSA) and prostate specific membrane antigen (PSMA) genes which are prominently expressed in androgen independent (AI) prostate cancers. The goal of this research is to develop a novel therapeutic agent, Ad-IU-1, using PSES to control the replication of adenovirus and the expression of a therapeutic gene, herpes simplex thymidine kinase (TK). AD-IU-1 replicates as efficient as a wild type adenovirus in PSA/PSMA positive cells, but not in PSA/PSMA negative cells. Prodrug GCV augmented Ad-IU-1's killing activity against PSA/PSMA positive cells, but not PSA/PSMA negative cells in vitro. Ad-IU-1 was more effective in inhibit the growth of androgen-independent CWR22rv tumors. Due to recent improvement in our adenoviral vector construction which allows us to insert a bigger transgene into the viral genome, we further investigated a fusing suicide gene, FCYttk, by combining two suicide genes, a yeast cytosine deaminase, FCY, and improved TK, ttk. FCYttk had a better killing activity than TK against prostate cancer cells. We have constructed and investigated a FCYttk-armed prostate restricted replicative adenovirus for future clinical investigation.

DTIC

Adenoviruses; Cancer; Gene Therapy; Prostate Gland

20070033082 Fox Chase Cancer Center, Philadelphia, PA USA

Tailored Communication to Enhance Adaptation Across the Breast Cancer Spectr

Miller, Suzanne M; Oct 2006; 62 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0238

Report No.(s): AD-A469351; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469351

The Behavioral Center of Excellence (BCE) in Breast Cancer was established to provide a comprehensive, multidisciplinary approach for studying the process of, and methods for facilitating, successful adaptation in the context of breast cancer risk, treatment, and recovery. The four ongoing studies are derived from and integrated by a unifying theoretical framework, and ere supported by four care facilities (i.e., Administrative, Communication, Genetic Testing and Bioinformatics Core). The four projects are: 1) development of an intervention to promote utilization of breast cancer risk assessment programs and adherence to screening recommendations and underserved African-American women; 21 use of a 'teachable moments and tailored communication materials to g r a t e utilization of risk assessment and adherence to screening amen0 daughters of diagnosed breast cancer patients 3) the g r m t i o n of psychological and physical adaptation among breast cancer patients at the completion of active treatments., during the re-entry phase); 4) promotion of psychological adaptation among

metastatic breast cancer patients. The overarching goal is to develop theoretically guided, tailored, and transportable breast cancer communications to enhance screening adherence, decision-making, and quality of life across the spectrum of disease (i.e., from risk through treatment to survivorship).
DTIC
Breast; Cancer; Mammary Glands; Metastasis; Telecommunication

20070033083 Mayo Clinic, Scottsdale, AZ USA
Immunotherapeutic Strategies in Breast Cancer: Preclinical And Clinical Trials
Gendler, Sandra J; Sep 2006; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0318
Report No.(s): AD-A469352; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469352

This project is focused on novel tumor vaccines directed at MUC1 and other tumor antigens. Our specific aims are: 1)To assess the effectiveness of vaccines against MUC1 and other tumor antigens in the prevention and treatment of spontaneous breast carcinomas in mice; 2)To translate an effective vaccine strategy into a phase I clinical trial in patients with undetectable disease following standard therapy. The model of spontaneous mammary cancer is the MUC1-expressing polyoma middle T antigen mice (MMT). We have tested five vaccines in the preclinical mouse model and all elicited a strong immune response. The vaccine using MUC1 class I binding peptides prevented MUC1-expressing tumor growth. We have designed the Phase I clinical trial using a peptide vaccine comprised of MUC1 and HER-2/neu MHC class I peptides and HER-2/neu MHC class II peptide with unmethylated CpG oligodeoxynucleotides and GM-CSF as adjuvants. The clinical trial has been unanimously approved by the Mayo Institutional Review Board (IRB 582-05) following receipt of FDA approval (BB-IND 12155). The peptides have been synthesized and vialed. It is a phase I trial testing MUC1 and HER-2/neu class I and class II peptides with CpG ODN and GM-CSF adjuvants in breast cancer patients free of disease. The amended clinical trial documents, which have been accepted by Colonel Brosch of the HSRRB on July 24, 2006, have been submitted to the Mayo IRB for approval. Approval should be forthcoming shortly. The approval notice and the documents reviewed and approved by the Mayo IRB will then be resubmitted to the HSRRB in order to obtain an Approval Memorandum prior to opening the clinical trial.
DTIC
Breast; Cancer; Clinical Medicine; Mammary Glands; Vaccines

20070033084 Florida Univ., Gainesville, FL USA
Common Mechanisms of Neuronal Cell Death after Exposure to Diverse Environmental Insults: Implications for Treatment
Hayes, Ronald L; Oct 2006; 261 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0765
Report No.(s): AD-A469353; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469353

Neuronal cell death after exposure to neurotoxins or after central nervous system (CNS) injury is the major cause of devastating neurological pathologies associated with military combat-related morbidity and mortality. An understanding of the cellular and molecular mechanisms contributing to neuronal cell death is critical to development of appropriate treatment strategies. Although the environmental causes of CNS injury are diverse (e.g., penetrating injuries, concussive injuries, neurotoxin exposure, etc), we hypothesize that regardless of the injury mechanisms, a relatively small subset of cellular and molecular events is responsible for the vast majority of cell death. The research results contained in this annual report summarize the findings of the second year of supported research on this grant. We have made great progress in implementing the proposed studies and have generated a wealth of data that supports both our broad and specific hypotheses. Importantly, our research indicates that the calcium activated family of cysteine proteases-the calpains- are rapidly activated in response to a variety of cellular insults while the cysteine protease caspase-3 is only activated in response to more specific cellular signals. These results suggest that inhibition of both calpain and caspase may provide greater neuroprotection than either inhibitor given alone.
DTIC
Death; Exposure; Injuries; Neurology; Neurophysiology; Toxins and Antitoxins

20070033085 Texas Univ., Houston, TX USA

TARGET (Translational Approaches for the Reversal, Genetic Evaluation and Treatment) of Lung Cancer

HOng, Waun K; Khuri, Fadlo R; Sep 2005; 91 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0706

Report No.(s): AD-A469354; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469354

TARGET is focused on a series of projects designed to obtain data in the preclinical and clinical settings to help us further understand the epidemiology of lung cancer, the molecular biology, genetics and epigenetics of lung cancer in the context of tobacco-damaged aerodigestive tract tissue, and the anti-cancer activity of several promising new agents, and various treatment and drug delivery approaches in models of lung cancer and other aerodigestive tract tumors.

DTIC

Cancer; Epidemiology; Genetics; Lungs; Targets

20070033086 TRUE Research Foundation, San Antonio, TX USA

Development and Implementation of an Objective, Non-invasive, Behaviorally Relevant Metric for Laser Eye Injury

Martinsen, Gary L; DiCarlo, Cheryl D; D'Andrea, John; Zwick, Harry; Stuck, Bruce; Sep 2005; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMDAMD-17-02-2-0061

Report No.(s): AD-A469355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469355

The use of lasers by both the military and civilian community is rapidly expanding. Thus, the potential for laser eye injury and retinal damage is increasing. Sensitive and accurate methods to evaluate and follow laser retinal damage are needed. The multifocal electroretinogram (mfERG) has the potential to meet these criteria. In this study, the mfERG was used to evaluate changes to retinal function following laser exposure. Landolt C contrast acuity was also measured in the six behaviorally trained Rhesus monkeys. The monkeys then received Nd:YAG laser lesions (1064 nm, 9 ns pulse width) in each eye. One eye received a single foveal lesion of approximately 0.13 mJ total intraocular exposure (TIE) and the other received six parafoveal lesions which varied in TIE from 0.13 to 4 mJ. mfERGs and behavioral data were collected both pre- and post-exposure. mfERGs were recorded using stimuli that contained 103, 241, and 509 hexagons. Landolt C contrast acuity was measured with five sizes of Landolt C (0.16 to 5.60 cycles/degree) of varying contrast presented on a monitor at 80 cm. mfERG response densities were sensitive to the functional retinal changes caused by the laser insult. In general, larger lesions showed greater mfERG abnormality than smaller. Deficits in contrast acuity were found to be more severe in the eyes with foveal injuries. Although the mfERG and contrast acuity access different levels of the visual system, both are sensitive to laser-induced retinal damage and may compliment tests for laser eye injury triage.

DTIC

Eye (Anatomy); Fovea; Injuries; Laser Damage; Lasers; Retina

20070033087 Texas Univ., Houston, TX USA

Role of Dynein Light Chain 1 in Tamoxifen Resistance in Breast Cancer

Song, Chunying; Mar 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0313

Report No.(s): AD-A469357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469357

My proposal is designed to discover the role of DLC1 in the action of tamoxifen in breast cancer and the involvement of its phosphorylation by Pak1 in this context. The hypothesis is that tamoxifen stimulates the expression and function of DLC1, and that deregulation of DLC1 stimulates the expression of ER-target genes and leading to an enhanced cell survival, and inability of tamoxifen to suppress the action of estrogen in breast cancer cells. We plan to investigate the following points. (1) Study the mechanisms of tamoxifen regulation of DLC1 expression in breast cancer cells. (2) Determine the functional consequences of tamoxifen regulation of DLC1 expression upon the biology of breast cancer cells. (3) Define the effects of DLC1-WT and DLC1-Ser-88-Ala mutant in a transgenic murine model. To date, we found that overexpression of DLC1 caused mammary alveolar hyperplasia, an early stage of mammary neoplasia. Moreover, mammary glands from MMTV-DLC1-Ser88Ala mice had accelerated involution. Together, these results suggest that deregulated DLC1 could alter mammary gland development and its phosphorylation by Pak1 is essential for its function.

DTIC

Breast; Cancer; Mammary Glands; Neoplasms

20070033088 Maryland Univ., Baltimore, MD USA

HER2 Regulation of Angiopoietin-2: A Mechanistic Factor in Metastasis

Carter, W B; Turner, Douglas; Oct 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0240

Report No.(s): AD-A469358; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469358

HER2 overexpression is a poor prognostic indicator in breast cancer. HER2 amplification is associated with early tumor dissemination, rapid tumor progression, and increased invasiveness, implying that HER2 has a significant role in the metastatic phenotype. We have demonstrated that two key steps in the metastatic process, angioinvasion and transendothelial migration, are augmented by HER2 expression, and we have linked Angiopoietin-2, a vascular destabilizing protein, to expression of HER2 (1). The objective of this research is to determine if the metastatic advantage of HER2 expressing cancer cells is imparted by Angiopoietin-2 production, and further to determine if overexpression of HER2 up-regulates Angiopoietin-2 expression. The scope of this research was to test: 1) angioinvasion using an in vitro microvessel dismantling assay and 2) endothelial cell retraction, a key step in tumor-cell transendothelial migration. We tested HER2 amplified breast cancer cell production of Angiopoietin-2, using blockade or stimulation of HER2 signaling. To determine if Angiopoietin-2 modulates the metastatic steps in question, we applied Angiopoietin-2 directly, or sequestered Angiopoietin-2 in these models. Breast cancer specimens were also tested for correlation of expression of HER2 and Angiopoietin-2. Further, we identified mechanistic steps in HER2 regulation of Angiopoietin-2 in breast cancer cells. Lastly, we demonstrated that the mechanism of HER2 amplified breast cancer cell-induction of endothelial cell retraction involves downregulation of VE cadherin and dissociation of catenin proteins from VE cadherin. This process releases the adherins junctions of the endothelial monolayer, thereby disrupting endothelial integrity.

DTIC

Breast; Cancer; Mammary Glands; Metastasis; Proteins

20070033090 Fox Chase Cancer Center, Philadelphia, PA USA

Cognitive-Affective Predictors of the Uptake of, and Sustained Adherence to, Lymphedema Symptom Minimization Practices in Breast Cancer Survivors

Miller, Suzanne M; Aug 2006; 127 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0295

Report No.(s): AD-A469362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469362

Approximately 20-30% of women develop lymphedema (LE) following breast cancer treatment. Effective symptom management requires that women recognize early signs of lymphedema, and maintain precautionary practices over time. Data indicates that knowledge and use of symptom minimization precautions are poor. Little is known about how breast cancer survivors perceive their LE risk, and the cognitive-affective factors that promote the uptake and adherence to LE symptom minimization precautions. Guided by the Cognitive-Social Health Information Processing (C-SHIP) model, we are conducting a longitudinal study, to assess barriers and facilitators associated with knowledge and adherence to LE symptom-minimization practices among breast cancer survivors. We are exploring the mediating role of cognitive-affective variables, and the moderating role of attentional style, on knowledge, uptake and adherence. Our preliminary analysis shows a correlation between high monitoring and more knowledge of lymphedema risks compared to low-monitoring styles. We are surveying levels of knowledge, and practice of symptom minimization precautions at baseline, 6-, and 12-month follow-up. Although many women are aware of LE minimization practices, data suggest that they are not incorporating the recommendations into their daily lives. Further, psychosocial factors play a role in the uptake of LE symptom-minimization practices, and sustained adherence over time.

DTIC

Breast; Cancer; Mammary Glands; Optimization; Predictions; Procedures; Signs and Symptoms

20070033091 Cleveland Clinic Foundation, Cleveland, OH USA

Far Forward Battlefield Telemedicine: Ultrasonic Guidance in Diagnosis and Emergency Therapeutics

Thomas, James D; Aug 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-2-0040

Report No.(s): AD-A469363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469363

To improve battlefield assessment of injured personnel we are exploiting several convergent trends in medicine and

technology, including ultrasound miniaturization and wireless connectivity. Specific aims include (1) validation of portable ultrasound to diagnose cardiac tamponade, pneumothorax, intraabdominal hemorrhage, etc.; (2) extension of digital echocardiography and local telemedicine to assist remote centers in transesophageal echocardiography; (3) Development of wireless telemedicine systems to relay ultrasonic images and loops to a remote review station; (4) Development of a precision guide for percutaneous drainage procedures using ultrasound guidance; (5) Combining this guide with wireless telemetry for remotely guided drainage; and (6) Extending this work to real-time three-dimensional ultrasonography. The technical and clinical challenges of such a proposal are complex but we have made significant progress on all aims, with wireless telemetry of continuous ultrasound data already a reality. If these goals can be accomplished, the ability of the Department of Defense to reduce mortality from battlefield trauma will be greatly enhanced. While this project has been developed specifically for battlefield telemedicine, the tools and techniques developed herein will have enormous application in the civilian sector, including delivery of diagnostic services to remote towns with little or no hardwire access to the internet.
DTIC
Diagnosis; Echocardiography; Emergencies; Radiotelephones; Telemedicine

20070033092 Pennsylvania Univ., Philadelphia, PA USA
Revealing the Functions of Tenascin-C in 3-D Breast Cancer Models Using Cell Biological and In Silico Approaches
Taraseviciute, Agne; Jones, Peter L; Mar 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0315
Report No.(s): AD-A469364; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469364

The extracellular matrix (ECM) glycoprotein tenascin-C (TN-C) has already been implicated in both breast cancer development and progression (Jones, 2001 & Jakhola,1998). TN-C has also been independently linked to poor prognosis in breast cancer (Suwiwat, 2004). However, the mechanisms by which TN-C exerts its effects on human mammary epithelial cells within an appropriate tissue context have not been elucidated. The purpose of this training grant is to determine the mechanism by which TN-C perturbs normal tissue architecture in three-dimensional (3-D) organotypic cultures of human mammary epithelial cells by focusing on cell-cell junctions, adherens junctions in particular, as well as activation of receptor tyrosine kinases, namely EGFR and c-met. Furthermore, as 3-D organotypic cultures are becoming more widely used in the biological community, we sought to develop a computational tool for objective evaluation of three-dimensional (3-D) architecture in organotypic cultures, in order to be able to determine the global effects of TN-C and other ECM components as well as oncogenes on overall tissue architecture. By elucidating the effects of TN-C on tissue architecture and gaining insights into the mechanisms involved, we hope to better understand how to rationally target the ECM, and TN-C in particular, for therapy in premalignant and malignant breast lesions.
DTIC
Breast; Cancer; Electronic Countermeasures; Enzymes; Epithelium; Mammary Glands; Phosphorus; Three Dimensional Models

20070033093 Harvard Medical School, Boston, MA USA
Early Life Processes, Endocrine Mediators and Number of Susceptible Cells in Relation to Breast Cancer Risk
Trichopoulos, Dimitrios; Apr 2007; 14 pp.; In English
Contract(s)/Grant(s): W81XWH-05-1-0314
Report No.(s): AD-A469365; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469365

To investigate the role of early life processes endocrine mediators and number of susceptible cells on adult life breast cancer risk. Method: Five interlinked component projects covering the spectrum from endometrial to adult life. Progress report: Component projects 1 to 4 were officially launched July 2005. Component projects 5a and 5b were officially launched July 18 2006. Tasks and subtasks to be performed were described in the submitted Statement of Work (SOW). Subtasks 4a 4b 5a 5b have been completed. Subtasks 1a 1b 2a 2b 3a 3b 3c 5c 5d are ongoing. Subtasks 2d and 4c have been initiated. Subtasks 5a and 5b are being implemented. Major findings: Data collection is still on-going. Analyses are pending and no findings can be reported yet.
DTIC
Breast; Cancer; Endocrinology; Mammary Glands; Risk

20070033095 California Univ., San Diego, La Jolla, CA USA

The Role of I-kappa-B Kinases in Prostate Carcinogenesis and the Effect of Their Inhibition on Survival of Prostate Tumors

Karin, Michael; Jan 2007; 60 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0120

Report No.(s): AD-A469367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469367

The research project was planned to investigate the role of IKB kinases (IKK) and NF-KB in development of prostate cancer (CaP) and explore the possibility that IKK inhibitors can be used in CaP treatment. To reach this goal we employed mouse models and in vitro cell culture systems. We found neither IKK beta nor IKK alpha were required for normal prostate development. However IKK alpha plays an important role in development of advanced CaP particularly in CaP metastasis. IKK alpha links inflammation to CaP metastasis by suppressing expression of the metastasis-suppressor gene maspin in response to RANK signaling. We also found that IKK beta/NF-kB activities in CaP cells were dramatically increased during development of androgen resistance. Deletion of IKK beta in inflammatory cells of the tumor microenvironment significantly reduced androgen-independent CaP formation. Furthermore we found that a putative IKK inhibitor IT-3 could suppress the proliferation of human CaP cells in vitro. Our results suggest an important role for both lKKa and IKK beta in development and progression of CaP and inhibition of one or both of them would be an effective option for treatment of CaP especially for prevention of metastasis and emergence of hormone refractory CaP.

DTIC

Cancer; Carcinogens; Prostate Gland; Survival; Tumors

20070033096 Loma Linda Veterans Association for Research and Education, Loma Linda, CA USA

Molecular Genetic and Gene Therapy Studies of the Musculoskeletal System

Mohan, Subburaman; Oct 2005; 265 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0021

Report No.(s): AD-A469369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469369

This proposal is divided into three sections: A) Molecular Genetic Projects, of which there are four projects. In our initial proposal, our final Molecular Genetic project was a fifth project involving a large human clinical trial, but work on this project has not been initiated at this time due to the Army suspension of human related activities and thus there is no progress to report; B) Gene Therapy Projects, of which there are three projects; and C) Support Service Facilities, of which there are four projects. Each of the above projects has an introduction. Our goals for the second 12-months of this funding period for each of the technical objectives, as well as our progress for each of the technical objectives, are described below. The progress report for each project is organized according to the outline provided by the office of the U.S. Army Medical Research and Material Command.

DTIC

Gene Therapy; Genetics; Musculoskeletal System

20070033097 Cold Spring Harbor Lab., New York, NY USA

In vivo RNAi Library Screen to Identify Mediators of Disease Progression and Drug Resistance in CML

Wendel, Hans-Guido; Sep 2006; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0803

Report No.(s): AD-A469370; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469370

Clinical data indicate a link of disease progression and resistance to imatinib therapy. While previous work on imatininb resistance has focused on mutations in the drug target these cannot explain the reduced effectiveness of imatinib in advanced disease stages. Usinga candidate approach we found that the p53 tumor suppressor is activated by and contributes to the antitumor activity of imatinib. Further p53 is implicated in disease progression inCML (Wendel et al. Proc NatI Acad Sci U S A. 2006 May 9;103(19):7444-9). To further approach the problem using an unbiased approach we proposed an in vivo RNAiscreen. This turned out to be technically extremely challenging and we had to take a very systematic approach at resolving some of the problems. However we have developed i) an improved RNAi design ii) suitable library vectors for in

vivo and in vitro work iii)nearly genome wide libraries in these vectors and iv) improved array-based detection methods. With these necessary and important improvements we now have promising preliminary data from in vitro screens.
DTIC
Clinical Medicine; Diseases; Drugs; Genome; In Vivo Methods and Tests; Libraries; Ribonucleic Acids

20070033098 Pittsburgh Univ., Pittsburgh, PA USA
Novel Resuscitation from Lethal Hemorrhage Suspended Animation for Delayed Resuscitation
Kochanek, Patrick M; Tisherman, Samuel A; Oct 2005; 240 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-2-0038
Report No.(s): AD-A469371; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469371

We have worked on novel ways to resuscitate combat casualties with exsanguination cardiac arrest (ExCA). We developed 'suspended animation (SA)' using a hypothermic normal saline (NS) flush into the aorta after rapid (5 min) ExCA, in dog models. Using a NS flush we achieved intact recovery after ExCA of up to 2h at 7-10 deg C. SA has evolved into Emergency Preservation and Resuscitation (EPR). This is an ADDENDUM to the yr 6 report. In that report, we showed that EPR was effective even when ExCA was preceded by ~2h of hemorrhagic shock mimicking delayed evacuation. In yr 6, we also developed a rat EPR model and advised industries and tested prototypes for devices to bring EPR to the field. In this ADDENDUM, we report that in yr 7 we carried out tasks to optimize EPR and bring it to a clinical trial. 2h of EPR may be inadequate for some victims, thus we sought to extend its duration. Adding energy substrates to the NS flush, allowed us to achieve good outcome after 3h of EPR in dogs. We also studied neuronal death in our rat model and neuronal culture. A role for cardiolipin oxidation as a death trigger was shown. We held a meeting of trauma surgeons to plan a clinical trial of EPR for civilian ExCA. Our work led, in yr 7, to multiple publications, one patent, a feature in US News and World Report, the SCCM young investigator award, and presentations at TATRC day and ATACCC 2005.
DTIC
Delay; Heart; Hemorrhages; Ischemia; Lethality; Resuscitation; Shock (Physiology)

20070033099 Stanford Univ., Stanford, CA USA
Alpha-v Integrin Targeted PET Imaging of Breast Cancer Angiogenesis and Low-Dose Metronomic Anti-Angiogenic Chemotherapy Efficacy
Chen, Xiaoyuan; Aug 2006; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0697
Report No.(s): AD-A469375; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469375

The overall objective of this project is to develop 18F-labeled RGD peptide derivatives for breast cancer imaging with prolonged tumor retention and improved in vivo kinetics to visualize and quantify alpha-v integrin expression and subsequently evaluate the metronomic anti-angiogenic chemotherapy efficacy on tumor regression necrosis and angiogenesis. Specific Aims: (1) To optimize 18F-labeled RGD peptide tracer for breast cancer imaging with prolonged tumor retention and improved in vivo kinetics. (2) To demonstrate the feasibility of PET/18F-RGD to image breast tumor growth spread and angiogenesis as well as quantifying alpha-v integrin expression level during breast tumor neovascularization over time. (3) To evaluate the efficacy of EMD 121974/paclitaxel combination on tumor regression necrosis and angiogenesis and demonstrate the feasibility of PET/18F-RGD to monitor the treatment outcomes. Major findings: We have previously reported that 18F-FB-E[c(RGDyK)]2 (18F-FRGD2) allows quantitative PET imaging of integrin alpha-v beta-3 expression. However the potential clinical translation was hampered by the relatively low radiochemical yield. We thus developed a new tracer 8F-FB-mini-PEG-E[c(RGDyK)]2 (18F-FPRGD2) that has improved radiolabeling yield without compromising the tumor targeting efficiency and in vivo kinetics. We also showed that RGD-Pacitaxel treatment cause significant reduction in tumor growth in integrin positive MDA-MB-435 breast cancer model which is superior to the combination of RGD and paclitaxel.
DTIC
Angiogenesis; Breast; Cancer; Chemotherapy; Dosage; Imaging Techniques; Mammary Glands; Necrosis; Radiochemistry

20070033100 Army War Coll., Carlisle Barracks, PA USA
Army Medical Department Support to Stability Operations
Armstrong, Kimberly K; Feb 28, 2007; 32 pp.; In English
Report No.(s): AD-A469380; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469380

We live in an uncertain world and military force is frequently used to shape the international environment in support of

our National Security Strategy. With weak and failing states serving as havens for our adversaries, the USA has embraced a policy to support democratic movements with the ultimate goal of ending tyranny. To achieve this goal, all elements of national power are drawn upon to stem instability and thwart enemies who wage asymmetric warfare across a transnational landscape. The Army Medical Department (AMEDD), with a proud tradition of peacekeeping and humanitarian missions, is an important war-fighting weapon in its own right. As combat turns to peacemaking and nation building, the AMEDD comes into its own for solving health problems in the area of operations and for winning the hearts and minds of the local population. With the world in an increasingly precarious state, the AMEDD plays a significant role in achieving US national interests. This paper looks at the AMEDD's role in stability operations. This includes an overview of the current environment and doctrine, the AMEDD's involvement in past missions, current and future challenges, and what AMEDD initiatives may be needed to prepare for the uncertainties that lie ahead.
DTIC
Medical Services; Military Operations; Stability

20070033105 Texas Univ., Houston, TX USA
VITAL: Vanguard Investigations of Therapeutic Approaches to Lung Cancer
Hong, Waun K; Lotan, Reuben; Stewart, David; Jan 2006; 315 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0142
Report No.(s): AD-A469399; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469399

The VITAL Research Program will provide a better understanding of the cellular and molecular processes that drive lung tumorigenesis so that an accurate risk model can be developed. In addition, the clinical trials that will be conducted in the VITAL Research Program will demonstrate the true rate of lung cancer recurrence and second primary tumor incidence in patients at high risk for these events and will identify the combination of biologic agents most effective in reducing these events in the high-risk population. The primary objective of the work proposed in the VITAL Research Program is development of a risk model for development of cancer recurrence and smoking-related second primary tumors based on an understanding of the biology of lung cancer development.
DTIC
Cancer; Lungs; Therapy

20070033107 Michigan Univ., Ann Arbor, MI USA
An Over View of the Continuation of the Work of the Mustard Consortium for the Use of the Free and Liposome Encapsulated Antioxidants as a Counter Measure to Mustards
Ward, Peter A; Smith, Milton G; Crawford, Keith; Stone, William; Das, Salil; Sciuto, Alfred; Anderson, Dana; Sep 2005; 104 pp.; In English
Contract(s)/Grant(s): DAMD17-03-2-0054
Report No.(s): AD-A469403; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469403

The Mustards Consortium has utilized both in vivo and in vitro models simultaneously to continue to elucidate mustard gas pathophysiology. In previous work done by the MC it was found that CEES, the mustard analogue, induced oxidative stress and was its primary mechanism of action. Consequently, NAC (N-acetylcystiene) was found to be protective as a prophylaxis and treatment. A combination of a water and fat soluble antioxidant encapsulated in a liposome (STIMAL) was found to have the best ameliorative effect against CEES> We have initiated development of next generation STIMAL, in order to optimize its ameliorative effect. The mechanism of action of the antioxidants is suspected to be primarily by their effect on redox regulated pathways. In an effort to elucidate the mechanism of action of the antioxidants and the pathophysiology of mustards, profiles are being developed for: gene expression and antioxidant levels, as well as biochemical pathways.
DTIC
Antioxidants; Organizations

20070033108 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Tandem Repeat Regions within the Burkholderia pseudomallei Genome and their Application for High-Resolution Genotyping

U'Ren, Jana M; Schupp, James M; Pearson, Talima; Hornstra, Heidie; Friedman, Christine L; Smith, Kimothy L; Daugherty, Rebecca R; Rhoton, Shane D; Leadem, Ben; Georgia, Shalamar; Mar 30, 2007; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469405; TR-06-132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469405

Background:The facultative, intracellular bacterium Burkholderia pseudomallei is the causative agent of melioidosis, a serious infectious disease of humans and animals. We identified and categorized large tandem repeat arrays and their distribution throughout the genome of B. pseudomallei strain K96243 in order to develop a genetic typing method for B. pseudomallei. We then screened 104 of the potentially polymorphic loci across a diverse panel of isolates including B. pseudomallei, B. mallei and B. thailandensis. A subset of these tandem repeat arrays were subsequently developed into a multiple-locus VNTR analysis to analyze 66 B. pseudomallei and 21 B. mallei isolates from around the world, as well as 95 lineages from a serial transfer experiment encompassing ~ 18,000 generations. Results:B. pseudomallei contains a preponderance of large tandem repeat loci throughout its genome, many of which are duplicated elsewhere in the genome. The majority of these loci are composed of repeat motif lengths of 6 to 9 bp with 4 to 10 repeat units and were predominately found in intergenic regions of the genome. Across the geographically diverse isolates, the 32 VNTR loci displayed between 7 and 28 alleles, and Nei's diversity values between 0.47 and 0.94 across all B. pseudomallei and B. mallei isolates. Mutation rates for these loci were comparable (>10-5 per locus per generation) to that of the most diverse tandemly repeated regions found in other less diverse bacteria. Conclusions:The frequency, location and duplicate nature of large tandemly repeated regions within the B. pseudomallei genome indicate that these tandem repeat regions may play a role in generating and maintaining adaptive genomic variation. Multiple-locus VNTR analysis revealed extensive diversity within the global isolate set containing B. pseudomallei and B. mallei, and it detected genotyp

DTIC

Bacteria; Genome; High Resolution; Infectious Diseases

20070033109 Texas Univ., Houston, TX USA

The BESCT (Biology, Education, Screening, Chemoprevention and Treatment) Lung Cancer Program

Hong, Waun; Apr 2006; 172 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0689

Report No.(s): AD-A469406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469406

Our long-term objectives are to define the molecular processes contributing to lung cancer development and progression to recognize genetic and phenotypic changes early enough to be reversed with molecular targeted therapy and to develop innovative therapeutic approaches to lung cancer. Thus, the specific aims are to understand molecular alterations, develop prevention strategies, and implement experimental molecular approaches to lung cancer. In the past year, we identified that hypermethylation of p16(INK4a) and RASSF1A was associated with clinical outcomes in patients with respectable NSCLC; hypermethylated DAP kinase attenuated TRAIL-induced apoptosis of NSCLC cells; tumor-dominant DNMT3B variants was strongly associated with methylation status of p16(INK4a) and RASSF1A, and clinical outcomes. Also growth inhibition and apoptosis induction by the combination of Celecoxib and 4HPR were mediated by both pathway and inhibited P13K/Akt survival pathway activated. We demonstrated that SCH66336 inhibited angiognic activities of NSCLC and HNSCC cells Partly by inhibiting hypoxia- or IGF-stimulated HIF-1a and thus VEGF production via blocking the interaction HIF-1 and Hsp90 and inducing protessomal degradation of HIF-1. Moreover, a mouse lung cancer model that develops lung carcinomas has been successfully developed and will be used for various studies including drug test and mechanistic studies of lung carcinogenesis.

DTIC

Cancer; Education; Lungs

20070033110 Defense Health Board Task Force on Mental Health, Falls Church, VA USA

An Achievable Vision: Report of the Department of Defense Task Force on Mental Health

Jun 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469411

Section 723 of the National Defense Authorization Act for fiscal year 2006 directed the Secretary of Defense to 'establish

within the Department of Defense a task force to examine matters relating to mental health and the Armed Forces' and produce 'a report containing an assessment of, and recommendations for improving, the efficacy of mental health services provided to members of the Armed Forces by the Department of Defense.' Towards that end, the Department of Defense Task Force on Mental Health (Task Force) was established, comprising seven military and seven civilian professionals with mental health expertise. Maintaining the psychological health, enhancing the resilience, and ensuring the recovery of service members and their families are essential to maintaining a ready and fully capable military force. Towards that end, the Task Force's vision for a transformed military system requires the fulfillment of four interconnected goals: A culture of support for psychological health, Service members and their families will receive a full continuum of excellent care in both peacetime and wartime, Sufficient and appropriate resources will be allocated to prevention, early intervention, and treatment, At all levels, visible and empowered leaders will advocate, monitor, plan, coordinate and integrate prevention, early intervention, and treatment. Findings: In general, the Task Force found that current efforts fall significantly short of achieving each of the goals enumerated above. The Task Force arrived at a single finding underpinning all others: The Military Health System lacks the fiscal resources and the fully-trained personnel to fulfill its mission to support psychological health in peacetime or fulfill the enhanced requirements imposed during times of conflict.
DTIC
Defense Program; Health; Medical Services; Mental Health; Military Personnel

20070033118 Duke Univ., Durham, NC USA
Task-Specific Optimization of Mammographic Systems
Saunders, Robert; Mar 2007; 171 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0323
Report No.(s): AD-A469423; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469423

This study sought to understand how different imaging parameters affect clinical diagnosis. First it developed research tools for measurement and simulation of mammographic imaging. Second we applied these research tools and conducted a large human observer experiment to answer several clinically relevant questions. The first question explored the impact of display resolution on the detection of breast masses and calcifications. We found that different displays had little impact on clinical performance. The second question explored the effect of reduced dose on the detection of breast lesions. We found that the increased noise from reduced dose did impact radiologist performance. Reducing the dose by half did not have a statistically significant impact on diagnostic accuracy suggesting that mammographic dose could be reduced modestly with little impact on clinical performance. These results have immediate implications for clinical breast imaging.
DTIC
Breast; Cancer; Imaging Techniques; Mammary Glands; Optimization; X Rays

20070033119 Case Western Reserve Univ., Cleveland, OH USA
Exploiting Novel-Calcium-Mediated Apoptotic Processes for the Treatment of Human Breast Cancers with Elevated NQO1 Levels
Bentle, Melissa S; Boothman, David A; Mar 2007; 64 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0301
Report No.(s): AD-A469426; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469426

Beta-lapachone (beta-lap; a.k.a. ARQ 501) is currently in Phase II clinical trials for the treatment of pancreatic adenocarcinoma in combination with gemcitabine. Beta-Lap is a novel antitumor agent that is bio-activated by the two-electron oxidoreductase NAD(P)H quinone oxidoreductase-1 (NQO1) (E.C. 1.6.99.2). Since NQO1 is highly expressed in many human cancers (e.g. breast, lung, pancreatic, and prostate cancer) it is an attractive target for selective cancer chemotherapy by beta-lap alone or in combination with IR (1-3). We previously reported that the initiation of beta-lap-induced cell death is triggered by the NQO1-dependent oxidoreduction of beta-lap (1). NQO1-mediated metabolism of beta-lap results in a futile cycling event wherein beta-lap is reduced to an unstable hydroquinone that reverts spontaneously back to its parent structure, using two molecules of oxygen (4). As a result, ROS are generated causing DNA damage, beta-H2AX foci formation, poly(ADP-ribose) polymerase-1 (PARP-1) hyperactivation, and subsequent loss of ATP and NAD+ (5). This loss of ATP and NAD+ was proposed to be the mechanism by which beta-lap could enhance the sensitivities of a variety of chemotherapeutic therapies as well as IR (6). B-lap-induced cell death was unique in that PARP-1 and p53 were cleaved concomitant with -calpain activation, consistent with the fact that global caspase inhibitors had little effect on beta-lap-induced proteolysis and lethality (1, 7). Interestingly, beta-lap-mediated cell death exhibited classical features of apoptosis (e.g. DNA

condensation, and terminal deoxynucleotidyl transferase-mediated dUTP nick-end labeling (TUNEL)-positive cells), but was not dependent on standard apoptotic mediators such as p53, Bax/Bak, or caspases (8).
DTIC
Apoptosis; Breast; Calcium; Cancer; Diseases; Mammary Glands

20070033120 Chicago Univ., Chicago, IL USA
Estrogen Receptor Alpha G525L Knock-In Mice
Sinkevicius, Kerstin W; Mar 2007; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0347
Report No.(s): AD-A469427; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469427

We have developed a 'knock-in' mouse model with a mutation (glycine 525 to leucine, G525L) in estrogen receptor alpha (ERalpha) that permits exogenous regulation of its ligand-induced signaling pathways, while not affecting ligand-independent signaling. The G525L ligand-binding pocket mutation significantly reduces ERalpha response to endogenous estrogens. These female estrogen non-responsive ERalpha knock-in (ENERKI) mice had immature and hypoplastic uterine and vaginal tissues and only developed rudimentary mammary gland ductal trees. Ovarian tissues contained no corpora lutea, indicating these mice are infertile due to anovulation. In addition, 89% of the ovaries contained large, hemorrhagic, cystic follicles. This physiology is consistent with a lack of estrogen negative feedback at the pituitary, which results in chronically elevated circulating levels of luteinizing hormone (LH). These phenotypes were similar to those of the ERalpha knock-out (alphaERKO) mice, confirming ligand-induced activation of ER is important in female reproductive tract development. Although the G525L mutation significantly reduces ERalpha response to endogenous estrogens, the ERalpha selective agonist propyl pyrazole triol (PPT) was still able to activate the mutant ERalpha in uterotrophic assays in the ENERKI females. Therefore, ERalpha signaling pathways can be regulated in developing mice as well as in adult animals with genetically induced mammary cancers through PPT administration or withdrawal.
DTIC
Breast; Cancer; Estrogens; Lutetium; Mammary Glands; Mice; Pituitary Gland

20070033123 Texas Univ., Houston, TX USA
Vital: Vanguard Investigations of Therapeutic Approaches to Lung Cancer
Hong, Waun K; Lotan, Reuben; Stewart, David; Jan 2007; 341 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0142
Report No.(s): AD-A469431; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469431

The VITAL Research Program will provide a better understanding of the cellular and molecular processes that drive lung tumorigenesis so that an accurate risk model for recurrence and/or the development of the second primary tumor can be developed, and the biologic agents most effect in reducing these events in the group of high-risk patients can be identified. Until this time, our clinical trails (Vanguard and Celecoxib trials) are ongoing and Tarceva trial will be opened in January 2007. The research projects are proceeding well as proposed, producing valuable findings with cell lines, and will validate these results using the clinical samples obtained from the VITAL trials in the coming years.
DTIC
Breast; Cancer; Lungs; Mammary Glands; Therapy

20070033293 Texas Univ., Galveston, TX USA
A Novel, Rapid Assay for Detection and Differentiation of Serotype-Specific Antibodies to Venezuelan Equine Encephalitis Complex Alphaviruses
Wang, Eryu; Paessler, Slobodan; Smith, Darci R; Coffey, Lark L; Kang, Wenli; Estrada-Franco, Jose; Weaver, Scott C; Aguilar, Patricia V; Pfeffer, Martin; Olson, James; Jan 2005; 7 pp.; In English
Contract(s)/Grant(s): N01-AI25489; U54-AI057156
Report No.(s): AD-A469440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An epitope-blocking enzyme-linked immunosorbent assay was developed for the rapid differentiation of serologic responses to enzootic variety IE and ID versus epizootic variety IAB and IC strains of Venezuelan equine encephalitis (VEE) virus. Two monoclonal antibodies that differentially recognize epizootic versus enzootic VEE virus epitopes were used to measure the serotype-specific blocking abilities of antibodies in sera of naturally infected humans, equines, and bovines, as

well as in experimentally infected equines. The assay is simple, species-independent, rapid, and sensitive, and will improve surveillance for VEE emergence. It could also be used to determine the epidemic potential of a VEE virus following an intentional introduction for bioterrorism.
DTIC
Antibodies; Assaying; Detection; Encephalitis; Microbiology; Viruses

20070033296 Massachusetts Inst. of Tech., Cambridge, MA USA
Photosynthetic Photovoltaic Cells
Baldo, Marc A; Jun 21, 2007; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-02-1-0399
Report No.(s): AD-A469444; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although organic solar cells are a promising source of inexpensive photovoltaic (PV) power, their low efficiency must be improved. We address this problem in a radical departure from the conventional model of organic solar cells. Our architecture is based on photosynthesis - that other example of organic solar cell technology, albeit optimized for two billion years. As in biology, we separate the optical and electrical functions of the solar cell by building an ′antenna' on top of a conventional solar cell. Biomimetic organic solar cells operate as follows: The antenna absorbs the light, and acts to supplement the conventional solar cell - the ′reaction center'. Most importantly, the antenna allows the reaction center to be much thinner, since it no longer must absorb all the light. Thus, its quantum efficiency can approach 100% potentially doubling the performance of organic solar cells.
DTIC
Photovoltaic Cells; Quantum Efficiency; Solar Cells

20070033299 WEB3D Consortium, San Francisco, CA USA
Development of an Amendment to X3D to Create a Standard Specification of Medical Image Volume Rendering, Segmentation, and Registration
Ressler, Sandy; Aratow, Mike; Nov 2006; 41 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0096
Report No.(s): AD-A469447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is currently no standard file format for representation of three dimensional (3D) medical imaging data. Extensible 3D (X3D) is an International Standards Organization (ISO) ratified, freely available standard that defines a runtime system and delivery mechanism for 3D graphics on the World Wide Web. The Web3D Consortium, which administers X3D, has developed a draft extension to X3D for a volume rendering, registration and segmentation component to define a file format and display of 3D medical imaging data. A formal ISO working project has been initiated to begin the process of ISO ratification of this extension.
DTIC
Image Processing; Imaging Techniques; Medical Services; Organizations; Radiography; Segments; Specifications

20070033304 California Univ., Irvine, CA USA
Role of the Mouse Pygopus 2 Gene and Wnt Signaling in Normal and Malignant Development of Mammary Glands and Hair Follicles
Dai, Xing; May 2006; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0516
Report No.(s): AD-A469452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development of mammary gland is governed by multiple genetic pathways although how these pathways are regulated and how they interact with each other is not yet fully understood. Previous studies have implicated the involvement of the canonical Wnt signaling pathway which includes several key components that act together to activate other genes that are directly involved in controlling cell division or differentiation in both normal and abnormal mammary gland development. The timing and overall activity of the pathway is key as its disruption leads to aberrant mammary development and its over stimulation leads to breast cancer. We proposed genetic experiments to examine the role of a novel component of the Wnt pathway in mammary gland development and tumorigenesis. Specifically we proposed to target genetic manipulations to a subset of the mammary epithelial cells that have stem cell characteristics. The mutant mice generated in this study should provide novel animal models to study the ontogeny and progression of mammary tumors. Furthermore results from our studies

should provide some insight into the role of epithelial stem cells in normal and diseased development. Finally our studies might implicate possible drug target for treating breast cancer in the future.
DTIC
Breast; Cancer; Cell Division; Genes; Hair; Mammary Glands; Mice; Proteins

20070033317 Little (Arthur D.), Inc., Cambridge, MA USA
Base Realignment and Closure Environmental Evaluation (BRAC EE) Fort Devens, Massachusetts
Lambe, Robert; Waterman, Richard; Sep 1995; 115 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAA15-91-D-0016-0005
Report No.(s): AD-A469475; ADL-67065-64; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A study to identify locations where transformers containing polychiorinated biphenyl (PCB) oil leaked onto soil on the Main and North Posts of Fort Devens was conducted as part of the Base Realignment and Closure Environmental Evaluation. This study was designated as Area Requiring Environmental Evaluation (AREE) 66. The study included evaluating the current PCB Transformer Management Program administered by the Fort Devens Environmental Management Office (EMO), the Fort Devens Spill Contingency Plan, and the ongoing transformer-inspection program. Personnel in both the Fort Devens EMO and the Fort Devens Directorate of Public Works were also interviewed. Transformers included in this study are transformers that were removed from service due to previous leaks. A total of nine locations were identified as having transformers removed due to leaks, and at six of the nine locations PCB oil had come into contact with surrounding soil. Soil samples were collected from each location and analyzed for PCB contamination. Based on the results of the laboratory analysis, further actions were recommended at four of the six locations. AREE 66A (Building 3752), AREE 66B (Building 1634), AREE 66C (Building 3575), and AREE 66F (Building 2025) have all been recommended for removal actions. In addition, soil sampling was performed at AREE 660, the Verteck Substation. Soil staining was identified in the substation and was sampled for PCB contamination. Of the 25 soil samples that contained PCBs, five contained PCBs exceeding Massachusetts Contingency Plan Standards. The contamination was detected around electrical equipment on the west side of the substation. A limited removal action is recommended for this location.
DTIC
Closures; Ground Water; Oil Slicks

20070033319 Salk Inst., La Jolla, CA USA
A Genetic Screen for Genes Involved in BRCA 1 Tumor Suppressor Function
Verma, Inder; Zhu, Quan; Mar 2007; 7 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0252
Report No.(s): AD-A469482; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Based on our initial screening, we have identified a number of candidates that are involved in DNA damage repair pathway mediated by BRCA1, which is an important aspect of tumor suppression of the molecular. As none of the candidates have previously been reported to play a role in DNA damage repair pathway we speculate that some novel components, such as RNA or chromatin structure, might be involved. Once verified and fully investigated, the possible target genes will contribute to the understanding of the biology of inherited breast cancer as well as the diagnosis and treatment of breast, ovarian and possibly other cancers.
DTIC
Breast; Cancer; Deoxyribonucleic Acid; Genes; Genetics; Mammary Glands; Suppressors; Tumors

20070033320 Retina Foundation, Boston, MA USA
Low Vision Research at the Schepens Eye Research Institute
Dartt, Darlene A; Woods, Russell; Stein-Streilein, Joan; Ksander, Bruce; Taylor, Andrew; Chen, Dong F; Young, Michael; Oct 1, 2005; 105 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0892
Report No.(s): AD-A469483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the grant is to prevent low vision that can occur on the battlefield in two contexts. The first area is inattentional blindness that can occur when using complex visual displays on military equipment, especially head mounted displays. The second use the collateral damage that can occur in the retina after laser burns. The scope of the work is 1. To determine the optimal angumented vision system by understanding the ability of an individual to access supplemental visual information presented by vision multiplexing and 2. To develop novel treatments that control the inflammatory response and

repair neuroretinal damage induced by retinal laser burns. Our major findings are 1. Applying cartoon-like edge filtering did not overcome inattentional blindness; 2. Later the retina and retinal pigmented epithelium, but not from vitreous, that suppress the inflammatory activity of actived macrophages; induced neuronal cell apoptosis that could potentially be repaired by biodegradable polymer/progenitor cell composites.
DTIC
Blindness; Eye (Anatomy); Laser Applications; Pigments; Retina; Vision; Visual Aids

20070033322 Norwegian Defence Research Establishment, Horten, Norway
Tomographic Scanning Imaging Seeker
Hovland, Harald; Oct 1, 2005; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469486; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Homing Devices; Imaging Techniques; Optical Scanners; Signal Processing; Tomography

20070033329 California Univ., Davis, CA USA
Prevention of Post-Radiotherapy Failure in Prostate Cancer by Vitamin D
Vijayakumar, Srinivasan; May 2007; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0070
Report No.(s): AD-A469499; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Prostate cancer patients receive either surgery or radiation therapy as treatment for cancer. Among patients receiving radiation therapy, nearly 50% have an elevation of PSA within five years of treatment. These patients then receive hormone treatment. In this study, we wish to test the theory that chemopreventive agents, which shoe the ability to prevent or delay the growth of prostate cancer cells in the laboratory, may also prevent or delay the growth of prostate cancer cells in the laboratory, may also prevent or delay the reappearance of prostate cancer in patients who have undergone radiation to treat their prostate cancer. We propose to have prostate cancer patients who have undergone radiation treatment take a non-toxic chemopreventive agent [a synthetic form of vitamin D, 1 -hydroxyvitamin D5] for two years and see if their reoccurrence rate can be decreased. Unlike regular vitamin D, D5 does not make calcium in the bloodstream and reach levels that cause serious side effects. Forty patients will participate. They will be randomized to D5 or placebo arms. A biopsy will be done at the end of the study and the tissue will be analyzed for any benefit of D5 in decreasing the recurrence of prostate cancer and also for any differences between the groups in terms of expressed intermediate molecular biomarkers.
DTIC
Calciferol; Cancer; Failure; Health; Prevention; Prostate Gland; Radiation Therapy

20070033340 Utah Univ., Salt Lake City, UT USA
Randomized Trial of Interleukin-2 (IL-2) as Early Consolidation Following Marrow Ablative Therapy with Stem Cell Rescue for Matastatic Breast Cancer
Samlowski, Wolfram E; Ward, John H; Buys, Saundra; Oct 2006; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9417
Report No.(s): AD-A469514; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Interleukin-2 (IL-2) has the capacity to activate lymphocytes to kill multidrug resistant cancer cells. Our phase I data established the feasibility of administering a single course of low-dose IL-2 (1.6 million IU/m2/day as a continuous i.v. infusion for I 8 days) as consolidation treatment to patients with metastatic breast cancer early after intensive chemotherapy. We are performing a phase II trial of AC+T chemotherapy followed by IL-2 consolidation (I cycle as described above) in high-risk stage II and III breast cancer patients. Disease free survival and toxicity assessment represent major clinical aims (Specific aim I). Immunologic effector mechanisms induced following MAT/SR by IL-2 infusion are being evaluated (Aim 2). This study opened 6/11/03. Fourteen patients have been accrued all have completed planned treatment. Toxicity has been minimal. Laboratory correlation studies have been completed and the results of this trial will be submitted for publication in the next several months.
DTIC
Ablation; Bone Marrow; Breast; Cancer; Consolidation; Immune Systems; Interleukins; Lymphocytes; Mammary Glands; Rescue Operations; Stem Cells; Therapy

20070033344 Hawaii Univ., Honolulu, HI USA

EcoHealth Consortium Workshop on Emerging Infectious Diseases and Information Technology

Wilcox, Bruce A; Duin, Kristin; Hood, Andrew; Oct 2005; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0335

Report No.(s): AD-A469518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During March 9-11 2005 a meeting was convened by the East West Center and the Asia-Pacific Institute of Tropical Medicine and Infectious Diseases at the University of Hawaii as part of National Institutes of Health Roadmap initiative 'Research Teams of the Future'. The meeting was entitled Emerging Infectious Diseases and Social-Ecological Systems. The purpose of this meeting was to advance interdisciplinary methods for investigation of the problem of emerging infectious diseases. While the meeting focused primarily on conceptual integration employing a holistic systems perspective based on the emerging paradigms employing complexity theory a parallel workshop was held on the applications of remote sensing GIS and environmental sensing technology. This document summarizes the results of the meeting and workshop including the post-meeting synthesis as they relate to environmental sensing technology and the potential applications to biosecurity.

DTIC

Cholera; Encephalitis; Infectious Diseases; Information Systems; Japan; Organizations; Parasitic Diseases; Tropical Regions

20070033347 Melbourne Univ., Victoria, Australia

The Role of Interleukin-6/GP130 Signaling in Prostate Cancer Progression and Its Contribution to Bone Metastasis Morbidity

Redvers, Richard P; Mar 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0378

Report No.(s): AD-A469521; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The cytokine interleukin-6 (IL-6) is strongly implicated in primary prostate cancer (PrCa) growth and the progression to bone metastasis. While expression and localization of IL-6 and its receptors gp 130 and IL-6R have been studied in organ-confined PrCa, these key mediators of the IL-6/gp130 signaling pathway have not been previously assessed in prostatic bone metastases. Thus far, our investigations with archival patient biopsies revealed that all PrCa bone metastases examined (n=14) expressed IL-6 on an overwhelming majority of cells (78 +/- 5%). The IL-6 receptor (IL-6R) was expressed in 11/14 cases in 77 +/- 7% of PrCa cells. Activated (phosphorylated) gp130 was expressed in all but one case (13/14), and was expressed in the majority of cells (79 +/- 5%) in 9/14 cases. Importantly, when IL-6R was localized to cell membranes (4/11 cases), phospho-gp130 and IL-6 were also detected at the cell membrane. Thus, members of the IL-6/GP130 axis are present in a high proportion of bone metastatic PrCa cells in most cases. The importance of this pathway will be further elucidated by characterizing anti-IL-6- treated BM18 transplants. Understanding the role of IL-6/gp130 signaling in this disease may lead to identification of novel targets and therapeutic strategies to improve and extend the quality of life for PrCa patients.

DTIC

Bones; Cancer; Immune Systems; Interleukins; Metastasis; Prostate Gland

20070033356 Mayo Clinic, Rochester, MN USA

A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer

Kwon, Eugene D; Dec 2005; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0245

Report No.(s): AD-A469532; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is an open-label, two-center, randomized phase II trial in which 108 patients with newly diagnosed advanced prostate cancer will be prospectively enrolled onto study. Patients with T3, NO, MX prostate cancer or patients with any T stage, Ni (defined as a single positive lymph node 2cm or less in size) and/or limited skeletal metastases will be considered for study inclusion. Limited skeletal metastases is defined as <3 metastatic lesions on bone scan. Patients must have undergone diagnosis and staging of their prostate cancer within 120 days of enrollment. Upon enrollment patients will be immediately randomized to receive either: i) 3 months of concurrent AA therapy + MDX-OlO (treatment group) or ii) 3 months of initial AA therapy alone (control group). Fifty four patients will be randomized at the Mayo Clinic, while the remaining 54 patients will be randomized at the University of California-San Francisco Comprehensive Cancer Center. Equal numbers of control and treatment group patients will be enrolled onto study at these two institutions over a period of eighteen months.

DTIC

Ablation; Bones; Cancer; Hormones; Males; Prostate Gland; Therapy

20070033357 Baltimore Research and Education Foundation, Inc., Baltimore, MD USA

Physical Characterization of a Highly Infectious Monodisperse Preparation of TSE Infectivity as a Substrate for Diagnostic Development

Rohwer, Robert G; Timmes, Andrew G; Gregori, Luisa L; Alexeeva, Irina; Sep 2006; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0749

Report No.(s): AD-A469533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Purification and characterization of the infectious agent that causes transmissible spongiform encephalopathies would be a breakthrough in the development of diagnostic tests and treatments for the victims of these fatal neurological diseases. Using a new preparation of highly dispersed, nanofiltered scrapie infected brain homogenate, we have determined the buoyant density and sedimentation constant of PrPres, the only known marker for scrapie infectivity. Our sucrose step gradient procedure, which combines the ultracentrifugation approaches of equilibrium density and sedimentation rate, succeeded in both purifying and concentrating both PrPres and infectivity. Scaled up production of purified scrapie infectivity involving one liter of dispersed and nanofiltered scrapie homogenate is underway. We are actively pursuing the original plan of this project, which is to use equilibrium density, sedimentation rate, and other biochemical characteristics to concentrate, purify, and study the scrapie infectious agent. The techniques used are unbiased in their ability to isolate infectious particles, whether they are purely proteinaceous or contain other factors.

DTIC

Diseases; Infectious Diseases; Nervous System; Substrates

20070033358 Queen's Medical Center, Honolulu, HI USA

Cancer Localization in the Prostate with F-18 Fluorocholine Positron Emission Tomography

Kwee, Sandi A; Thibault, Gregory; Stack, Richard; Coel, Marc N; Sesterhenn, Isabel A; Jan 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0056

Report No.(s): AD-A469534; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project is to develop and evaluate fluorine-18 (F-18) fluorocholine (FCH) positron emission tomography (PET) as an imaging technique that can be used to delineate malignant tumors in the prostate gland. The proposed technique works by measuring the tissue metabolism of FCH, a substrate that is preferentially metabolized by cancer cells due to malignant over-expression of the choline transporter and choline kinase enzyme. The project scope covers a clinical study to recruit men with prostate cancer who have elected treatment by radical prostatectomy surgery. These men will undergo preoperative PET scanning to measure F-18 FCH uptake in anatomical sextants of the prostate gland. Imaging results will be compared to histopathologic analyses of the prostatectomy specimen to determine the accuracy of F-18 FCH PET for detecting cancerous prostate sextants. Magnetic resonance microscopy (MRM) followed by complete embedding and close step-sectioning of specimens will produce the histopathologic standard of reference for this study. Based on data collected from 15 subjects so far, the diagnostic sensitivity and specificity of FCH PET for identifying malignant prostate sextants is estimated at 85% and 62% respectively. Because recent technological advances in PET and computerized tomography (CT) may improve accuracy further, the project is being revised to capitalize on the new features of two PET/CT scanners to be installed at the contract performing organizations in 2007. This revision is expected to enhance the clinical relevance of the final study results. Project completion will require a one-year no-cost extension. To support this change in project scope, we report: 1) an interim analysis of the data, 2) a study on the feasibility of FCH PET/CT guided prostate radiation therapy, and 3) the application of new PET imaging techniques (list-mode and time-of-flight PET) to prostate imaging.

DTIC

Cancer; F-18 Aircraft; Histology; Pathology; Position (Location); Positrons; Prostate Gland; Tomography

20070033359 Johns Hopkins Univ., Baltimore, MD USA

Structure and Mechanism-Based Design of ErbB Receptor Inhibitors

Leahy, Daniel J; Sep 2006; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0449

Report No.(s): AD-A469535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The work proposed for this award involved using the crystal structures of the extracellular domains of the EGF receptor (EGFR) and its homologs HER2/Neu/ErbB2, HER3/ErbB3, and HER4/ErbB4, which were recently determined in my lab and elsewhere, to design a new class of inhibitors of this family of receptors. These structures had shown that ligands bind to two separate surfaces in these receptors that are normally far apart in the absence of ligand. Binding ligand (e.g. EGF) requires

a large conformational change in the receptor to bring these surfaces close together, and it is this conformational change that then leads to receptor dimerization and initiation of a signaling cascade through activation of a cytoplasmic tyrosine kinase. Our idea had been to create through mutagenesis a ligand that bound more tightly to one of the binding surfaces but not to the other. Theoretically, this ligand would bind to the receptor but not induce the conformational change needed to activate the receptor and thus serve an inhibitor of the receptor.
DTIC
Enzymes; Inhibitors; Phosphorus

20070033360 Pennsylvania Univ., Philadelphia, PA USA
Investigation of Novel Molecular Targets for Pleckstrin Homology (PH) Domains Found in Oncogenes Implicated in Breast Cancer
Keleti, David; Lemmon, Mark A; Mar 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0320
Report No.(s): AD-A469536; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Homology (PH) domains are commonly thought of as membrane-targeting modules involved in signaling pathways that bind phosphoinositides (PPIns) with high affinity and specificity. In a recent study of S. cerevisiae, however, the vast majority demonstrated little affinity or specificity for PPIns (Yu et al, 2004). I show comparable results for my selected human PH domains, with only one that is high affinity and PPIns-specific, while the remainder are low to moderate affinity and promiscuous for PPIns. I outline two instances where multipoint contacts (protein-protein and protein-phosphoinositide interactions) may account for specific membrane targeting observed in vivo. First, SH3BP-2 PH was identified as highly specific for the membrane lipid PtdIns(3,4)P2, and targets the host adaptor protein to the membrane (while its SH2 and PR domains bind proteins). Second, FAPP1 and OSBP PH domains possess comparable affinities for Golgi- and plama membrane-enriched PPIns in vitro, although they both localize to the Golgi, and not the plasma membrane in vivo, a likely result of a direct interaction with the Golgi GTPase Arf1 (Godi et al, 2004). I have solved the structure of a member of this PH domain class in complex with PPIns, and suggest reasons for its unique PPIns binding properties. Finally, the drug perifosine was found to selectively target Akt1/PKBalpha PH in vitro, albeit with a relatively low binding affinity.
DTIC
Breast; Cancer; Carcinogens; Domains; Homology; In Vitro Methods and Tests; Mammary Glands; Oncogenes; pH; Targets; Tumors; Viruses

20070033361 Georgetown Univ., Washington, DC USA
DNA Repair and Ethnic Differences in Prostate Cancer Risk
Goldman, Radoslav; Mar 1, 2007; 102 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0294
Report No.(s): AD-A469537; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer is the most common lethal tumor among US males and is particularly high in African Americans. This study evaluates DNA repair in a study of 240 prostate cancer patients and 240 healthy controls matched on age and race in a 50% African American population. Low DNA repair correlates with increased risk of certain cancers but prostate cancer was not yet examined. We hypothesize that low DNA repair especially in African American men contributes to increased risk of having prostate cancer. To evaluate this hypothesis we quantify DNA repair capacity in blood cells using comet assay and evaluate how this repair capacity is related to genetic variants in OGG1 and XRCC1 DNA repair genes. Genetic variants of OGG1 and XRCC1 with a decreased DNA repair capacity were previously identified. This means that a portion of the general population carrying the 'at risk' variant might be at higher risk of developing prostate cancer. This pilot study is expected to fill important gaps in our understanding of prostate cancer ecology produce new hypotheses which can be tested in an expanded prostate cancer study focus prostate cancer prevention in a new direction and help design better cancer prevention and treatment strategies.
DTIC
Africa; Cancer; Deoxyribonucleic Acid; Ethnic Factors; Maintenance; Prostate Gland; Risk

20070033362 University of Southern Illinois, Springfield, IL USA
Lipoxygenase, Angiogenicity, and Prostate Cancer Radioresistance
Nie, Daotai; Jan 1, 2007; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0143
Report No.(s): AD-A469539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Radiotherapy is a prevalent modality for the treatment of prostate tumor. Although radiation is capable of eradicating

localized prostate tumors, nearly 30% of patients treated with potentially curative doses relapse at the sites of irradiation. Therefore, there is an imperative need to improve the success rate of radiotherapy for PCa. This proposal is focused on a role of 12-lipoxygenase (LOX) in modulating radiation response of PCa cells. 12-LOX catalyzes the formation of 12(S)-hydroxyeicosatetraenoic acid (HETE). Our studies suggest an involvement of 12-LOX in radioresistance of PCa cells. It is our hypothesize that VEGF is an important intermediary for 12-LOX mediated radioresistance in PCa. We intend to define the role of 12-LOX in radioresponse in PCa. 12-LOX will be overexpressed in LNCaP and DU145 cells. Then we will study whether an increase in 12-LOX expression LNCaP and DU145 cells can enhance their resistance to radiotherapy. We also propose to study whether VEGF is required by 12-LOX to enhance PCa radioresistance through blockade of VEGF activity with a neutralizing antibody. Finally, we will evaluate whether BHPP, a 12-LOX inhibitor, can be used to sensitize prostate tumors to radiotherapy.
DTIC
Antibodies; Cancer; Prostate Gland; Radiation Therapy

20070033364 New York Hospital-Cornell Medical Center, New York, NY USA
Comparative Analysis of Vitamin A (Retinol) Regulated Genes in African-American and Caucasian Prostate Cancer Patients
Touma, Sue K; Gudas, Lorraine J; Nanus, David M; Tickoo, Satish K; Mar 2007; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0056
Report No.(s): AD-A469541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Vitamin A (retinol) and its related metabolites like retinoic acid (RA) have great potential in their roles as prostate cancer chemopreventive and chemotherapeutic agents by exerting regulation on cell growth and differentiation. Several studies have shown that there is a reduction in retinoid levels and retinoid receptors (e.g. RARBeta2) in prostate cancer. RA is being used to treat patients with prostate cancer and has been shown to inhibit tumor growth and reverse the events of carcinogenesis in animal models of prostate cancer. There is a disparity in prostate cancer among the African-American population and we hypothesize that more severe disruptions of retinoid signaling occur, contributing to this disparity. The purpose of this study is to examine the underlying causes for the clinical behavior of prostate cancer in African-Americans as compared to Caucasian patients. Immunohistochemical analysis has shown the expression of LRAT, an enzyme responsible for retinol esterification and storage as retinyl esters, to be reduced in tumor tissue specimens from prostate cancer patients as compared to adjacent nonmalignant tissue. Understanding the role of retinoid signaling in prostate carcinogenesis will lead to improved chemoprevention strategies and to the development of novel therapies for this disease.
DTIC
Africa; Cancer; Chemotherapy; Drugs; Genes; Patients; Prostate Gland; Races (Anthropology); Retina; Retinene

20070033368 Social Sectors Development Strategies, Inc., Boston, MA USA
Preventing the Consequences of Alcohol Abuse: Identification of Soldiers at High Risk for Fatal and Serious Injuries
Bell, Nicole S; Jan 2007; 404 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0676
Report No.(s): AD-A469548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report outlines progress made with support from grant #DAMD17-01-1-0676 Preventing the consequences of alcohol abuse: Identification of soldiers at high risk for fatal and serious injuries research project. The goals of this study were to improve our understanding of the risk factors for alcohol-related injury, as well as the long-term consequences of alcohol problems with regard to injuries. Another aim of this study was to obtain, develop and improve datasets and research methodologies so that they can be better used for research and prevention purposes in both the Army and civilian populations. The underlying main hypothesis of this study was that those soldiers with alcohol problems (abuse or dependence) are at greater risk of injury fatality and serious nonfatal injuries. Thus, the identification of alcohol-related problems and subsequent treatment may help reduce the risk of subsequent injuries. Individuals with alcohol-related problems could be identified from existing administrative databases, such as the hospital discharge data, health behavior surveys and alcohol treatment program data. We have described their profiles, documented increased risk for various patterns of intentional and unintentional injuries and documented the long-term sequelae of alcohol-related problems with regard to increased risk for fatal and nonfatal injuries. We have also identified protective factors and variations in the causal pathway between alcohol abuse and various injury outcomes.
DTIC
Alcohols; Injuries; Military Personnel; Risk

20070033369 Scripps Research Inst., La Jolla, CA USA

The Effects of Deregulated Cyclin Expression in Mitosis. A Role in Breast Tumorigenesis

Keck, Jamie M; Reed, Steve I; May 2006; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0383

Report No.(s): AD-A469549; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project is to study the effects of constitutive cyclin E expression on mitotic division and to better understand the mechanisms through which cyclin E leads to chromosome instability. Cyclin E functions to promote the G1/S phase transition and centrosome duplication; however, deregulation of cyclin E expression in cell culture results in premature entry into S phase and induces a moderate level of chromosome instability. We show that deregulated cyclin E can directly interfere with mitotic division leading to chromosome instability. Cells delay in late stages of prometaphase prior to complete alignment of chromosomes at the metaphase plate. In some cases, cells fail to divide chromosomes and instead return to interphase, resulting in polyploidy. In this third year of funding, I have completed the final goal of the project to determine the mechanism by which cyclin E delays mitosis. Cyclin E was found to inhibit the anaphase promoting complex (APC) ubiquitin ligase by inhibiting the specificity subunit, Cdh1, through a kinase-dependent mechanism. This inhibition led to significant accumulation of APC-Cdh1 substrates, cyclin B1, Cdc20, and securin. Furthermore, reducing Cdh1 in cells by RNAi mimics the protein accumulation and mitotic delay phenotypes observed upon cyclin E deregulation.

DTIC

Breast; Cancer; Chromosomes; Mammary Glands; Mitosis

20070033370 McGill Univ., Montreal, Quebec Canada

Negative Suppressors of Oncogenic Activation of the Met Receptor Tyrosine Kinase

Abella, Jasmine V; Mar 2007; 22 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0392

Report No.(s): AD-A469550; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Hepatocyte Growth Factor (HGF) RTK, Met, regulates cell proliferation, differentiation, migration, invasion and survival. Met activation is tightly controlled through several levels of regulation to achieve an appropriate biological response. In addition to mutations that activate the Met receptor in human cancer, I have previously shown that the specific uncoupling of Met from ubiquitination results in its oncogenic activation through deregulate endocytosis. My recent work has uncovered a novel role for the Gab1 scaffold in regulating Met internalization and subsequent degradation. HGF stimulation induces membrane ruffling events including the formation of lamellipodia and circular dorsal ruffles (CDRs). I show that Gab1 localizes to CDRs and recruits the Met receptor to this plasma membrane compartment where receptors are then internalized into the cell. Overexpression of Gab1 in HeLa and MDCK cells increases CDR formation, induces a more rapid Met translocation to a perinuclear compartment and enhances HGF induced Met degradation. Mutations in Gab1 that impair recruitment to Met or the plasma membrane, fail to enhance Met degradation. Interestingly, we also show that the endocytic protein, STAM2, can associate with Gab1 and is enriched in CDRs with Gab1. This represents a novel function for both proteins in normal Met downregulation.

DTIC

Carcinogens; Suppressors; Tumors; Tyrosine; Viruses

20070033371 Texas Univ., Houston, TX USA

Crosstalk Between Leptin Receptor and IGF-IR in Breast Cancer: A Potential Mediator of Chemoresistance

Nahta, Rita; Apr 1, 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0452

Report No.(s): AD-A469551; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Obesity is a major risk factor for the development and progression of breast cancer, and is associated with reduced treatment response and reduced overall survival. The obesity-associated hormones IGF-I and leptin are found at high levels in the serum of breast cancer patients, and their receptors, IGF-IR and the leptin receptor (Ob-R) are overexpressed in a majority of breast tumor tissues. We have discovered by co-immunoprecipitation that IGF-IR and Ob-R physically interact in breast cancer cells. This interaction was associated with cross talk from IGF-IR to Ob-R, as IGF-I stimulation promoted signaling downstream of the leptin receptor, including increased phosphorylation of Ob-R, STAT3, and JAK2. Our preliminary data suggests that this cross talk is unidirectional, as leptin stimulation did not alter IGF-IR phosphorylation. Our ongoing studies will examine this cross talk in more detail, in part by determining the biological and molecular effects of inhibition

of these growth factor receptors. We will then examine the influence of this cross talk on response to taxane-based chemotherapy.
DTIC
Breast; Cancer; Chemotherapy; Crosstalk; Insulin; Mammary Glands

20070033372 McGill Univ., Montreal, Quebec Canada
Role of Crk Adaptor Proteins in Cellular Migration and Invasion in Human Breast Cancer
Fathers, Kelly E; Mar 1, 2007; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0381
Report No.(s): AD-A469552; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Crk adaptor proteins (CrkI, CrkII and CrkL) play an important role during cellular signalling by mediating the formation of protein-protein complexes and are involved in cellular migration, invasion, and adhesion. Targeting CrkI and CrkII in breast cancer cell lines by RNA interference demonstrated that loss of Crk expression corresponded with a significant decrease in cell migration and invasion. This implies that Crk adaptor proteins play an important role in integrating signals for migration and invasion of highly malignant cancer cell lines. As migration and invasion are important components of the metastatic cascade, future work includes stable knockdown of Crk in breast cancer cell lines and performing in vivo metastasis assays. Furthermore, mouse models over-expressing CrkI/II result in delayed ductal outgrowth. MMTV-CrkII mice display enhanced branching and leads to tumour development. This has important implications as we have shown elevated levels of Crk are observed in human breast cancer. This project may provide information, which could be used to develop effective treatments for breast cancer, as well as other cancer types.
DTIC
Breast; Cancer; Mammary Glands; Migration; Proteins

20070033373 Colorado Univ., Aurora, CO USA
Breast Cancer Lymphatic Dissemination-Influence of Estrogen and Progesterone
Harrell, Joshua C; Horwitz, Kathryn B; Mar 2007; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0314
Report No.(s): AD-A469553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancers commonly spread to lymph nodes (LNs). If the primary tumors are estrogen receptor (ER) and/or progesterone receptor (PR) positive, then the likelihood that LN metastases express receptors exceeds 80%. However, due to lack of ER+ models, little is known about the role of hormones in breast cancer spread or the effects of the LN microenvironment on hormone responsiveness. We have developed metastasis models using ZsGreen labeled MCF-7 and T47D human breast cancer cells. Tumors are tracked in living mice by whole-body imaging, and macrometastases or micrometastases are detected by intravital imaging or fluorescence microscopy. Tumor growth is estrogen dependent and required for intratumoral lymphangiogenesis. Seventy-five percent of all tumors and >95% of larger tumors generate LN metastases. Occasionally more distant metastases are also observed. 'Triads' of primary tumors, tumorfilled draining lymphatic vessels, and tumor-filled LNs from the same mouse show that (a) proliferation, as measured by 5-bromo-2'-deoxyuridine uptake, is higher in the LN than in the primary tumor. (b) High ER levels are extensively down-regulated by estradiol in primary tumors. However, there is partial failure of ER down-regulation in LNs associated with (c) reduced PR expression. This suggests that ER are dysfunctional in the LN microenvironment and perhaps hormone resistant. (d) CD44 is sparsely expressed in primary tumor cells but homogeneously overexpressed in cells transiting the lymphatics and populating LNs. We hypothesize that CD44 expression targets tumor cells for transport to, and uptake in, LNs. If so, the CD44 pathway could be targeted therapeutically to slow or prevent LN metastases.
DTIC
Breast; Cancer; Estrogens; Females; Hormones; Lymphatic System; Mammary Glands; Metastasis

20070033374 Pittsburgh Univ., Pittsburgh, PA USA
The Cadherin Interaction as a Rate Limiting Step in Breast Cancer Metastasis to the Liver
Shepard, Christopher R; Mar 2007; 8 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0403
Report No.(s): AD-A469554; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epithelial-cadherin's (E-cadherin) transcriptional silencing in most advanced tumors, due to promoter methylation, enables tumor cells to disseminate from the primary mass. However, E-cadherin-positive metastatic carcinoma foci do

originate from mainly E-cadherin-negative primaries. We demonstrate that co-culture of hepatocytes with invasive breast cancer cells lacking E-cadherin triggers an epigenetic reversion in the breast cancer cells resulting in demethylation of the E-cadherin promoter and subsequent expression on the protein level. Further, we show that the E-cadherin ligation between breast cancer cells and hepatocytes is functional and activates the canonical MAPK pathway and Akt pathway in these cancer cells. Our epigenetic-reversion hypothesis for E-cadherin represents not only a paradigm shift in the current thinking that absence of E-cadherin is a fundamental issue, but would also reveal new strategies to combat the initial stages of metastatic disease in breast cancer patients.
DTIC
Breast; Cancer; Liver; Mammary Glands; Metastasis

20070033375 California Univ., San Francisco, CA USA
Inclusion of Minority Patients in Breast Cancer Clinical Trials: The Role of the Clinical Trial Environment
Kaplan, Celia P; May 2007; 25 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0254; BC050899
Report No.(s): AD-A469556; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Clinical trials are the primary vehicle for transforming laboratory discoveries in breast cancer care into clinical practice. Enhanced participation by minorities in these trials is necessary to assess the effectiveness of advances in breast cancer care among major subpopulations and to ensure equity in the distribution of research benefits. While inroads to increasing minority inclusion in breast cancer clinical trials have been made, recent reports continue to demonstrate lower enrollment among African Americans, Asian Americans, and Latinos when compared to Whites. Minority participation in clinical trials will likely remain low without research designed to understand the reasons for limited participation. To address persistent ethnic and socioeconomic disparities in cancer care, including participation in research, interventions need to assess the broader context of clinical trials and include the larger community where these trials take place. This study examines the combined effect of these factors on minority referral. The authors have identified trial characteristics that may impact minority recruitment, such as accessibility of trials, linguistic capacity and cultural competence of clinical trial staff, and outreach efforts. They have begun to analyze the geographic, social, and physical attributes of the communities surrounding the trials. Having received approval from the UCSF Committee on Human Research (effective 21 December 2006), the authors will initiate interviews with research team members and primary care providers to identify key indicators associated with clinical trial referral. This research will provide the basis for a standardized methodology to assess the overall capability of trial sites to include minorities, and contribute to the development of interventions aimed at clinical trial sites that address specific barriers associated with the social or physical environment.
DTIC
Breast; Cancer; Mammary Glands; Minorities; Patients

20070033376 Southwest Louisiana Healthcare System, Lake Charles, LA USA
Community Hospital Telehealth Consortium
Williams, Jr, Elton L; Apr 2005; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-C-0078
Report No.(s): AD-A469557; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Hospitals; Management Systems; Medical Services; Organizations; Telemedicine

20070033391 Duke Univ., Durham, NC USA
Modulating EGFR Signaling by Targeting the Deacetylase HDAC6-Hsp90 Complex in Breast Tumors
Yao, Tso-Pang; Jun 2006; 7 pp.; In English
Contract(s)/Grant(s): W81XWH-04-01-0555
Report No.(s): AD-A469574; No Copyright; Avail.: Defense Technical Information Center (DTIC)
By facilitating the structural maturation and thereby the stability and activity oncogenic proteins, such as ErbB2, the molecular chaperone Hsp90 has emerged as a promising cancer therapeutic target. Toward understanding the regulation of Hsp90 and identifying new therapeutic approach targeting Hsp90 activity, we have characterized reversible acetylation as a critical mechanism that regulates Hsp90 function. Here we present evidence that Hsp90 chaperone activity is regulated by reversible acetylation and controlled by the deacetylase HDAC6. Inactivation of HDAC6 leads to Hsp90 hyperacetylation, its dissociation from an essential co-chaperone, p23, and a loss of chaperone activity. Using glucocorticoid receptor (GR) as a

model client protein, we showed that in HDAC6 deficient cells, Hsp90-dependent maturation of the glucocorticoid receptor (GR) is compromised, providing evidence that HDAC6-catalyzed deacetylation is critical for Hsp90 activity. Our study identifies reversible acetylation as a unique mechanism that regulates Hsp90 chaperone complex activity. Based on this observation, we are now investigating whether HDAC6-regulated Hsp90 acetylation is also critical for ErbB2-induced tumor transformation.
DTIC
Breast; Cancer; Mammary Glands; Modulation; Tumors

20070033392 New York Univ., New York, NY USA
Development and Novel Uses of Antibodies in Epithelial Ovarian Cancer
Curtin, John P; Aug 1, 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0668
Report No.(s): AD-A469576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Immunologic approaches to treat ovarian cancer, a chemo-sensitive tumor, are in their infancy and have generally represented isolated clinical trial efforts. Further understanding of the host response to epithelial cancers and the potential capability of innovative immunologic technologies to ovarian cancer may play a key role in therapeutic advances. This integrated program proposes to expand the scope of ovarian cancer treatment in general, and immunotherapy in particular by working in three new and interrelated directions. These include: 1) new techniques that may identify relevant new human antibodies and characterize the target antigens, 2) test these in project models to evaluate the potential role in future therapy for ovarian cancer combined with radiation and chemotherapy, and 3) explore their role in allowing for the more accurate targeting of gene therapy. During the second year of the project, we were able to continue projects 1 - 3, culminating in the submission and acceptance of the abstract entitled 'The HUI77 Cryptic Epitope is Expressed in Human Ovarian Carcinoma and Regulates Tumor Cell Adhesion and Proliferation in Vitro' at the Society of Gynecologic Oncologists annual meeting.
DTIC
Antibodies; Cancer; Ovaries; Pharmacology

20070033397 Laboratorio Referencial Direccion de Salud, Iquitos, Peru
Potential Use of Pyriproxyfen for Control of Aedes aegypti Diptera: Culicidae) in Iquitos, Peru
Sihuincha, Moises; Zamora-Perea, Elvira; Orellana-Rios, Agner; Stancil, Jeffrey D; Lopez-sifuentes, Victor; Vidal-Ore, Carlos; Devine, Gregor J; Jan 20, 2005; 12 pp.; In English
Report No.(s): AD-A469593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effects of pyriproxyfen were tested against a local population of Aedes aegypti (L.) in Iquitos, Peru . Bioassays showed that, when applied to late instars, pyriproxyfen prevented adult emergence at extremely low concentrations (LC50= 0.012 ppb). There was no adult emergence from water sampled from storage tanks that had been seeded with the equivalent of 50-83 ppb (AI) pyriproxyfen. Five months after treatment, despite constant dilution of these tanks, water sampled from these sources continued to be lethal to larvae and pupae. Additional studies, carried out in the laboratory, showed that groups of five or 20 female blood-fed mosquitoes, exposed to residues of approximately equal 0.003 g (AI) pyriproxyfen/m squared, could transfer enough chemical to new oviposition sites to prevent approximately equal 80% of adult emergence from larvae developing in that previously uncontaminated water. Moreover, although the fecundity of the adult females used as the transfer vehicles in these tests was unaffected, the subsequent eclosion of the eggs that these mosquitoes laid was decreased by 70-90%. It also was shown that, at very high concentrations (>30,000 ppb), pyriproxyfen-treated water sources were as likely to be used as oviposition sites as untreated sources. These data suggest that treated sites might act as sinks for mosquito reproduction and moreover that such sites might act as dissemination sources for the horizontal transfer of larvicides to new environments by mature females. We review the literature on the environmental and human health effects of this compound and discuss its potential for use as a mosquito control agent in the field.
DTIC
Diseases; Insects; Peru

20070033398 Naval Medical Research Center, Silver Spring, MD USA
The Effect of Trihalomethane and Haloacetic Acid Exposure on Fetal Growth in a Maryland County
Porter, Chad K; Putman, Shannon D; Hunting, Katherine L; Riddle, Mark R; Mar 29, 2005; 12 pp.; In English
Report No.(s): AD-A469594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As water flows from treatment plants to the tap, chlorine, used to disinfect surface water meant for residential use, reacts

with residual organic and inorganic matter, creating chlorine disinfection by-products. In recent years, these by-products have been scrutinized as a potential reproductive and developmental hazard. This study examined whether exposure to the four total trihalomethanes or the five haloacetic acids (two major subgroups of chlorine disinfection by-products) was related to an increased risk of intrauterine growth retardation in four regions of a Maryland county from 1998 to 2002. Maternal exposure to each by-product was evaluated for each trimester as well as over the entire pregnancy. The authors were not able to demonstrate any consistent, statistically significant effect on intrauterine growth retardation associated with any of the chlorine disinfection by-products, nor did they find any indication of a dose-response relation. However, they did find some potential for a slightly elevated risk of intrauterine growth retardation during the second and third trimesters for both total trihalomethanes and five haloacetic acids when comparing increasing quintiles of exposure to constituents of total trihalomethanes and five haloacetic acids.
DTIC
Antiseptics; Exposure; Fetuses

20070033400 Chicago Univ., Chicago, IL USA
The Characterization and Treatment of Aggressive Breast Cancer
Nanda, Rita; May 2006; 15 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0545
Report No.(s): AD-A469602; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Several groups have demonstrated that women with BRCA1 germline mutations are more likely to have breast cancers that are basal-like by gene expression profiling. While BRCA1 germline mutations are uncommon, and contribute to fewer than 5% of breast cancer cases, our lab has demonstrated that methylation of the BRCA1 promoter occurs to some degree in almost 50% of high-grade, hormone receptor negative sporadic tumors. As promoter methylation leads to transcriptional repression, we propose that such tumors will be sensitive to DNA damaging agents and resistant to microtubule inhibitors, given the role that BRCA1 plays in both DNA repair and cell cycle. My laboratory has generated preliminary in vitro data that demonstrates breast cancer cells with BRCA1 promoter methylation and low expression levels are three-fold more sensitive to cisplatin and ten times more resistant to paclitaxel, as compared to cells with normal BRCA1 expression.
DTIC
Breast; Cancer; Mammary Glands; Neoplasms; Tumors

20070034096 Harvard Univ., Cambridge, MA USA
Synthesis and Manipulation of Biofunctional Magnetic Particles
Whitesides, George M; Ingber, Donald E; Prentiss, Mara; Xia, Younan; Jun 18, 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0782
Report No.(s): AD-A469435; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The most important conclusions of this program for biology arc that mechanical forces (here, generated magnetically) applied to the surface of cells provides a method of stimulating cells, and of reading out their response (via changes in the cytoskeleton) to changes in their environment. Magnetic interactions have many characteristics required for broad utility in biomedicine: in particles, i) magnetic forces can be much stronger than optical forces; ii) they are not screened or attenuated (as are optical and electrostatic forces) by the medium; iii) the availability of nanoscale magnetic particles, and to modify the properties of these particles through surface chemistry, provides a method of applying large forces locally and to specific receptors or targets; iv) cells respond readily to mechanical stimulation by magnetic forces; v) magnetic interactions provide the basis for a range of methods for separations of cells and molecules.
DTIC
Cells (Biology); Chemical Reactions; Surface Reactions; Magnetic Properties; Biophysics

20070034128 Force Health Protection and Readiness Policy and Programs, Falls Church, VA USA
Department of Defense Implementation Plan for Pandemic Influenza
Aug 2006; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469361; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469361
The Secretary of Defense's principal responsibility in responding to a pandemic will be to protect U.S. interests at home and abroad. This implementation plan sets forth Department of Defense (DoD) guidance and addresses key policy issues for

pandemic influenza planning. This guidance will enable the Combatant Commanders, Military Departments, and DoD agencies to develop plans to prepare for, detect, respond to, and contain the effects of a pandemic on military forces, DoD civilians, DoD contractors, dependents, and beneficiaries. Additionally, plans will address the provision of DoD assistance to civil authorities both foreign and domestic. Finally, attention to the key security concerns, such as humanitarian relief and stabilization operations that may arise as a result of a pandemic, will be addressed.
DTIC
Defense Program; Influenza; Viruses

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*.

20070032749 Research and Technology Organization, Neuilly-sur-Seine, France
Test Methodology for Protection of Vehicle Occupants against Anti-Vehicular Landmine Effects
April 2007; 176 pp.; In English
Report No.(s): RTO-TR-HFM-090; AC/323(HFM-090)TP/72; Copyright; Avail.: CASI: C01, CD-ROM: A09, Hardcopy

In 2001, the NATO/RTO HFM-090/TG-25 was created in response to the NATO/RTO HFM ET-007, which identified the lack of suitable information for injury assessment of the anti-vehicle mine threat. Furthermore, the Task Group was asked to help the STANAG 4569 Team of Experts to develop an injury assessment methodology for the qualification of light-armoured and logistic vehicles (blast) landmines protection systems. Injury criteria, tolerance levels and measurement methods were proposed to assess the most vulnerable body regions to a blast mine strike under a vehicle. The tolerance levels established for these body regions are considered to represent low risk of life-threatening and disabling injuries. The results, conclusions and recommendations of the HFM-090/TG-25 work are presented in the technical report.
Author
Mines (Ordnance); Tanks (Combat Vehicles); Countermeasures; Human Factors Engineering; Military Technology; Mathematical Models; Injuries; Musculoskeletal System; Biodynamics

20070032750 Research and Technology Organization, Neuilly-sur-Seine, France
Virtual Environments for Intuitive Human-System Interaction: Human Factors Considerations in the Design, Use, and Evaluation of AMVE-Technology, Part 2
July 2007; 178 pp.; In English; Original contains color illustrations
Report No.(s): RTO-TR-HFM-121-Part-II; AC/323(HFM-121)TP/62; Copyright; Avail.: CASI: C01, CD-ROM: A09, Hardcopy

Changing missions and development of new virtual and augmented reality technologies require the alliance to investigate and integrate new concepts for preparing their militaries and for evaluating human-system integration (HSI) for the design of new equipment. New paradigms and media of Augmented, Mixed, and Virtual Environments (AMVE) provide a realistic training environment and natural HSI using complex realistic or abstract synthetic environments. There are still many open research issues which limit practical application of these technologies. This report addresses relevant human factors issues that must be considered in the design, operation and performance assessment of AMVE-systems. The report discusses how AMVE technologies have been applied to solve real world military problems. While AMVE technologies have proved useful they still need further development before they can become a truly intuitive technology.
Author
Human Factors Engineering; Virtual Reality; Perception; Human-Computer Interface; Psychometrics

20070032751 Research and Technology Organization, Neuilly-sur-Seine, France
Multimedia Visualisation of Massive Military Datasets
June 2007; 252 pp.; In English; Original contains color and black and white illustrations
Report No.(s): RTO-TR-IST-021; AC/323(IST-021)TP/43; Copyright; Avail.: CASI: C01, CD-ROM: A12, Hardcopy

IST-021/RTG-007 considered the visualisation of massive military datasets, with a particular interest in methods of evaluating visualisation systems. In common with its predecessor groups under both RTO and the earlier Defence Research Group, IST-021/RTG-007 considered visualisation to happen inside a person's head, not on a screen. For evaluation purposes, several different nations offered national visualisation systems, but for different individual reasons only two were finally made

available. Two evaluation techniques were used, both of which presented some difficulties for evaluators when confronted with the complexities of real military visualisation systems. A visualisation testbed was constructed and used for several studies of display techniques in support of visualisation. Under the patronage of IST-021/RTG-007, a visualisation network of experts (NX) was continued, and both the NX and IST-021/RTG-007 organized workshops that examined particular facets of the visualisation problem, with some emphasis on counter-terrorism operations. The work of the group demonstrated that a major visualisation issue was the representation of network phenomena, such as computer network security against attack, social networks in counter-terrorism, causal and supportive networks in logistical operations, networks of effects in infrastructure damage, and a wide variety of other network situations of military relevance. The group recommended that a technical team be set up to study the visualisation of network-related phenomena. Such a group was approved with the designation IST-059/RTG-025.

Author

Data Bases; Multimedia; Military Technology; Scientific Visualization

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20070033071 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analysis of Routing Worm Infection Rates on an IPV4

Gorsuch, James E; Mar 2007; 130 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469318; AFIT/GCS/ENG/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469318

Malicious logic, specifically worms, has caused monetary expenditure problems to network users in the past. Worms, like Slammer and Code Red, have infected thousands of systems and brought the Internet to a standstill. This research examines the ability of the original Slammer worm, the Slammer based routing worm proposed by Zou et al, and a new Single Slash Eight (SSE) routing worm proposed by this research to infect vulnerable systems within a given address space. This research investigates the Slammer worm's ability to generate a uniform random IP addresses in a given address space. Finally, a comparison of the speed increase from computing systems available today versus those in use during the original Slammer release is performed. This research finds that the both the Slammer based routing worm and the SSE routing worm are faster than the original Slammer. The random number generator of the original Slammer worm does generate a statistically uniform distribution of addresses within the range under test. Further, this research shows that despite the previous research into the speed of worm propagation, there is a large void in testing worms on the systems available today that need to be investigated. The speed of the computing systems that the worms operated on in the past were more than three times slower than today?s systems. As the speed of computer systems continue to grow, the speed of worm propagation should increase with it as their scan rates directly relate to their infection rate. As such, the immunity of the future IPv6 network, from scanning worms may need to be reexamined.

DTIC

Infectious Diseases

20070033074 California Inst. of Tech., Pasadena, CA USA

Optical Logic With Gain: Photonic Crystal Nanocavity Switches

Scherer, Axel; Jul 31, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0418; Proj-2305

Report No.(s): AD-A469324; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469324

In this final report, we will describe the experimental results and new design concepts that we have developed over the past 3 years. We compare several approaches that take advantage of the addition of gain to optical logic system, and describe methods for electronic control over that gain. Moreover, we show several strategies of introducing optical gain into complex all optical logic systems and explore the ultimate operational speed of these switches. It is generally desirable to miniaturize

optical logic system in order to enable their integration in large numbers, and the approaches taken during this project have been focused on lithographically connected devices that can be readily miniaturized and integrated in large numbers.
DTIC
Computers; Crystals; Logic Design; Switches

20070034099 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
APHID: Anomaly Processor in Hardware for Intrusion Detection
Hart, Samuel A; Mar 2007; 123 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469491; AFIT/GCE/ENG/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Anomaly Processor in Hardware for Intrusion Detection (APHID) is a step forward in the field of co-processing intrusion detection mechanism. By using small, fast hardware primitives APHID relieves the production CPU from the burden of security processing. These primitives are tightly coupled to the CPU giving them access to critical state information such as the current instruction(s) in execution, the next instruction, registers, and processor state information. By monitoring these hardware elements, APHID is able to determine when an anomalous action occurs within one clock cycle. Upon detection, APHID can force the processor into a corrective state, or a halted state, depending on the required response. APHID primitives also harden the production system against attacks such as Distribute Denial of Service attack and buffer overflow attacks. APHID is designed to be fast and agile, with the ability to create multiple monitors that switch in and out of monitoring with the context switches of the production processor to highly focused coverage over multiple devices and sections of code.
DTIC
Anomalies; Central Processing Units; Computer Information Security; Detection; Warning Systems

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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.

20070033030 Arizona Univ., Tucson, AZ USA
Detecting Deception in the Military Infosphere: Improving and Integrating Human Detection Capabilities with Automated Tools
Burgoon, Judee K; Nunamaker, Jr , Jay F; George, Joey; Biros, David; Apr 25, 2007; 141 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0394
Report No.(s): AD-A469246; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469246

This 5-year project conducted principally by University of Arizona, Florida State University, Michigan State University, and Air Force Institute of Technology, reports results of (1) theoretical development on a model of interactive deception, (2) laboratory and field testing to identify reliable indicators of deceit and variables that moderate those effects, (3) identification of cognitive biases that adversely impact human deception detection, (4) development of a prototype suite of tools - Agent99 - for automatically identifying linguistic, vocal and visual indicators of deceit, (5) development of a curriculum and computer-based system for delivering training in deception detection, and (6) field testing of the prototypes and training. Several tools have been implemented, and lessons learned provide important guidance for future development of deception detection tools and procedures.
DTIC
Artificial Intelligence; Computer Programs; Deception; Detection; Human Performance; Information Systems

20070033040 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Comparative Analysis of a High Bypass Turbofan Using a Pulsed Detonation Combustor
Andrus, Ionio Q; Mar 2007; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469258; AFIT/GAE/ENY/07-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469258

It has been proposed that the implementation of a pulsed detonation combustor in a high-bypass turbofan engine would result in an engine that is both more efficient and more reliable. The validity of the performance claims are evaluated based

on a comparison between the baseline and hybrid turbofans. The hybrid pulsed detonation engine was modeled in the Numerical Propulsion Simulation System (NPSS) and shares a common architecture with the baseline turbofan model, except that the combustor of the baseline engine is replaced with a pulsed detonation combustor. Detonation effects are calculated using a closed form solution of the Chapman-Jouguet Mach number with a total energy correction applied. Cycle time is calculated to provide a reasonable estimate of frequency for the user input geometry, and the losses due unsteady flow are accounted for by applying pressure and temperature losses to the fluid. A parametric study was performed to evaluate the effects of these losses on net thrust and TSFC. There is a definite level of acceptable loss that if surpassed makes pulsed detonation combustion a good candidate for inclusion into a hybrid turbofan engine.
DTIC
Air Breathing Engines; Bypasses; Combustion Chambers; Detonation; Turbofans

20070033049 Air Force Communications Command, Scott AFB, IL USA
Multi-Dimensional Range Querying Using a Modification of the Skip Graph
Brault, Gregory J; Mar 2007; 136 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469272; AFIT/GE/ENG/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469272

Skip graphs are an application layer-based distributed routing data structure that can be used in a sensor network to facilitate user queries of data collected by the sensor nodes. This research investigates the impact of a proposed modification to the skip graph proposed by Aspnes and Shah. Nodes contained in a standard skip graph are sorted by their key value into successively smaller groups based on random membership vectors computed locally at each node. The proposed modification inverts the node key and membership vector roles, where group membership is computed deterministically and node keys are computed randomly. Both skip graph types are modeled in Java. Range query and node mobility simulations are performed. The number of skip graph levels, total node count, and query precision are varied for query simulations; number of levels and total node count is varied for the mobility simulation. Query performance is measured by the number of skip graph messages used to execute the query while mobility performance is measured by the number of messages transmitted to maintain skip graph coherence. When the number of levels is limited and query precision is low, or when query precision is matched by the number of levels in the skip graph and total network node counts are increased, the modified skip graph transmits fewer messages to execute the query. Furthermore, fewer update messages are needed to fix lost node references due to mobile nodes.
DTIC
Computer Graphics; Computer Networks

20070033060 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
In Pursuit of an Aptitude Test for Potential Cyberspace Warriors
Smith, Tiffany S; Mar 2007; 104 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469300; AFIT/GIR/ENG/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469300

The Air Force has officially assumed the cyberspace mission. To perform this mission well, it is important to employ personnel who have the necessary skill sets and motivation to work in a cyberspace environment. The first step in employing the right people is to screen all possible candidates and select those with an aptitude for acquiring the skill sets and with the motivation to perform this work. This thesis attempts to determine the necessary skills and motivations to perform the cyberspace mission and recommends a screening process to select the candidates with the highest probability for success. Since this mission is new, no one really knows what skills and motivations are necessary for it. To assist in determining the skills and motivations for cyber warriors, the author considers the skills and motivations of computer hackers. If the skills and motivations of successful hackers can be identified, those skills and motivations can be used as a tool for developing an aptitude test to be used as a screening device. A blueprint for an aptitude test is provided based on the findings of the hacker skills and motivations.
DTIC
Aptitude; Armed Forces (United States); Military Personnel; Personnel; Personnel Selection; Psychological Tests

20070033061 General Accounting Office, Washington, DC USA

Defense Acquisitions: Stronger Management Practices are Needed to Improve DOD's Software-Intensive Weapon Acquisitions

Schinasi, Katherine V; Andrew, Cheryl; Breen, Beverly; Chin, Lily; Hubler, Ivy; Mebane, Carol; Sullivan, Mike; Nooruddin, Sameena; Ahearn, Marie P; Panwar, Madhav; Mar 2004; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469302; GAO-04-393; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469302

The Department of Defense (DoD) has been relying increasingly on computer software to introduce or enhance the performance capabilities of major weapon systems. To ensure successful outcomes, software acquisition requires disciplined processes and practices. Without such discipline, weapon programs encounter difficulty in meeting cost and schedule targets. For example, in fiscal year 2003, DoD might have spent as much as $8 billion to rework software because of quality-related issues. GAO was asked to identify the practices used by leading companies to acquire software and to analyze the causes of poor outcomes of selected DoD programs. GAO also was asked to evaluate DoD's efforts to develop programs for improving software acquisition processes and to assess how those efforts compare with leading companies' practices. In a review of five DoD programs, GAO found that outcomes were mixed for software-intensive acquisitions. The F/A-18 C/D, a fighter and attack aircraft, and the Tactical Tomahawk missile had fewer additional cost and schedule delays. For these programs, developers used an evolutionary approach, disciplined processes, and meaningful metrics. In contrast, the following programs, which did not follow these management strategies, experienced schedule delays and cost growth: F/A-22, an air dominance aircraft; Space-Based Infrared System, a missile-detection satellite system; and Comanche, a multimission helicopter. GAO recommends that the Secretary of Defense direct the military services and agencies to adopt specific controls to improve software acquisition outcomes. These practices should be incorporated into DoD policy, software process improvement plans, and development contracts. DoD concurred with two revised recommendations and partially concurred with two others.

DTIC

Computer Programming; Contract Management; Defense Program; Management Planning; Procedures; Procurement; Software Engineering; Weapon Systems

20070033070 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Heuristically Driven Search Methods for Topology Control in Directional Wireless Hybrid Networks

Garner, Roger L; Mar 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469317; AFIT/GCS/ENG/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469317

Information and Networked Communications play a vital role in the everyday operations of the USA Armed Forces. This research establishes a comparative analysis of the unique network characteristics and requirements introduced by the Topology Control Problem (also known as the Network Design Problem). Previous research has focused on the development of Mixed-Integer Linear Program (MILP) formulations, simple heuristics, and Genetic Algorithm (GA) strategies for solving this problem. Principal concerns with these techniques include runtime and solution quality. To reduce runtime, new strategies have been developed based on the concept of flow networks using the novel combination of three well-known algorithms; knapsack, greedy commodity filtering, and maximum flow. The performance of this approach and variants are compared with previous research using several network metrics including computation time, cost, network diameter, dropped commodities, and average number of hops per commodity. The results conclude that maximum flow algorithms alone are not quite as effective as previous findings, but are at least comparable and show potential for larger networks.v

DTIC

Communication Networks; Topology; Wireless Communication

20070033078 Carnegie-Mellon Univ., Pittsburgh, PA USA

Design Fragments

Fairbanks, George; Apr 19, 2007; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0389; DAAD19-01-1-0485

Report No.(s): AD-A469340; CMU-ISRI-07-108; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469340

Frameworks are a valuable way to share designs and implementations on a large scale. Client programmers, however, have difficulty using frameworks. They find it difficult to understand non-local client-framework interactions, design solutions when they do not own the architectural skeleton, gain confidence that they have engaged with the framework correctly, represent their successful engagement with the framework in a way that can be shared with others, ensure their design intent

is expressed in their source code, and connect with external files. A design fragment is a specification of how a client program can use framework resources to accomplish a goal. From the framework, it identifies the minimal set of classes, interfaces, and methods that should be employed. For the client program, it specifies the client-framework interactions that must be implemented. The structure of the client program is specified as roles, where the roles can be filled by an actual client program's classes, fields, and methods. A design fragment exists separately from client programs, and can be bound to the client program via annotations in their source code. These annotations express design intent; specifically, that it is the intention of the client programs to interact with the framework as specified by the design fragment.
DTIC
Client Server Systems; Fragments

20070033124 Simulation Technology and Applied Research, Inc., Mequon, WI USA
Computer-Aided Design and Optimization of High-Performance Vacuum Electronic Devices
DeFord, John F; Held, Ben; Bruss, Adam; Petillo, John; Jun 15, 2007; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-05-C-0375
Report No.(s): AD-A469433; STAR-06-SBIR-ONR-T4; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469433

We have completed implementation of a variety of numerical optimization methods, including multi-directional search (MDS), differential evolution (DE), the Powell conjugate gradient method, and a zero-crossing technique. These methods have been extensively tested on several guns and collectors. The user interface to these techniques in Analyst has been completed and is included in Analyst Version 10. We have also completed development of a system for computing the manufacturing sensitivity of a design point. To support collector optimization we have recently created capabilities for the Analyst magnetostatics solver (MS3P) to output magnetic field files in a format that MICHELLE can read, and we have worked with SAIC on modifications to MICHELLE to use these files. This report was developed under a SBIR contract award for Solicitation topic N04-113.
DTIC
Computer Aided Design; Design Optimization; Electronic Equipment; Graphical User Interface; Optimization; Vacuum; Vacuum Apparatus

20070033290 General Accounting Office, Washington, DC USA
Defense Acquisitions: Knowledge of Software Suppliers Needed to Manage Risks
Neumann, John; Mullins, Brian; Cohen, Delores; Oakley, Shelby S; Miller, Christopher; Middleton, Gary; Ahearn, Marie; May 2004; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469303; GAO-04-678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) is increasingly reliant on software and information systems for its weapon capabilities, and DoD prime contractors are subcontracting more of their software development. The increased reliance on software and a greater number of suppliers results in more opportunities to exploit vulnerabilities in defense software. In addition, DoD has reported that countries hostile to the USA are focusing resources on information warfare strategies. Therefore, software security, including the need for protection of software code from malicious activity, is an area of concern for many DoD programs. DoD acquisition and software security policies do not fully address the risk of using foreign suppliers to develop weapon systems software. The current acquisition guidance allows program officials discretion in managing foreign involvement in software development, without requiring them to identify and mitigate such risks. Moreover, other policies intended to mitigate information systems vulnerabilities focus mostly on operational software security threats, such as external hacking and unauthorized access to information systems, but not on insider threats, such as the insertion of malicious code by software developers. Recent DoD initiatives may provide greater focus on these risks, but to date have not been adopted as practice within DoD. GAO was asked to examine DoD's efforts to identify software development suppliers, and manage risks related to foreign involvement in software development on weapon systems. To address software vulnerabilities and threats, GAO recommends that DoD better define software security requirements and require program managers to mitigate associated risks accordingly. DoD agreed with the findings but only partially concurred with the recommendations over concerns that they place too much responsibility for risk mitigation with program managers. GAO has broadened the recommendations to address DoD's concerns.
DTIC
Computer Programming; Contract Management; Procurement; Risk; Security; Software Engineering; Weapon Systems

20070033302 Naval Undersea Warfare Center, Newport, RI USA
User's Manual for the Tonpilz-Window Interaction Model (TWIM) Program
Hull, Andrew J; Apr 2, 2007; 56 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-N07PR01253-00
Report No.(s): AD-A469450; NUWC-NPT-TD-11800; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Tonpilz-Window Interaction Model (TWIM) program calculates the element receive response of an array of Tonpilz sensors that resides behind an elastomeric sonar window loaded on the front side with a fluid that contains an acoustic pressure. This program allows the user to build a mathematical model of a Tonpilz array that is in contact with a fluid-loaded sonar window. This user's manual explains the program in detail and includes sample output and flowcharts.
DTIC
Acoustics; Audio Frequencies; Computer Programs; Manuals; Sonar; User Manuals (Computer Programs)

20070033306 Nottingham Univ., UK
Estimating the Sediment Yield Due to Bend Migration in Meandering Rivers
Jun 2007; 10 pp.; In English
Contract(s)/Grant(s): N62558-06-P-0316
Report No.(s): AD-A469455; RK1525-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of this research is to compile a database of meander shifting observed in US rivers over periods of 30 to 60 years that can be used to estimate possible sediment yields due to bend movement. The database is based on an existing Transportation Research Board database, but with improved quality control and accuracy. The potential for using the database to make estimates of bank erosion sediment yield will be explored towards the end of the study.
DTIC
Estimates; Estimating; Migration; Rivers; Sediments

20070033310 Woods Hole Oceanographic Inst., MA USA
Undersea Acoustic Communication and Navigation Technology Development and Demonstration
Freitag, Lee E; Preisig, James C; Dec 31, 2006; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-C-201; Proj-WHOI-100201.00; Proj-HOI-100201.01
Report No.(s): AD-A469461; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This final report contains a cumulative summary of project highlights included in the annual reports. It is provided primarily to meet contract close-out requirements, but also has a list of references and related projects. Additional information is available from the authors in addition to the published papers cited herein. The long-term goals of this program include the development of an integrated acoustic communication and long-baseline acoustic navigation system that supports the requirements of the Autonomous Operations FNC program. The goal of the AO-FNC focuses on a multi-vehicle solution to the Undersea Search and Survey (USS) mission, in particular that proposed by Bluefin Robotics. The Bluefin Robotics approach utilizes several types of vehicles, all linked acoustically, to carry out the target search mission. The long-term goals of the overall program include the demonstration of the multi-vehicle capability for mapping, target detection and classification, reacquisition and ultimately neutralization. The acoustic communication system will enable the vehicles to transfer both navigation and target information around the network, and to allow external command, control, and mission progress monitoring.
DTIC
Acoustics; Communication; Communication Networks; Navigation; Sound Transmission; Underwater Vehicles

20070033312 Science Applications International Corp., McLean, VA USA
FIIDOS--A Computer Code for the Computation of Fallout Inhalation and Ingestion Dose to Organs Computer User's Guide (Revision 4)
Dudley A, III Egbert, Stephen D Stiver, John H Case, David, Raine; May 2007; 169 pp.; In English
Contract(s)/Grant(s): HDTRA1-07-C-0015; Proj-CS
Report No.(s): AD-A469466; DTRA-TR-07-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report discusses the technical aspects of the computer code FIIDOS (Fallout Inhalation and Ingestion Dose to Organs, Version 4), describes user inputs and operations, and includes sample problems. This report updates the original FIIDOS Computer User's Guide published in 1985.
DTIC
Computer Programs; Dosage; Fallout; Organs; Radiation Dosage; Respiration

20070033323 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Hardware Realization of a Transform Domain Communication System

Haker, Marshall E; Mar 2007; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469487; AFIT/GE/ENG/07-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research was to implement a Transform Domain Communication System (TDCS) in hardware and compare experimental bit error performance with results published in literature. The intent is to demonstrate the effectiveness or ineffectiveness of a TDCS in communicating binary data across a real channel. In this case, an acoustic channel that is laden with narrowband interference was considered. A TDCS user pair was constructed to validate the proposed design using Matlab(Trademark) to control a PC sound card. The proposed TDCS design used the Bartlett method of spectrum estimation, the spectral notching algorithm found in TDCS literature, quadrature phase shift keying, and minimum mean square error transverse equalization to mitigate the effects of noise and intersymbol interference. Water-filling was evaluated as an alternative to spectral notching for performing waveform design and is shown to perform equivalently. Validated software was migrated to code suitable for use onboard a Digital Signal Processor Starter Kit (DSK). Two DSK boards were used, one for transmission and reception, and bit error performance results were obtained. Bit error analysis reveals that the TDCS hardware performs approximately the same as literature suggests.

DTIC

Computer Programs; Phase Shift; Telecommunication; User Requirements

20070033355 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Using Concept Maps to More Efficiently Create Intelligence Information Models

Coryell, Christopher E; Mar 2007; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469530; AFIT/GCE/ENG/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information models are a critical tool that enables intelligence customers to quickly and accurately comprehend U.S. intelligence agency products. The Knowledge Pre-positioning System (KPS) is the standard repository for information models at the National Air and Space Intelligence Center (NASIC). The current approach used by NASIC to build a KPS information model is laborious and costly. Intelligence analysts design an information model using a manual, butcher-paper-based process. The output of their work is then entered into KPS by either a single NASIC KPS 'database modeler' or a contractor (at a cost of roughly $100K to the organization). This thesis proposes a tool-supported approach that allows intelligence analysts to create information models for NASIC with almost no database modeler or contractor support. The approach allows analysts to express an information model as a concept map, a analyst-understandable model of an intelligence domain. An existing tool, CmapTools, supports the analyst-in-the-loop process of concept map creation. A completed concept map is automatically converted into KPS by a prototype tool called Cmap Conversion for KPS, which was created as part of this work. They restrict, to a reasonable degree, how analysts express concept maps within CmapTools to ensure that automatic conversion is possible. The authors validated their approach using a representative NASIC-provided KPS information model: performance of fixed-wing aircraft. Using these tools, a new information model was constructed in 4 hours and 20 minutes, a 89% improvement over the 40 hours estimated by NASIC to complete the same task using their existing approach. For this representative information model, NASIC estimates this approach would save them roughly $200K.

DTIC

Data Processing; Intelligence; Mapping; Models; Software Development Tools; Translating

20070033399 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optimizing Distributed Sensor Placement for Border Patrol Interdiction Using Microsoft Excel

Patrascu, Adrian C; Apr 2007; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469595; AFIT/GOR/ENS/07-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research was to develop an electronic sensor placement model for border security. A model was developed using Microsoft Excel, with some add-on capabilities, to optimize the placement of electronic sensors on a border network given a pre-determined budgetary constraint. The model is capable of handling multiple sensor types, which are placed together as packages, and allows for daytime, nighttime, or 24 hour operation of each sensor type. Additionally, each sensor can be assigned a specific range and detection probability curve within the given range. The model is capable of optimizing either average coverage, or minimum coverage, across the nodes of a network by selecting the nodes where sensor packages are to be placed. Due to its simplicity and ability to run in Microsoft Excel, it is believed that the model developed in this research can also be used in a number of military applications where border security is necessary.

DTIC

Drugs; Patrols; Spreadsheets

20070034097 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Virtualization Technology Applied to Rootkit Defense

Medley, Douglas P; Mar 2007; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469494; AFIT/GCE/ENG/07-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research effort examines the idea of applying virtualization hardware to enhance operating system security against rootkits. Rootkits are sets of tools used to hide code and/or functionality from the user and operating system. Rootkits can accomplish this feat through using access to one part of an operating system to change another part that resides at the same privilege level. Hardware assisted virtualization (HAV) provides an opportunity to defeat this tactic through the introduction of a new operating mode. Created to aid operating system virtualization, HAV provides hardware support for managing and saving multiple states of the processor. This hardware support overcomes a problem in pure software virtualization, which is the need to modify guest software to run at a less privileged level. Using HAV, guest software can operate at the pre-HAV most privileged level. This thesis provides a plan to protect data structures targeted by rootkits through unconventional use of HAV technology to secure system resources such as memory. This method of protection will provide true real-time security through OS attack prevention, rather than reaction.

DTIC

Computer Information Security; Computer Programs; Computers; Security

20070034110 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Using Relocatable Bitstreams For Fault Tolerance

Montminy, David P; Mar 2007; 131 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469223; AFIT/GCE/ENG/07-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469223

This research develops a method for relocating reconfigurable modules on the Virtex-II (Pro) family of Field Programmable Gate Arrays (FPGAs). A bitstream translation program is developed which correctly changes the location of a partial bitstream that implements a module on the FPGA. To take advantage of relocatable modules, three fault-tolerance circuit designs are developed and tested. This circuit can operate through a fault by efficiently removing the faulty module and replacing it with a relocated module without faults. The FPGA can recover from faults at a known location, without the need for external intervention using an embedded fault recovery system. The recovery system uses an internal PowerPC to relocate the modules and reprogram the FPGA. Due to the limited architecture of the target FPGA and Xilinx tool errors, an FPGA with automatic fault recovery could not be demonstrated. However, the various components needed to do this type of recovery have been implemented and demonstrated individually.

DTIC

Computer Programming; Fault Tolerance

20070034111 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Exploring Hardware-Based Primitives to Enhance Parallel Security Monitoring in a Novel Computing Architecture

Mott, Stephen; Mar 2007; 191 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469220; AFIT/ENG/GE/07-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469220

This research explores how hardware-based primitives can be implemented to perform security-related monitoring in real-time, offer better security, and increase performance compared to software-based approaches. In doing this, we propose a novel computing architecture, derived from a contemporary shared memory architecture, that facilitates efficient security-related monitoring in real-time, while keeping the monitoring hardware itself safe from attack. This architecture is flexible, allowing security to be tailored based on the needs of the system. We have developed a number of hardware-based primitives that fit into this architecture to provide a wide array of monitoring capabilities. A number of these primitives provide capabilities, such as multi-context monitoring and virtual memory introspection, that were not previously possible at the hardware level. Not only does this allow for more robust security-related monitoring when compared to software-based approaches, it also allows the security-related monitoring concepts presented in this research to be applied across a broad range of computing environments.

DTIC

Architecture (Computers); Computer Information Security; Security

20070034112 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Software Protection Against Reverse Engineering Tools

Benson, Joshua A; Mar 2007; 170 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469485; AFIT/GIA/ENG/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Advances in technology have led to the use of simple to use automated debugging tools which can be extremely helpful in troubleshooting problems in code. However, a malicious attacker can use these same tools. Securely designing software and keeping it secure has become extremely difficult. These same easy to use debuggers can be used to bypass security built into software. While the detection of an altered executable file is possible, it is not as easy to prevent alteration in the first place. One way to prevent alteration is through code obfuscation or hiding the true function of software so as to make alteration difficult. This research executes blocks of code in parallel from within a hidden function to obscure functionality. This method is tested on six programs; a DOS version of the UNIX grep utility and five computational functions: Fast Fourier Transfer, Successive Over-Relaxation, Sparse matrix-multiply, Monte Carlo integration, and dense LU factorization. It tests the impact of using four, eight, and twelve parallel threads of execution to obscure functionality. The concept is effective, but is limited due to the cost associated with using threads. The computational functions make millions of calls to the hidden function. The average cost per thread for these five functions turns out to be 7.04906 x 10 (exp -6) seconds. The grep function does not make millions of calls and is therefore more feasible. Care must be taken to ensure the compiler does not remove parallel threads if optimization is used.

DTIC

Computer Programming; Protection; Reverse Engineering; Software Development Tools; Software Engineering; Threads

20070034130 Sonalysts, Inc., Waterford, CT USA

Virtual Observer Controller (VOC) for Small Unit Infantry Laser Simulation Training

Banta, H G; Troillet, David B; Daly, Jason P; Martin, Glenn A; Apr 2007; 96 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W74V8H-04-C-0045; Proj-A790

Report No.(s): AD-A469326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469326

This report was developed under a Small Business Technology Transfer Research (STTR) Phase II contract. It describes the development of a prototype Virtual Observer/Controller (VOC) to observe the performance of and offer limited feedback to small-unit, dismounted Infantry Soldiers while training with the Soldier Visualization System (SVS). The successful integration of technologies paved the way for SVS exercises that were not completely dependent on a human observer/controller. The development and implementation of the prototype VOC required several major efforts: (a) identifying the Soldier behaviors that merit performance evaluations, (b) developing situation triggers in the context of a training scenario that stimulate the Soldier behaviors that will be observed and evaluated, (c) determining how to detect those behaviors in an automated fashion, and (d) developing instructional strategies that can adequately respond to both individual actions and small-unit collective behaviors.

DTIC

Computer Assisted Instruction; Controllers; Education; Lasers; Military Personnel; Simulation

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20070032735 NASA Goddard Space Flight Center, Greenbelt, MD, USA

What Do Our Users Want? Perspectives on Understanding and Meeting User Needs for Multi-Mission Data Services

McGuire, Robert E.; Candey, Robert M.; Bilitza, D.; [2006]; 1 pp.; In English; 2006 Joint Assembly Meeting, 23-26 May 2006, Baltimore, MD, USA; Copyright; Avail.: Other Sources; Abstract Only

The Sun-Earth Connection Active Archive (SECAA) project of NASA's Space Physics Data Facility operates a range of unique and heavily used multi-mission data services in support of the large-scale science objectives of the Great Observatory, including services such as CDAWeb, the CDAWeb Plus client, SSCWeb, OMNIweb and the CDF data format. In developing and operating these services, we have encountered and continue to struggle with a wide range of issues such as balancing scope and functionality with simplicity and ease of use, understanding the effectiveness of our choices and identifying areas

most important for further improvement. In this paper, we will review our key services and then discuss some of our observations and new approaches to understanding and meeting user data service requirements. Some observations are obvious but may still have substantial implications; e.g. functionality without information content is of little user interest, which has led to our recent emphasis on development of web services interfaces, so the content and functionality we already serve is readily and fully available as a building block for new services. Some observations require careful design and tradeoffs; e.g. users will complain when they are offered interfaces with limited options but users are also easily intimidated and become lost when offered extensive options for customization. Some observations remain highly challenging; e.g. a comprehensive multi-mission, multi-source view of all data and services available easily produces a daunting list, but a more selective view can easily lead users to overlook available and relevant data. It is often difficult to obtain and meaningfully interpret measures of true productive usage and overall user satisfaction, even with a variety of techniques including statistics, citations, case studies, user feedback and advisory committees. Most of these issues will apply to and may even be more acute for distributed implementation architectures.
Author
Atmospheric Physics; Solar Terrestrial Interactions; User Requirements; Web Services; Data Processing

20070032903 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Model-Based Systems
Frisch, Harold P.; [2007]; 8 pp.; In English; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032903

Engineers, who design systems using text specification documents, focus their work upon the completed system to meet Performance, time and budget goals. Consistency and integrity is difficult to maintain within text documents for a single complex system and more difficult to maintain as several systems are combined into higher-level systems, are maintained over decades, and evolve technically and in performance through updates. This system design approach frequently results in major changes during the system integration and test phase, and in time and budget overruns. Engineers who build system specification documents within a model-based systems environment go a step further and aggregate all of the data. They interrelate all of the data to insure consistency and integrity. After the model is constructed, the various system specification documents are prepared, all from the same database. The consistency and integrity of the model is assured, therefore the consistency and integrity of the various specification documents is insured. This article attempts to define model-based systems relative to such an environment. The intent is to expose the complexity of the enabling problem by outlining what is needed, why it is needed and how needs are being addressed by international standards writing teams.
Derived from text
Systems Engineering; Complex Systems; Models; Computer Systems Programs

20070032940 Computer Sciences Corp., Greenbelt, MD, USA
A Queue Simulation Tool for a High Performance Scientific Computing Center
Spear, Carrie; [2007]; 12 pp.; In English; CMG '07 INternational Conference Computer Measurement Group, 2-7 Dec. 2007, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NASA Order S-40941-X; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Center for Computational Sciences (NCCS) at the Goddard Space Flight Center provides high performance highly parallel processors, mass storage, and supporting infrastructure to a community of computational Earth and space scientists. Long running (days) and highly parallel (hundreds of CPUs) jobs are common in the workload. NCCS management structures batch queues and allocates resources to optimize system use and prioritize workloads. NCCS technical staff use a locally developed discrete event simulation tool to model the impacts of evolving workloads, potential system upgrades, alternative queue structures and resource allocation policies.
Author
Parallel Processing (Computers); Resource Allocation; Computer Systems Simulation; Supercomputers

20070033001 Army War Coll., Carlisle Barracks, PA USA
Converging the Networks
Benedict, Leith A; Mar 26, 2007; 22 pp.; In English
Report No.(s): AD-A469200; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469200

Recent combat operations have demonstrated the inadequacy of current tactical communication systems and the

significant communication bandwidth shortfalls that exist between operation and tactical forces. Data requirements supporting combat operations have increased exponentially in comparison to the bandwidth available, placing an enormous challenge on the archaic generations of communications equipment currently in the field. The data explosion of the late 1990s radically transformed how the Army fought, leading to the transition from a voice centric, acetate map-based force to a digitized force dependent on multiple data feeds to provide a common picture of the battlefield. Imagery, file sharing, e-mail, collaborative tools and Video Teleconferencing replaced the telephone and fax machine as the primary means of communications. Over time, technological insertions and upgrades to communications systems improved data capabilities at the operational and tactical levels, but this effort couldn't keep up with the ever-increasing bandwidth requirements. Forces deployed in austere environments required access to data services similar to capabilities provided in garrison. Existing limitations of the legacy communications systems coupled with the inability of the Signal Corps and the acquisition community to provide solutions, caused Warfighters to look elsewhere to solve their bandwidth shortfalls. This was the beginning of the 'deregulation' of the network from the grasp of the signal community and what has been described as a 'free-for-all' in communications systems procurements. Systems were procured without regard to technical architecture, resulting in a federation of stove-piped systems and networks that are operated outside the common user architecture. This paper examines the efficiencies that can be gained by converging these disparate networks into a single, seamless common user architecture that can meet the bandwidth requirements of all users.
DTIC
Bandwidth; Communication Networks; Computer Networks; Convergence; Telecommunication

20070033303 California Univ., Berkeley, CA USA
Fault Tolerant Real-Time Networks
Zakhor, Avideh; Henzinger, Thomas; Trevedi, Kishor; Ammar, Mostafa; Lynch, Nancy; Shin, Kang; May 30, 2007; 53 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0327
Report No.(s): AD-A469451; 1-22506-23800-44; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Our main objective in this MURI project has been to investigate foundational and experimental techniques tor enabling real-time, fault-tolerant network protocols. Our overall research goal has been to study networking architectures, services, and algorithms which require innovative quality-of-service and fault-tolerance mechanisms. We have focused on multimedia delivery in traditional client-server architectures, both in the case of the Internet and wireless networks, as well as on peer-to-peer content delivery and on mobile ad-hoc networks. The unique composition of the team has brought new synergies to the problem domain which permits the complete illumination of each newly proposed protocol from all angles, from mathematical modeling and analysis to experimental evaluation, from real-time and QoS aspects to fault-tolerance and reliability aspects. Our approach is to improve newly designed protocols through feedback from timing and fault analysis, and to develop new analysis techniques driven by new protocol designs.
DTIC
Communication Networks; Fault Tolerance; Protocol (Computers); Real Time Operation

20070033338 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
On-Demand Key Distribution for Mobile Ad-Hoc Networks
Graham, Daniel F; Mar 2007; 72 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469510; AFIT/GCS/ENG/07-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Mobile ad-hoc networks offer dynamic portable communication with little or no infrastructure. While this has many benefits, there are additional shortcomings specific to wireless communication that must be addressed. This research proposes gossip-based on-demand key distribution as a means to provide data encryption for mobile ad-hoc networks. This technique uses message keys to avoid encrypting and decrypting a message at every node. Other optimizations used include secure channel caching and joint rekey messages. The use of gossip makes the scheme robust to node failure. Experimental results show only a 15% increase in end-to-end delay with a node failure rate of 10%. The percentage of messages successfully delivered to nodes stays between 91-98% under the same 10% node failure rate. The network load is distributed to all nodes in the group preventing overload and single points of failure.
DTIC
Communication Networks; Computer Networks; Portable Equipment

20070034048 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Overview of AMS (CCSDS Asynchronous Message Service)
Burleigh, Scott; August 9, 2006; 20 pp.; In English; DARPA DTN Phase 2 Kickoff, 9 Aug. 2006, Arlington, VA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40291

This viewgraph presentation gives an overview of the Consultative Committee for Space Data Systems (CCSDS) Asynchronous Message Service (AMS). The topics include: 1) Key Features; 2) A single AMS continuum; 3) The AMS Protocol Suite; 4) A multi-continuum venture; 5) Constraining transmissions; 6) Security; 7) Fault Tolerance; 8) Performance of Reference Implementation; 9) AMS vs Multicast (1); 10) AMS vs Multicast (2); 11) RAMS testing exercise; and 12) Results.
CASI
Data Systems; Messages; Systems Engineering; Synchronism; General Overviews

20070034083 Carnegie-Mellon Univ., Pittsburgh, PA USA
Symmetric Publish/Subscribe via Constraint Publication
Tomasic, Anthony; Garrod, Charles; Popendorf, Kris; Jun 2006; 21 pp.; In English
Contract(s)/Grant(s): NBCHC030029
Report No.(s): AD-A469315; CMU-CS-06-129R; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469315

Current publish / subscribe systems offer a range of expressive subscription languages for constraints. However, classical systems restrict the publish operation to be a single published object that contains only constants and no constraints. We introduce symmetric publish / subscribe, a novel generalization of publish / subscribe where both publications and subscriptions contain constraints in addition to constants. Published objects are matched to subscriptions by computing the intersection of their constraints. This generalization improves the performance of classical publish / subscribe systems and introduces a new class of applications for publish / subscribe. This paper describes the core algorithms of our publish / subscribe implementation, evaluates the performance of these algorithms both analytically and empirically, and documents cases where the additional expressive power of symmetric publish / subscribe can be gained with minimal additional computational cost compared to the classical system.
DTIC
Message Processing; Languages; Interprocessor Communication

20070034094 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Use of Tabu Search in a Solver to Map Complex Networks onto Emulab Testbeds
MacDonald, Jason E; Mar 2007; 144 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469511; AFIT/GCE/ENG/07-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The University of Utah's solver for the testbed mapping problem uses a simulated annealing metaheuristic algorithm to map a researcher's experimental network topology onto available testbed resources. This research uses tabu search to find near-optimal physical topology solutions to user experiments consisting of scale-free complex networks. While simulated annealing arrives at solutions almost exclusively by chance, tabu search incorporates the use of memory and other techniques to guide the search towards good solutions. Both search algorithms are compared to determine whether tabu search can produce equal or higher quality solutions than simulated annealing in a shorter amount of time. It is assumed that all testbed resources remain available, and that hardware faults or another competing mapping process do not remove testbed resources while either search algorithm is executing. The results show that tabu search produces a higher proportion of valid solutions for 34 out of the 38 test networks than simulated annealing. For cases where a valid solution was found, tabu search executes more quickly for scale-free networks and networks with less than 100 nodes.
DTIC
Computer Networks; Mapping; Problem Solving; Test Stands

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*.

20070033341 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Unified Behavior Framework for Reactive Robot Control in Real-Time Systems
Woolley, Brian G; Mar 2007; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469515; AFIT/GCS/ENG/07-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Endeavors in mobile robotics focus on developing autonomous vehicles that operate in dynamic and uncertain environments. By reducing the need for human-in- the-loop control, unmanned vehicles are utilized to achieve tasks considered dull or dangerous by humans. Because unexpected latency can adversely affect the quality of an autonomous system's operations, which in turn can affect lives and property in the real-world, their ability to detect and handle external events is paramount to providing safe and dependable operation. Behavior-based systems form the basis of autonomous control for many robots. This thesis presents the unified behavior framework, a new and novel approach which incorporates the critical ideas and concepts of the existing reactive controllers in an effort to simplify development without locking the system developer into using any single behavior system. The modular design of the framework is based on modern software engineering principles and only specifies a functional interface for components, leaving the implementation details to the developers. In addition to its use of industry standard techniques in the design of reactive controllers, the unified behavior framework guarantees the responsiveness of routines that are critical to the vehicle's safe operation by allowing individual behaviors to be scheduled by a real-time process controller. The experiments in this thesis demonstrate the ability of the framework to: 1) interchange behavioral components during execution to generate various global behavior attributes; 2) apply genetic programming techniques to automate the discovery of effective structures for a domain that are up to 122 percent better than those crafted by an expert; and 3) leverage real-time scheduling technologies to guarantee the responsiveness of time critical routines regardless of the system?s computational load.
DTIC
Autonomous Navigation; Reactivity; Real Time Operation; Robot Control; Robots

20070033396 Army War Coll., Carlisle Barracks, PA USA
Theoretical, Legal and Ethical Impact of Robots on Warfare
Cowan, Jr, Thomas H; Mar 30, 2007; 24 pp.; In English
Report No.(s): AD-A469591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ever since the first human tribe went to war with its neighboring human tribe, warfare has been a human experience. Authors through the ages have captured their observations of this phenomenon into a body of knowledge that we call the 'Theory of War.' As we enter the 21st Century, the advances in robotics are helping to move man further and further away from the battlefield. While some of these advances still have man in the loop, some of these systems are fully automatic and clearly break the paradigm of warfare being 'composed of violence, hatred, and enmity.' While the technological work on robotics is progressing at break-neck speed, the work being done on evaluating the impact of robots on the Theory of War, the Law of War, and the ethics of conducting war are not keeping pace. The author establishes a sense of urgency for the importance of looking at how to best use this technology. To do this, he first describes the expected employment of robots on the battlefield and the appropriate methods of controlling them. He then uses a historical example -- the fall of France in 1940 -- of how a larger military was overwhelmed by another adversary because they failed to fully synchronize technological change with strategic concepts. On 10 May 1940, Germany attacked France with a force that was outnumbered by the combined forces of Britain, France, Belgium, and Holland. The French had the best tanks in the world and the allies had an overall advantage in the number of divisions, tanks, aircraft, and artillery pieces. Yet in 6 short weeks, Germany defeated Holland, Belgium, and France and drove the British force into the sea at Dunkirk. The Germans suffered 150,000 casualties while the allies suffered over 2.2 million. Finally, the author evaluates the impact of robots on the Theory of War and the Law of War and looks at some legal and ethical dilemmas that robots will create if they are employed in warfare.
DTIC
Ethics; International Law; Robots; Warfare

20070034043 Research and Technology Organization, Neuilly-sur-Seine, France
Uninhabited Military Vehicles (UMVs): Human Factors Issues in Augmenting the Force
July 2007; 514 pp.; In English; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-HFM-078; AC/323(HFM-078)TP/69; Copyright; Avail.: CASI: C01, CD-ROM: A22, Hardcopy

Uninhabited Military Vehicles (UMVs) are used to augment manned forces in dull, dirty, or dangerous tasks. Human factors issues range from control station design, to vehicle interoperability, and integration with manned systems. New principles are reviewed for supporting the operator, and for collaboration between multiple operators. Future study is needed on techniques for distributive collaboration, command and control of UMV teams, and enabling flexible human supervisory control of multiple, highly-automated UMV assets.
Author
Human Factors Engineering; Man Machine Systems; Unmanned Ground Vehicles; Adaptive Control; Systems Engineering

20070034073 NASA Dryden Flight Research Center, Edwards, CA, USA
Reconfigurable Control Design with Neural Network Augmentation for a Modified F-15 Aircraft
Burken, John J.; May 10, 2007; 27 pp.; In English; AIAA Infotech\@Aerospace 2007 Conference and Exhibit, 7-10 May 2007, Rohnert Park, CA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034073

The viewgraphs present background information about reconfiguration control design, design methods used for paper, control failure survivability results, and results and time histories of tests. Topics examined include control reconfiguration, general information about adaptive controllers, model reference adaptive control (MRAC), the utility of neural networks, radial basis functions (RBF) neural network outputs, neurons, and results of investigations of failures.
CASI
Adaptive Control; F-15 Aircraft; Neural Nets; Servomechanisms; Configuration Management

20070034082 California Univ., Santa Cruz, CA USA
On Iterative Regularization and Its Application
Charest Jr , Michael R; Milanfar, Peyman; Jun 2007; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0387
Report No.(s): AD-A469424; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469424

Many existing techniques for image restoration can be expressed in terms of minimizing a particular cost function. Iterative regularization methods are a novel variation on this theme where the cost function is not fixed, but rather refined iteratively at each step. This provides an unprecedented degree of control over the tradeoff between the bias and variance of the image estimate, which can result in improved overall estimates error. This useful property, along with the provable convergence properties of the sequence of estimates produced by these iterative regularization methods lend themselves to a variety of useful applications. In this paper, we introduce a general set of iterative regularization methods, discuss some of their properties and applications, and include examples to illustrate them.
DTIC
Restoration; Iterative Solution; Estimates

20070034109 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Locating Encrypted Data Hidden Among Non-Encrypted Data Using Statistical Tools
Hayden, Walter J; Mar 2007; 92 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469225; AFIT/GCS/ENG/07-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469225

This research tests the security of software protection techniques that use encryption to protect code segments containing critical algorithm implementation to prevent reverse engineering. Using the National Institute of Standards and Technology (NIST) Tests for Randomness encrypted regions hidden among non-encrypted bits of a binary executable file are located. The location of ciphertext from four encryption algorithms (AES, DES, RSA, and TEA) and three block sizes (10, 100, and 500 32-bit words) were tested during the development of the techniques described in this research. The test files were generated from the Win32 binary executable file of Adobe's Acrobat Reader version 7.0.9. The culmination of this effort developed a

technique capable of locating 100% of the encryption regions with no false negative error and minimal false positive error with a 95% confidence. The encrypted region must be encrypted with a strong encryption algorithm whose ciphertext appears statistically random to the NIST Tests for Randomness, and the size of the encrypted region must be at least 100 32-bit words (3,200 bits).
DTIC
Cryptography; Position (Location)

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070032700 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Fidelity, Fuel-Like Thermal Simulators for Non-Nuclear Testing: Analysis and Initial Test Results
Bragg-Sitton, Shannon M.; Dickens, Ricky; Dixon, David; Kapernick, Richard; June 24, 2007; 1 pp.; In English; American Nuclear Society (ANS) Space Nuclear Conference (SNC) 2007, 24-28 Jun. 2007, Boston, MA, USA; Copyright; Avail.: Other Sources; Abstract Only

Non-nuclear testing can be a valuable tool in the development of a space nuclear power system, providing system characterization data and allowing one to work through various fabrication, assembly and integration issues without the cost and time associated with a full ground nuclear test. In a non-nuclear test bed, electric heaters are used to simulate the heat from nuclear fuel. Testing with non-optimized heater elements allows one to assess thermal, heat transfer. and stress related attributes of a given system, but fails to demonstrate the dynamic response that would be present in an integrated, fueled reactor system. High fidelity thermal simulators that match both the static and the dynamic fuel pin performance that would be observed in an operating, fueled nuclear reactor can vastly increase the value of non-nuclear test results. With optimized simulators, the integration of thermal hydraulic hardware tests with simulated neutronic response provides a bridge between electrically heated testing and fueled nuclear testing. By implementing a neutronic response model to simulate the dynamic response that would be expected in a fueled reactor system, one can better understand system integration issues, characterize integrated system response times and response characteristics and assess potential design improvements at relatively small fiscal investment. Initial conceptual thermal simulator designs are determined by simple one-dimensional analysis at a single axial location and at steady state conditions; feasible concepts are then input into a detailed three-dimensional model for comparison to expected fuel pin performance. Static and dynamic fuel pin performance for a proposed reactor design is determined using SINDA/FLUINT thermal analysis software, and comparison is made between the expected nuclear performance and the performance of conceptual thermal simulator designs. Through a series of iterative analyses, a conceptual high fidelity design is developed: this is followed by engineering design, fabrication, and testing to validate the overall design process. Test results presented in this paper correspond to a ‘first cut’ simulator design for a potential liquid metal (NaK) cooled reactor design that could be applied for Lunar surface power. Proposed refinements to this simulator design are also presented.
Author
Liquid Metal Cooled Reactors; Reactor Design; Spacecraft Power Supplies; Thermal Analysis; Three Dimensional Models; Simulation

20070032727 NASA Marshall Space Flight Center, Huntsville, AL, USA
Improving the Hydrodynamic Performance of Diffuser Vanes via Shape Optimization
Goel, Tushar; Dorney, Daniel J.; Haftka, Raphael T.; Shyy, Wei; [2007]; 29 pp.; In English; 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews the use of surrogate modeling for shape optimization of diffuser vanes to improve the hydrodynamic performance. The use of upper-stage expander cycle employs radial turbines - allow higher pump speeds, improve efficiencies at design and off-design operating conditions The diffuser pump with vanes was found to be more efficient than the vaneless design. Therefore the objectives of the current work are to maximize the ratio of static pressure at inlet and outlet in a diffuser pump via shape optimization of the vanes, and to to demonstrate a multiple surrogate model based optimization framework for design and analysis.
CASI
Design Analysis; Shape Optimization; Turbines; Vanes; Structural Design; Turbine Blades

20070032907 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Unit Quaternion from Rotation Matrix
Markley, F. Landis; [2007]; 4 pp.; In English; No Copyright; Avail.: Other Sources

In this note, we review Shepperd's algorithm and present a variant that always produces a normalized quaternion even if numerical errors cause the matrix A to be not precisely orthogonal, a feature not present in Shepperd's original algorithm. It follows that this variant provides a very efficient method for computing an exactly orthogonal matrix that is close to an approximately orthogonal matrix.
Derived from text
Algorithms; Matrices (Mathematics); Orthogonality; Quaternions; Rotation

20070033015 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Implementation and Optimization of the Advanced Encryption Standard Algorithm on all 8-Bit Field Programmable Gate Array Hardware Platform
Silva, Ryan J; Mar 2007; 148 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469218; AFIT/GE/ENG/07-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469218

The contribution of this research is three-fold. The first is a method of converting the area occupied by a circuit implemented on a Field Programmable Gate Array (FPGA) to an equivalent as a measure of total gate count. This allows direct comparison between two FPGA implementations independent of the manufacturer or chip family. The second contribution improves the performance of the Advanced Encryption Standard (AES) on an 8-bit computing platform. This research develops an AES design that occupies less than three quarters of the area reported by the smallest design in current literature as well as significantly increases area efficiency. The third contribution of this research is an examination of how various designs for the critical AES SubBytes and MixColumns transformations interact and affect the overall performance of AES. The transformations responsible for the largest variance in performance are identified and the effect is measured in terms of throughput, area efficiency, and area occupied.
DTIC
Algorithms; Cryptography; Field-Programmable Gate Arrays

20070033056 Universal Energy Systems, Inc., Dayton, OH USA
On the Bifurcation of the Thermo-Elastic Deformation of an Asymmetric Plate (Preprint)
Jefferson, George; Parthasarathy, Triplicane; May 2007; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-5233; Proj-2311
Report No.(s): AD-A469285; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469285

The deformation of a thin flat elastic plate typically exhibits classic elastic bifurcation behavior when subjected to a through-thickness-graded thermal, or other inelastic, strain. For small strain there is a unique solution to the governing equations, while for larger strain multiple equilibrium solutions exist. Physically, the plate will initially deform to a particular shape or mode and when a critical strain is reached the mode of deformation will snap to a secondary form. This problem has been examined numerous times in the literature. However, in the special case of square symmetry, in both plate shape and materials properties, additional equilibrium deformation modes become available which are not predicted by the existing calculations. In this paper, analytic solutions are presented for these additional bifurcation modes, and the stability of these solutions was evaluated numerically. It is shown that for certain plate materials and geometry the special-case modes occur at a significantly lower strain than predicted by existing analyses. The predictions are verified by comparison with a finite element simulation.
DTIC
Asymmetry; Deformation; Elastic Deformation; Symmetry

20070033116 Naval Research Lab., Washington, DC USA
NRL Plasma Formulary
Huba, J D; Jan 2007; 72 pp.; In English
Report No.(s): AD-A469421; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469421

The NRL Plasma Formulary originated over twenty five years ago and has been revised several times during this period.
DTIC
Maxwell Equation; Plasmas (Physics)

20070033291 Massachusetts Inst. of Tech., Cambridge, MA USA

Error Analysis in the Joint Event Location/Seismic Calibration Inverse Problem

Rodi, William L; Sep 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-03-C-0109; Proj-1010

Report No.(s): AD-A469438; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is developing new mathematical and computational techniques for analyzing the uncertainty in seismic event locations, as induced by observational errors and errors in travel-time models: The analysis is being done in the context of the multiple-event inverse problem, in which the locations of multiple events are inferred jointly with travel-time corrections for the event-station paths. The premise is that one of the events is the target of the uncertainty analysis while the others are calibration events that serve to constrain the path corrections within some level of error. An uncertainty analysis on the coupled location/calibration inverse problem leads to the notion of a 'multiple-event' confidence region on the target event location, which accounts implicitly for errors in the inferred path corrections, including the effects of uncertainty in the calibration event locations. The approach we have developed considers the nonlinearity of the forward problem and allows the use of non-Gaussian models for data errors and soft or hard constraints on the problem parameters. The project has addressed mainly the basic multiple-event location problem, wherein travel-time corrections comprise a simple time term for each station/phase combination in the data set. We have developed a numerical scheme for computing multiple-event confidence regions for this problem, based on grid search and Monte Carlo sampling techniques. Given the computationally intensive nature of the approach, some approximations were developed to reduce the computational effort. Experiments with data from the Nevada Test Site validated the approach and demonstrated the adequacy of the approximations when the location uncertainty is not too large. A modification of the approach we are investigating, which offers the possibility of additional efficiency, is the computation of multiple-event confidence regions defined in a Bayesian sense.

DTIC

Calibrating; Error Analysis; Nuclear Explosions; Position (Location)

20070033333 Defence Research and Development Canada, Valcartier, Quebec Canada

Military Application of Differential FTIR Radiometry for Passive Standoff Detection

Theriault, Jean-Marc; Puckrin, Eldon; Lavoie, Hugo; Bouffard, Francois; Dube, Denis; Oct 1, 2005; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Fourier Transformation; Infrared Spectra; Interferometry; Radiometers

20070033336 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Multi-Dimensional Classification Algorithm for Automatic Modulation Recognition

Albairat, Ouail; Mar 2007; 138 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA99-99-C-9999

Report No.(s): AD-A469506; AFIT/GE/ENG/07-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis proposes an approach for modulation classification using existing features in a more efficient way. The Multi-Dimensional Classification Algorithm (MDCA) treats features extracted from signals of interest as elements with irrelevant identities, hence eliminating any dependence of the classifier on any particular feature. This design enables the use of any number of features, and the MDCA algorithm provides the capability to classify modulations in higher dimensions. The use of multiple features requires an equal number of data dimensions, and thus classification in as high a dimensional space as possible can improve final classification results. Finally, the MDCA algorithm uses a relatively small number of simple operations, which leads to a fast processing time. Simulation results for the MDCA algorithm demonstrate good potential. In particular, the MDCA consistently performed well (at SNR levels down to -10dB in some cases) and in identifying more modulation types.

DTIC

Algorithms; Classifications; Modulation

20070033350 Akademiya Nauk BSSR, Minsk, Russian Federation

Possible Procedure Modification and a System Likeness for Object Identifying on Remote Sensing Images

Fedulov, Y; Kuleshov, A; Murashko, N; Romanchik, D; Oct 2005; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469524; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Analysis of Variance; Classifications; Gray Scale; Identifying; Images; Remote Sensing; Vector Analysis

20070033566 Naval Undersea Warfare Center, Newport, RI USA

Method of Converting Received Data to a Two-Dimensional Color Map

Pees, Edward H, Inventor; Jun 20, 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020289; No Copyright; Avail.: Other Sources

Beams of sampled data are converted into a two-dimensional color map thereof. Fourier transforms are performed on range cells of each beam with each transform being sampled M times where M is defined by M discrete sets of red, green and blue intensity values of a color spectrum. For each range cell in each beam, each sample of the corresponding M-sampled Fourier transform is multiplied by a corresponding one of the red, green and blue intensity values from a corresponding one of the M discrete sets thereof. Each of the resulting M red values, M green values and M blue values are averaged. As a result, a triplet is defined for each range cell by the averaged values. For each triplet, the minimum thereof is used to reduce the triplet's averaged values to thereby form a corresponding re-valued triplet. The resulting array of re-valued triplets are normalized across all of the range cells with the resulting array of re-valued triplets so-normalized being used to generate a two-dimensional color display.

DTIC

Acoustic Properties; Color; Display Devices; Fourier Transformation; Maps; Underwater Acoustics

20070034135 Naval Academy, Annapolis, MD USA

Algorithmic Reformulation of Polynomial Problems

Brown, Christopher W; Jun 13, 2007; 28 pp.; In English

Report No.(s): AD-A469251; USNA-CS-TR-2007-01; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE

ONLINE: http://hdl.handle.net/100.2/ADA469251

This paper considers the problem of existential quantifier elimination for real algebra (QE). It introduces an algorithmic framework for exploring reformulations of QE problems, with the goal of finding reformulations that make difficult problems tractable for QE implementations, or for which these implementations find simpler solutions. The program qfr is introduced, which implements this approach, and its performance on some example problems is reported.

DTIC

Algorithms; Computer Programs; Polynomials

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070032972 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Ensemble-Based Smoother with Retrospectively Updated Weights for Highly Nonlinear Systems

Chin, T. M.; Turmon, M. J.; Jewell, J. B.; Ghil, M.; Monthly Weather Review; July 12, 2006; Volume 135, pp. 186-202; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40386; http://dx.doi.org/10.1175/MWR3353.1

Monte Carlo computational methods have been introduced into data assimilation for nonlinear systems in order to alleviate the computational burden of updating and propagating the full probability distribution. By propagating an ensemble of representative states, algorithms like the ensemble Kalman filter (EnKF) and the resampled particle filter (RPF) rely on the existing modeling infrastructure to approximate the distribution based on the evolution of this ensemble. This work presents an ensemble-based smoother that is applicable to the Monte Carlo filtering schemes like EnKF and RPF. At the minor cost of retrospectively updating a set of weights for ensemble members, this smoother has demonstrated superior capabilities in state tracking for two highly nonlinear problems: the double-well potential and trivariate Lorenz systems. The algorithm does not require retrospective adaptation of the ensemble members themselves, and it is thus suited to a streaming operational mode. The accuracy of the proposed backward-update scheme in estimating non-Gaussian distributions is evaluated by comparison to the more accurate estimates provided by a Markov chain Monte Carlo algorithm.

Author

Monte Carlo Method; Probability Theory; Kalman Filters; Algorithms; Nonlinear Systems

20070033327 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Stochastic Estimation and Control of Queues within a Computer Network

Stuckey, Nathan C; Mar 2007; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469497; AFIT/GE/ENG/07-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An extended Kalman filter is used to estimate size and packet arrival rate of network queues. These estimates are used by a LQG steady state linear perturbation PI controller to regulate queue size within a computer network. This paper presents the derivation of the transient queue behavior for a system with Poisson traffic and exponential service times. This result is then validated for ideal traffic using a network simulated in OPNET. A more complex OPNET model is then used to test the adequacy of the transient queue size model when non-Poisson traffic is combined. The extended Kalman filter theory is presented and a network state estimator is designed using the transient queue behavior model. The equations needed for the LQG synthesis of a steady state linear perturbation PI controller are presented. These equations are used to develop a network queue controller based on the transient queue model. The performance of the network state estimator and network queue controller was investigated and shown to provide improved control when compared to other simplistic control algorithms.
DTIC

Computer Networks; Kalman Filters; Stochastic Processes

20070033330 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Biological Cell Identification by Integrating Micro-Fluidics, Electrical Impedance Spectroscopy and Stochastic Estimation

Schwenn, Karl R; Mar 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469500; AFIT/GE/ENG/07-20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The integration of micro-fluidics, electrical impedance spectroscopy and stochastic estimation will lead to a device with enhanced detection capabilities. The goal of this thesis was to build a micro-fluidic electrical impedance measurement device that can be used in combination with a stochastic estimator to accurately identify living cells. A microdevice capable of making impedance measurements on individual living cells was designed and built using a series of standard microelectronic fabrication techniques. A microchannel was patterned in SU-8 photoresist between two gold microelectrodes on a two inch Pyrex 7740 wafer. The design process, the fabrication techniques for the microchannel, the fluid port fabrication and the cover slip bonding processes are described in detail. Small glass cover slips were bonded to the wafer using Loctite 3301 adhesive. Impedance measurements of single cells, in the microchannel device, were made using a HP4194A impedance analyzer. Preliminary analysis of the impedance data suggests that Jurkat cells have characteristic impedance signatures, corresponding to their cell type. The microdevice that was designed and built for this project should facilitate future work to implement a stochastic estimation algorithm capable of single cell identification.
DTIC

Algorithms; Cells (Biology); Electrical Impedance; Fluidics; Spectroscopy; Stochastic Processes

20070034024 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Deep Space Network Scheduling Using Evolutionary Computational Methods

Guillaume, Alexandre; Lee, Seugnwon; Wang, Yeou-Fang; Terrile, Richard J.; March 3, 2007; 4 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40315

The paper presents the specific approach taken to formulate the problem in terms of gene encoding, fitness function, and genetic operations. The genome is encoded such that a subset of the scheduling constraints is automatically satisfied. Several fitness functions are formulated to emphasize different aspects of the scheduling problem. The optimal solutions of the different fitness functions demonstrate the trade-off of the scheduling problem and provide insight into a conflict resolution process.
Author

Deep Space Network; Genetics; Tradeoffs; Genome

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070032860 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Managing Analysis Models in the Design Process

Briggs, Clark; April 23, 2006; 5 pp.; In English; 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 23-26 Apr. 2007, Waikiki, HI, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40262

Design of large, complex space systems depends on significant model-based support for exploration of the design space. Integrated models predict system performance in mission-relevant terms given design descriptions and multiple physics-based numerical models. Both the design activities and the modeling activities warrant explicit process definitions and active process management to protect the project from excessive risk. Software and systems engineering processes have been formalized and similar formal process activities are under development for design engineering and integrated modeling. JPL is establishing a modeling process to define development and application of such system-level models.

Author

Aerospace Systems; Systems Engineering; Space Exploration; Performance Prediction; Large Space Structures; Complex Systems

20070032902 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Penalty Function approach for Compromise Mechanisms in Distributed Collaborative Design Optimization

Ganguly, Sandipan; Keha, Ahmet B.; Wu, Teresa; Andary, James; December 11, 2006; 24 pp.; In English; Copyright; Avail.: Other Sources

When multiple enterprises collaborate to design a product, each has to compromise their locally optimal designs not only for an overall feasible design but also for a better overall design. Several techniques like collaborative optimization, game theory, hierarchical optimization and set-based reasoning have been used to solve design optimization problems in a distributed and collaborative environment. Each of these techniques either has computational difficulties or limited flexibility. This paper proposes a distributed optimization technique where the degree of compromise of each participating designer can be controlled by modeling its attitude towards collaboration. An artificial agent is responsible for the overall design and guides the compromise process. When the designers feasible design spaces are convex and intersecting, we prove that the proposed methodology always converges to a desirable solution. We further investigate how various parameters in the problem formulation can be adjusted to regulate computational effort, risk attitude and rules of compromise.

Author

Penalty Function; Multidisciplinary Design Optimization; Mathematical Models; Iteration; Distributed Processing

20070033054 SRI International Corp., Menlo Park, CA USA

Balancing the Needs of Personalization and Reasoning in a User-Centric Scheduling Assistant

Berry, Pauline; Gervasio, Melinda; Peintner, Bart; Yorke-Smith, Neil; Feb 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NBCHD030010

Report No.(s): AD-A469282; SRI-TN-561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469282

We describe the interaction of three aspects core to a personalized scheduling task. First, we develop a preference model designed to capture user preferences for the task of scheduling a meeting request between multiple people, and a methodology for preference elicitation to initially populate this model. Second, we explain a natural-language-based elicitation of the meeting request details and constraints, and outline the solving of the resulting constrained scheduling problem (with preferences). Third, we describe the display of solutions to the scheduling problem to the user, as candidate scheduling options with explanations, and detail unobtrusive learning of revisions to the preference model from the user's choices among the candidates. We describe the user studies that informed our design choices, and assess the resulting system in terms of the quality of scheduling options presented, according to the user. The scheduling task enabled by the integration of these aspects has been implemented within a deployed application.

DTIC

Artificial Intelligence; Balancing; Decision Support Systems; Scheduling; User Requirements

20070033076 Carnegie-Mellon Univ., Pittsburgh, PA USA

Toward a Discipline of Scenario-Based Architectural Engineering

Kazman, Rick; Carriere, S J; Woods, Steven G; Jan 2000; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469331; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469331

Software architecture analysis is a cost-effective means of controlling risk and maintaining system quality throughout the processes of software design, development and maintenance. This paper presents a sequence of steps that maps architectural quality goals into scenarios that measure the goals, mechanisms that realize the scenarios and analytic models that measure the results. This mapping ensures that design decisions and their rationale are documented in such a fashion that they can be systematically explored, varied, and potentially traded off against each other. As systems evolve, the analytic models can be used to assess the impact of architectural changes, relative to the system's changing quality goals. Although scenarios have been extensively used in software design to understand the ways in which a system meets its operational requirements, there has been little systematic use of scenarios to support analysis, particularly analysis of a software architecture's quality attributes: modifiability, portability, extensibility, security, availability, and so forth. In this paper we present a unified approach to using scenarios to support both the design, analysis and maintenance of software architectures, and examples from large-scale software development projects where we have applied the approach. We also present a tool, called Brie, that aids in: scenario capture, mapping scenarios to software architectures, and the association of analytic models with particular portions of architectures. The approach that we have devised, and that Brie supports, is a foundation for a discipline of architectural engineering. Architectural engineering is an iterative method of design, analysis and maintenance where design decisions are motivated by scenarios, and are supported by documented analyses.

DTIC

Computer Programming; Computer Programs; Design Analysis; Mapping; Software Engineering

20070033077 Carnegie-Mellon Univ., Pittsburgh, PA USA

Quality Attribute Design Primitives and the Attribute Driven Design Method

Bass, Len; Klein, Mark; Bachmann, Felix; Jan 2001; 15 pp.; In English

Report No.(s): AD-A469332; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469332

This paper discusses the understanding of quality attributes and their application to the design of a software architecture. We present an approach to characterizing quality attributes and capturing architectural patterns that are used to achieve these attributes. For each pattern, it is important not only how the pattern achieves a quality attribute goal but also what impact the pattern has on other attributes. We embody this investigation of quality into the Attribute Driven Design Method for designing software architecture.

DTIC

Computer Programming; Design Analysis; Software Engineering

20070033305 Rutgers - The State Univ., New Brunswick, NJ USA

Algorithms for Port-of-Entry Inspection

Roberts, Fred S; May 29, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0237

Report No.(s): AD-A469453; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Finding ways to intercept illicit nuclear materials and weapons destined for the USA via the maritime transportation system is an exceedingly difficult task. Until recently, only about 2% of ships entering U.S. ports have had their cargoes inspected. The percentage at some ports has now risen to 6%, but this is still a very small percentage. The purpose of this project was to develop decision support algorithms that help to optimally intercept illicit materials and weapons. The algorithms developed focused on finding inspection schemes that minimize total cost, including the 'cost' of false positives and false negatives. The project viewed the inspection problem as a stream of entities arriving at a port, with a decision maker having to decide how to inspect them, which to subject to further inspection, and which to allow to pass through with only minimal levels of inspection. This is a complex sequential decision making problem. Sequential decision making is an old subject, but one that has become increasingly important with the need for new models and algorithms as the traditional methods for making decisions sequentially do not scale. Previous algorithms for optimally intercepting illicit cargo assumed that sensor performance, operating characteristics of ports, and overall threat level were all fixed. The author's approach involved decision logics and was built around problem formulations that led to the need for combinatorial optimization algorithms as well as methods from the theory of Boolean functions, queueing theory, and machine learning. Algorithms for

designing port-of-entry inspection rapidly come up against the combinatorial explosion caused by the many possible alternative inspection strategies. In this project, the authors worked to develop an approach that brings many of these complications explicitly into the analysis.
DTIC
Algorithms; Decision Support Systems; Fissionable Materials; Inspection; Nuclear Weapons

20070033325 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Layered Social and Operational Network Analysis
Geffre, Jennifer L; Mar 2007; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469492; AFIT/GOR/ENS/07-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To provide maximal disruption to a clandestine/terrorist network's ability to conduct missions, we must develop a means to determine the individuals' importance to the network and operations. In a network centric world, this importance is represented as an additive value of their criticality across the convergence of multiple layers of network connections. The connections layers of the network are comprised of social layers (Acquaintance, Friendship, Nuclear Family, Relatives, Student-Teacher, and Religious Mentors, Reverent Power and others), as well as layers representing interactions involving Resources, Knowledge/Skills and Temporal Local. The social criticality of an individual is measured by centrality. Event Trees and Risk Importance Measures are often used in a system reliability analysis to determine critical elements in the success or failure of operations. The inclusion of time and location importance will be determined by the observation of various group members at that local. The synergy gained from the application of these concepts to terror groups can be used to identify critical locations, resources and knowledge to their operations and can then be attributed to individuals connected to those essential elements. The combination of social and operational criticality can then be used to identify individuals whose removal or influence would disrupt or diminish network operations.
DTIC
Group Dynamics; Network Analysis; Networks; Risk; Systems Analysis

20070034023 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Fault Injection Campaign for a Fault Tolerant Duplex Framework
Sacco, Gian Franco; Ferraro, Robert D.; von llmen, Paul; Rennels, Dave A.; March 3, 2007; 18 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40314

Fault tolerance is an efficient approach adopted to avoid or reduce the damage of a system failure. In this work we present the results of a fault injection campaign we conducted on the Duplex Framework (DF). The DF is a software developed by the UCLA group [1, 2] that uses a fault tolerant approach and allows to run two replicas of the same process on two different nodes of a commercial off-the-shelf (COTS) computer cluster. A third process running on a different node, constantly monitors the results computed by the two replicas, and eventually restarts the two replica processes if an inconsistency in their computation is detected. This approach is very cost efficient and can be adopted to control processes on spacecrafts where the fault rate produced by cosmic rays is not very high.
Author
Fault Tolerance; System Failures; Damage; Commercial Off-the-Shelf Products; Computer Programs; Cosmic Rays

20070034095 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Critical Infrastructure Rebuild Prioritization using Simulation Optimization
Cho, Namsuk; Mar 2007; 178 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469509; AFIT/GOR/ENS/07-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis examines the importance of a critical infrastructure rebuild strategy following a terrorist attack or natural disaster such as Hurricane Katrina. Critical infrastructures are very complex and dependent systems in which their re-establishment is an essential part of the rebuilding process. A rebuild simulation model consisting of three layers (physical, information, and spatial) captures the dependency between the six critical infrastructures modeled. We employ a simulation optimization approach to evaluate rebuild prioritization combinations with a goal of minimizing the time needed to achieve an acceptable rebuild level. We use a simulated annealing heuristic as an optimization technique that works in concert with

the rebuild simulation model. We test our approach with three disaster scenarios and find that the initial rebuild strategy greatly impacts the time to recover. With respect to the scenarios tested, we recommend a rebuild strategy and areas for further investigation that may be of use to disaster and emergency management organizations.
DTIC
Emergencies; Management Methods; Optimization; Simulation

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20070034085 Carnegie-Mellon Univ., Pittsburgh, PA USA
The Focused Inverse Method for Linear Logic
Chaudhuri, Kaustuv; Dec 4, 2006; 223 pp.; In English
Contract(s)/Grant(s): N00014-04-1-0724; CCR-0306313
Report No.(s): AD-A469279; CMU-CS-06-162; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469279

Linear logic presents a unified framework for describing and reasoning about stateful systems. Because of its view of hypotheses as resources, it supports such phenomena as concurrency, external and internal choice, and state transitions that are common in such domains as protocol verification, concurrent computation, process calculi and games. It accomplishes this unifying view by providing logical connectives whose behavior is closely tied to the precise collection of resources. The interaction of the rules for multiplicative, additive and exponential connectives gives rise to a wide and expressive array of behaviors. This expressivity comes with a price: even simple fragments of the logic are highly complex or undecidable. Various approaches have been taken to produce automated reasoning systems for fragments of linear logic. This thesis addresses the need for automated reasoning for the complete set of connectives for first-order intuitionistic linear logic (circle multiply, 1,-o, &, Top, circle plus, 0, !, Universal quantifier, Existential quantifier), which removes the need for any idiomatic constructions in smaller fragments and instead allows direct logical expression. The particular theorem proving technique used is a novel combination of a variant of Maslov's inverse method using Andreoli's focused derivations in the sequent calculus as the underlying framework. The goal of this thesis is to establish the focused inverse method as the premier means of automated reasoning in linear logic. To this end, the technical claims are substantiated with an implementation of a competitive first-order theorem prover for linear logic as of this writing, the only one of its kind.
DTIC
Protocol (Computers); Automatic Control; Theorem Proving

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*.

20070033012 Bridge Diagnostics, Inc., Boulder, CO USA
Load Test and Load Rating Report for Bridge 305 Over Foster's Creek Located at Naval Weapons Facility, Charleston, SC
Schulz, Jeff L; Commander, Brett C; Stanton, Terry R; Varela-Ortiz, Wilmel; Lugo, Carmen Y; McKenna, Mihan H; Jun 2007; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469215; ERDC/GSL-TR-07-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469215

This study focuses on the load rating analysis of a prestressed concrete channel-beam located at the Naval Weapons Facility in Charleston, SC, subjected to military moving loads through load testing and analytical models. The superstructure of the bridge was instrumented with 56 reusable strain transducers to accurately characterize the structure's live load response. A load test was initially performed with a 67-kip dump truck across the bridge along three lateral paths. The load test results were used to calibrate a finite element model in order to verify if the structure could safely handle larger loads imposed by the heavy equipment transporter system carrying an MIA1 Abrams tank and the Rough Terrain Container Handler DV43

handler vehicles. Once it was confirmed by the model that these larger vehicles could cross controlled load tests were performed with both vehicles, and data were recorded during multiple passes of both vehicles. These data were used to verify the predicted responses and to verify that the loads were not inducing damage to the structure. When the testing phase was completed, the data were examined thoroughly and the model was revised to best represent the actual structural responses. Load ratings were computed for the standard design and rating vehicles along with several heavy military loads. The main conclusions obtained from the load ratings are that all of the design vehicles and military vehicles can cross the bridge within the Operating (maximum) load limits. All of the vehicles, with the exception of the four-wheeled cargo handlers, can cross the bridge within the Inventory (design) load limits. Two of the most important parameters that can be determined when a load testing analysis is performed are the dynamic allowance (impact factor) and the live load distribution.
DTIC
Dynamic Loads; Finite Element Method; Load Tests; Loads (Forces); Ratings

20070033022 Air Force Research Lab., Wright-Patterson AFB, OH USA
Nanoparticle-Wetted Relays: Reconfigurable Surfaces for Energy Transmission Contacts
Voevodin, A A; Vaia, R; Patton, S T; Diamanti, S; Pender, M; Yoonessi, M; Brubaker, J; Hu, J J; Sanders, J H; Phillips, B S; Jan 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A469236; AFRL-ML-WP-TP-2007-451; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469236

Performance and reliability of dynamic physical contacts between two solid surfaces has challenged technologists from pre-Hellenistic pulleys and Da Vinci mechanisms for transmission of mechanical energy to modern switches and relays for transmission of electrical energy, currently a $4B global industry that impacts telecom and mobile phones, automotive, aerospace and consumer products. Local oscillations in the stress, temperature and electrostatic potential during a contact cycle result in the evolution of the topology, chemistry and physical properties of the two surfaces, degrading the characteristics of the junction with service. These challenges are especially acute in ultra-fast (MHz) micro electromechanical system (MEMS) relays requiring high current, low impendence operation over billions of cycles. Various surface modification approaches, such as gold alloys and refractory coatings and self-assembled monolayers, have been unsuccessful in enabling the maintenance of these multifunctional (low adhesion, low resistivity) contracts. Taking inspiration from 1940s mercury-wetted electrical contact relays and current nanoparticle organic solutions, here we demonstrate that nobel metal nanoparticle liquids (NPLs) provide reconfigurable and replenishable surface asperities that extend the durability by 10 to 100 times without the inherent toxicity of mercury or capillarity that limits relay miniaturization. These non-volatile NPLs are made of 5-20 nm Au and Pt nanoparticles with organic coronas consisting of surface tethered ionic liquids. The nanoscopic size and corona fluidity are critical in providing sufficient electrical conductivity through nanoparticle jamming while maintaining a low contact adhesion by dynamically restoring a nanoscopic asperity texture via liquid surface migration.
DTIC
Electric Contacts; Electric Power Transmission; Energy Transfer; Nanoparticles; Wetting

20070033034 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Lamb Wave Propagation in Varying Thermal Environments
Andrews, Jennifer P; Mar 2007; 201 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469250; AFIT/GA/ENY/07-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469250

During flight, launch, and reentry, external surfaces on aerospace vehicles undergo extreme thermo-acoustic loads resulting in structural degradation. Structural health monitoring techniques are being devised to evaluate the health of these structures by locating and quantifying structural damage during and after flight. One such technique uses Lamb wave propagation to assess damage on the surface and through the thickness of thin materials. The objective of this study was to assess the sensitivity of piezo-generated Lamb wave propagation to isothermal and thermal gradient environments using both theoretical and experimental methods. Experimental isothermal tests were conducted over a temperature range of 0-225-F. The changes in temperature-dependent material properties were correlated to measurable differences in the response signal?s waveform and propagation speed. An analysis of the experimental signal response data demonstrated that elevated temperatures delay wave propagation, although the delays are minimal at the temperatures tested in this study. Both these results and experimental group velocity dispersion curves verified theoretical predictions. Subsequent experimental testing in thermal gradient environments, with peak temperatures ranging 114-280-F, also displayed an observable yet minimal delay in

wave propagation. Finally, theoretical simulations at temperatures up to 600-F revealed significantly increased delays in wave propagation.
DTIC
Lamb Waves; Thermal Environments; Thermodynamic Properties; Wave Propagation

20070033068 Southwest Research Inst., San Antonio, TX USA
Investigation of Electrostatic Charge in Hose Lines
Johnson, James E; Owen, Thomas E; Hutzler, Scott A; Oct 2006; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE07-99-C-L053
Report No.(s): AD-A469314; TFLRF-384; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469314

Current military specifications for collapsible hose used in Army fuel hose line systems, such as the Assault Hose line System (AHS) and the developmental Rapidly Installed Fuel Transfer System (RIFTS) require a means to maintain conductivity/electric bond throughout the length of the hose line. A wire embedded in the hose typically provides this conductive path for static charge to safely dissipate to ground. The need and value for this conductive wire in hose lines have been questioned particularly given the type of fuels used by the military today. This work provides an engineering assessment, based on experiments and analysis that shows that the RIFTS hose line can be safely operated without a continuous grounding system (bond wire) when operated under conditions for which it was designed. It is also shown that the breakdown potential of the hose is well above voltages generated by the triboelectric effect and thus electrical breakdown is not expected.
DTIC
Electrostatic Charge; Hoses

20070033383 Air Force Research Lab., Wright-Patterson AFB, OH USA
An Investigation into Impacting Techniques for Simulating Foreign Object Damage and Their Influence on the Fatigue Limit Strength of Ti-6Al-4V
Thompson, Steven R; Nicholas, Theodore; Ruschau, John J; Porter, William J; Buchanan, Dennis J; Oct 1, 2005; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Aluminum Alloys; Foreign Bodies; Gas Turbines; Impact Damage; Residual Strength; Simulation; Titanium Alloys; Vanadium Alloys

20070033385 Magellan Aerospace Corp., Ontario Canada
Canadian Forces Experience with Turbofan HCF - Case Study
Kinart, Corey; Theriault, Pierre; Oct 1, 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469566; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Brackets; Canada; Turbofan Engines; Turbofans; Vibration

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*.

20070033020 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling Acoustic Effects on shear-Coaxial Jet Flow Utilizing Molecular Dynamic Simulation
Sailsman, Jermaine S; Mar 2007; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469233; AFIT/GA/ENY/07-M16; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469233

The purpose of this research is to determine if acoustical effects on a coaxial shear injection jet flow can be modeled through the use of molecular dynamic simulation. Molecular dynamic simulations model flows as a group of interacting particles. The flow in this research was simulated using nitrogen molecules. The initial task involved achieving effective geometry for a simulated coaxial jet. The coaxial jet geometry was driven by the desire for simulations to operate in the

continuum regime, which requires very low Knudsen numbers. Three outer to inner jet ratios of 0.0, 1.0, and 6.0 were examined with the inner jet velocity maintained constant at 50 m/s. Velocity profiles in the coaxial component need to be controlled in order to validate the continuum flow. Acoustic interference is introduced into the simulation, and mixing and density profiles provide valuable information into the how the flow is affected by the acoustic interference. Radial density profiles also provide information about the shape the jet with and without acoustic interference as it exits the injector. The affects of acoustic interference for most cases showed good agreement with the previous experimental data. Results showed good validation of the simulation and warrants more in-depth study.
DTIC
Coaxial Flow; Jet Flow; Molecular Dynamics; Shear Flow; Signal Transmission; Simulation; Sound Waves

20070033066 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Fuel Estimation Using Dynamic Response
Hines, Michael S; Mar 2007; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469309; AFIT/GA/ENY/07-M12; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469309

New regulations governing satellites in geostationary orbit require satellites to transfer into a parking orbit as part of the decommissioning process. These regulations increase the demand for accurate fuel estimation techniques for satellites. This study estimates the change in fuel mass from the dynamic response of the Air Force Institute of Technology?s simulated satellite (SimSAT) to known control inputs. With an iterative process, the moment of inertia of SimSAT about the yaw axis was estimated by matching a model of SimSAT to the measured angular rates. A change in fuel mass was then estimated from the known relation between the change in moment of inertia to the change in fuel mass. Fuel masses of 1, 2, and 3 kilograms were estimated. The fuel estimation process developed in this study was able to estimate the fuel as 1.5664 ? 3.7157 kg, 2.8880 ? 3.8875 kg, and 3.9114 ? 3.4648 kg respectively. While the theory behind the estimation process is sound, the implementation still requires work.
DTIC
Dynamic Response; Estimates; Fuels

20070033292 Washington Univ., Seattle, WA USA
Updates for Bottom Reverberation Codes
Ivakin, Anatoliy N; Apr 10, 2007; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-G-0460
Report No.(s): AD-A469439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of this research is to develop a package of upgraded bottom reverberation codes based on up-to-date understanding of the physics and mechanisms of sound-seabed interaction. The specific scientific objective of this project is to develop a prototype for a package of physics-based bottom reverberation codes which would be self-consistent and practical. It assumes that the codes would be tested by practical use, particularly by including in analysis of existing seabed scattering database. In this project, scattering data obtained at recent sediment acoustics experiments in shallow water (SAX04) and in laboratory conditions (LMA-CNRS, France) have been used successfully for such testing. The self-consistency and practicality assume also that the codes are able to take into account general characteristics of acoustic systems, such as their directivity and frequency bandwidth (for both narrow- and broad-band systems), and use practically measurable environmental inputs. A first version of such package has been developed in this project that can represent a foundation for development of an up-to-date, physics based interface between acoustic response of the system, such as time series of the reverberation signal, and seabed geoacoustic and geotechnical parameters, such as sediment density, sound speed, attenuation, grain size and others.
DTIC
Acoustic Scattering; Acoustic Velocity; Audio Equipment; Reverberation; Sediments; Shallow Water

20070033565 Naval Undersea Warfare Center, Newport, RI USA
Adaptive High Frequency Laser Sonar System
Cray, Benjamin A, Inventor; Jun 20, 2007; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-D020288; No Copyright; Avail.: Other Sources

An acoustic sensing device includes a housing having an internal cavity filled with a vibration decoupling medium. An acoustic window formed of an acoustically transparent material is mounted in the housing. This mounting can be by

antivibration mounts to prevent housing noise from affecting the acoustic window. A scanning laser vibrometer is positioned within the housing and directed to detect vibrations of the acoustic window. Antivibration mounts are joined between said scanning laser vibrometer and said housing. In further embodiments, the scanning laser vibrometer detects vibrations at a plurality of locations on the acoustic window forming a virtual array. In operation, the scanning laser vibrometer scans the surface of the acoustic window to detect its surface velocity which is directly proportional to the incident acoustic pressure. DTIC

Acoustics; High Frequencies; Lasers; Patent Applications; Signal Detectors; Sonar; Vibration Meters

20070034086 Washington Univ., Seattle, WA USA

North Pacific Acoustic Laboratory CTD Data: R/V Moana Wave Cruise IW98 (August 15-30, 1998) and R/V Melville Cruise IW99 (June 18-July 3, 1999)

Dickinson, S; Howe, B M; Colosi, J A; Apr 2007; 154 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-97-1-0259

Report No.(s): AD-A469468; APL-UW-TM-1-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two research cruises were conducted in the summers of 1998 and 1999 as part of the North Pacific Acoustic Laboratory (NPAL) project. The cruises objective was to test the theory that predicts acoustic fluctuations from the internal wave sound speed or temperature fluctuations. Here we discuss the in situ profile measurements of temperature, salinity, and derived sound speed taken with conductivity temperature density (CTD) instruments dropped off the side of the ships as they steamed between the NPAL Acoustic Thermometry of Ocean Climate source off Kauai and a billboard receiving array on Sur Ridge off Point Sur, California. The first cruise, IW98, was aboard the University of Hawaii research vessel Moana Wave. The second cruise, IW99, was aboard the R/V Melville.

DTIC

Acoustic Properties; Acoustic Velocity; Sound Waves

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20070033353 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wessling, Germany

ARES - A New Airborne Reflective Emissive Spectrometer

Mueller, Andreas; Richter, Rolf; Kaufmann, Hermann; Oct 1, 2005; 9 pp.; In English

Report No.(s): AD-A469527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Airborne Equipment; Images; Spectrometers

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*.

20070032744 NASA Langley Research Center, Hampton, VA, USA

Advanced Optical Technologies for Space Exploration

Clark, Natalie; August 26, 2007; 11 pp.; In English; SPIE Optics and Photonics 2007, 26-30 Aug. 2007, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 305295.02.07.07.20; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032744

NASA Langley Research Center is involved in the development of photonic devices and systems for space exploration missions. Photonic technologies of particular interest are those that can be utilized for in-space communication, remote sensing, guidance navigation and control, lunar descent and landing, and rendezvous and docking. NASA Langley has recently established a class-100 clean-room which serves as a Photonics Fabrication Facility for development of prototype optoelectronic devices for aerospace applications. In this paper we discuss our design, fabrication, and testing of novel active

pixels, deformable mirrors, and liquid crystal spatial light modulators. Successful implementation of these intelligent optical devices and systems in space, requires careful consideration of temperature and space radiation effects in inorganic and electronic materials. Applications including high bandwidth inertial reference units, lightweight, high precision star trackers for guidance, navigation, and control, deformable mirrors, wavefront sensing, and beam steering technologies are discussed. In addition, experimental results are presented which characterize their performance in space exploration systems.
Author
Optoelectronic Devices; Photonics; Space Exploration; Adaptive Optics; Fabrication; Technology Utilization

20070032935 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Measuring a Precise Ultra-Lightweight Spaceflight Mirror on Earth: The Analysis of the SHARPI PM Mirror Figure Data during Mirror Processing at GSFC
Antonille, Scott; Content, David; Rabin, Douglas; Wallace, Thomas; Wake, Shane; [2007]; 1 pp.; In English; SPIE Optics and Photonics, 26-30 Aug. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The SHARPI (Solar High Angular Resolution Photometric Imager) primary mirror is a 5kg, 0.5m paraboloid, diffraction limited at FUV wavelengths when placed in a 0-G environment. The ULE sandwich honeycomb mirror and the attached mount pads were delivered by ITT (then Kodak) in 2003 to NASA s Goddard Space Flight Center (GSFC). At GSFC, we accepted, coated, mounted, and vibration tested this mirror in preparation for flight on the PICTURES (Planet Imaging Concept Testbed Using a Rocket Experiment) mission. At each step, the integrated analysis of interferometer data and FEA models was essential to quantify the 0-G mirror figure. This task required separating nanometer sized variations from hundreds of nanometers of gravity induced distortion. The ability to isolate such features allowed in-situ monitoring of mirror figure, diagnosis of perturbations, and remediation of process errors. In this paper, we describe the technical approach used to achieve these measurements and overcome the various difficulties maintaining UV diffraction-limited performance with this aggressively lightweighted mirror.
Author
Honeycomb Mirrors; Space Flight; Photometry; Imaging Techniques; Diagnosis; Distortion; Diffraction; Interferometers; Angular Resolution

20070032951 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coadding Techniques for Image-based Wavefront Sensing for Segmented-mirror Telescopes
Smith, Scott; Aronstein, David; Dean, Bruce; Acton, Scott; [2007]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Image-based wavefront sensing algorithms are being used to characterize optical performance for a variety of current and planned astronomical telescopes. Phase retrieval recovers the optical wavefront that correlates to a series of diversity-defocused point-spread functions (PSFs), where multiple frames can be acquired at each defocus setting. Multiple frames of data can be coadded in different ways; two extremes are in 'image-plane space,' to average the frames for each defocused PSF and use phase retrieval once on the averaged images, or in 'pupil-plane space,' to use phase retrieval on every set of PSFs individually and average the resulting wavefronts. The choice of coadd methodology is particularly noteworthy for segmented-mirror telescopes that are subject to noise that causes uncorrelated motions between groups of segments. Using data collected on and simulations of the James Webb Space Telescope Testbed Telescope (TBT) commissioned at Ball Aerospace, we show how different sources of noise (uncorrelated segment jitter, turbulence, and common-mode noise) and different parts of the optical wavefront, segment and global aberrations, contribute to choosing the coadd method. Of particular interest, segment piston is more accurately recovered in 'image-plane space' coadding, while segment tip/tilt is recovered in 'pupil-plane space' coadding.
Author
Wave Fronts; James Webb Space Telescope; Image Analysis; Segmented Mirrors; Point Spread Functions; Defocusing; Attitude (Inclination)

20070033055 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Quantifying Non-Equilibrium in Hypersonic Flows Using Entropy Generation
Gabriele, Jr, Thomas P; Mar 2007; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469284; AFIT/GAE/ENY/07-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469284

The constitutive relations traditionally used for finding shear stress and heat flux in a fluid become invalid in

non-equilibrium flow. Their derivation from kinetic theory only demonstrates they are valid only for small deviations from equilibrium. Because it is fundamentally linked to non-equilibrium, entropy generation is used to investigate the limits of the continuum constitutive relations. However, the continuum equations are inherently limited to near equilibrium conditions due to the constitutive relations; thus kinetic theory must be used as a basis for comparison. Direct Simulation Monte Carlo (DSMC), a particle method alternative to continuum methods, is based on kinetic theory and is used to develop a flow solution free from equilibrium assumptions. Solutions were obtained for hypersonic flow over two axisymmetric geometries using both a continuum solver and DSMC. Formulations for entropy generation are presented for each method, and the two solutions are compared. The continuum solver fails to capture regions of non-equilibrium as evidenced by thicker shocks in the DSMC solution. To extend the useful range of the continuum constitutive relations, the Lennard-Jones model is offered as an alternative to Sutherland?s Law for calculating viscosity and thermal conductivity. The two are compared, and parameters offering a good fit for these flows are suggested for the Lennard-Jones model.
DTIC
Deformable Mirrors; Entropy; Equilibrium Flow; Hypersonic Flow

20070033125 Cornell Univ., Ithaca, NY USA
Bridging Between Photonic Scales
Lipson, Michal; Oct 29, 2005; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA49620-03-1-0424
Report No.(s): AD-A469434; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469434

We show confinement of light traveling in micron-size waveguides into nm-size regions. Most photonic dielectric cavities have been traditionally limited to sizes that are on the order of the wavelength of light. Here we show a decrease in mode volume by several orders of magnitude over previous dielectric microcavities based on wavelength independent dielectric discontinuities. The principle of reduction of effective mode volume, well below the dimensions of the wavelength of light can be applied to nearly every existing microcavity resonator to enhance not only light emission but also non-linear effects. Such a reduction can enable the demonstration of effective mode volumes of nm-size and increase of Purcell factor by orders of magnitude. This technique may enable new experiments in cavity Quantum Electrodynamics, ultra-sensitive single atom detection, and low threshold lasers
DTIC
Crystals; Fiber Optics; Nanostructures (Devices); Photonics; Waveguides

20070033345 Defence Research and Development Canada, Valcartier, Quebec Canada
Canadian Airborne Hyperspectral Imager Development
Smithson, Tracy; St-Germain, Daniel; Garneau, Jean-Marc; Oct 1, 2005; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Canada; Imagery

20070034011 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optical Alignment of the JWST ISIM to the OTE Simulator (OSIM): Current Concept and Design Studies
Frey, Bradley J.; Davila, Pamela S.; Marsh, James M.; Ohl, Raymond G.; Sullivan, Joseph; [2007]; 1 pp.; In English; SPIE Optics and Photonics Meeting, 26-30 Aug. 2007, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The James Webb Space Telescope's (JWST) Integrated Science Instrument Module (ISIM) is the scientific payload of the observatory and contains four science instruments. During alignment and test of the integrated ISIM (i.e. ISIM + science instruments) at NASA's Goddard Space Flight Center (GSFC), the Optical telescope element SIMulator (OSIM) will be used to optically stimulate the science instruments to verify their operation and performance. In this paper we present the design of two cryogenic alignment fixtures that will be used to determine and verify the proper alignment of OSIM to ISIM during testing at GSFC. These fixtures, the Master Alignment Target Fixture (MATF) and the ISIM Alignment Target Fixture (IATF), will provide continuous, 6 degree of freedom feedback to OSIM during initial ambient alignment as well as during cryogenic vacuum testing.
Author
Alignment; James Webb Space Telescope; Instrument Orientation; Optical Equipment; Metrology

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20070032696 NASA Marshall Space Flight Center, Huntsville, AL, USA
Numerical Investigation of Plasma Flows in Magnetic Nozzles
Polzin, K. A.; Sankaran, K.; June 25, 2007; 1 pp.; In English; American Institute of Aeronautics and Astronautics (AIAA) Plasmadynamics and Lasers Conference, 25-28 Jun. 2007, Miami, FL, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Magnetic nozzles are used in many laboratory experiments in which plasma flows are to be confined, cooled. accelerated, or directed. At present, however, there is no generally accepted theoretical description that explains the phenomena of plasma detachment from an externally-imposed magnetic field. This is an important problem in the field of plasma propulsion, where the ionized gas must detach from the applied, solenoidal magnetic field to realize thrust production. In this paper we simulate a plasma flowing in the presence of an applied magnetic field using a multidimensional numerical simulation tool that includes theoretical models of the various dispersive and dissipative processes present in the plasma. This is an extension of the simulation tool employed in previous work by Sankaran et al. The new tool employs the same formulation of the governing equation set. but retains the axial and radial components of magnetic field and the azimuthal component of velocity that were neglected in other works. We aim to compare the computational results with the various proposed magnetic nozzle detachment theories to develop an understanding of the physical mechanisms that cause detachment. An applied magnetic field topology is obtained using a magnetostatic field solver and this field is superimposed on the time-dependent magnetic field induced in the plasma to provide a self-consistent field description. The applied magnetic field and model geometry match those found in experiments by Kurtki and Okada. We model this geometry because there ts a substantial amount of experimental data that can be compared to our computations, allowing for validation of the model. In addition, comparison of the simulation results with the experimentally obtained plasma parameters will provide insight into the mechanisms that lead to plasma detachment, revealing how the 3 scale with different input parameters.
Author
Magnetic Fields; Magnetic Nozzles; Magnetohydrodynamic Flow; Magnetostatic Fields; Mathematical Models; Plasmas (Physics); Simulation; Plasma Engines

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*.

20070033073 Delaware Univ., Newark, DE USA
TeraHertz Nanodevices for Communiction, Imaging, Sensing and Ranging
Kolodzey, James; Goossen, Keith; Dec 2006; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0380
Report No.(s): AD-A469322; ELEG332147; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA469322

This research program focused on the design, fabrication and optimization of THz devices using Group IV semiconductor nanotechnology. The devices were based on SiGe quantum wells (OWs), by intracenter transitions in doped nanostructures and photonic crystals fabricated by MBE and CVD. The SiGe OWs gave good performance, but the output powers were low and the operating temperature needed to be cryogenic. The dopant emitters were simpler in design, but the initial devices needed low temperatures so that the dopant states are occupied (carrier freeze out). With deep energy dopants, such as nitrogen in SiC, however, the emission occurs at relatively high temperatures, up to 150 K. We have demonstrated the operation of very high performance with the emitted power near I mW from a device several square mm in surface area.
DTIC
Crystals; Detection; Detectors; Imaging Techniques; Nanostructures (Devices); Nanotechnology; Rangefinding

20070033298 Brown Univ., Providence, RI USA

Novel Nanometric Superstructures for Radiation and Magnetic Sensing

Xu, Jimmy; May 22, 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F29601-02-C-0214; Proj-4846

Report No.(s): AD-A469446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The desired extreme uniformity and dense packing of quantum electric elements over a large area combined with the nanoscale features of the structures (2D or 3D superlattices) have made their fabrications a great challenge for the conventional e-beam lithography based approaches. In the case of applications that require yet larger area than semiconductor wafers and/or conformation to curved surfaces, as often required in radiation sensing, it is even beyond the reach of conventional nanofabrication approaches. The difficulty in fabrication has impeded the development of the sensing devices and slowed down the progress in understanding the underlying physics and potential of nanostructures. To address these needs and challenges, we have pursued successfully the development of alternative nanofabrication approaches, based on non-lithographical patterning. These new nano-fabrication approaches have then been applied to the development of a new class of nanomaterials -- lateral nanodot, nanopost, and nanoantidot superlattices with unprecedented uniformity, scalability, and versability. The suite of novel nanofabrication technologies and the new class of nanomaterials, resulting from this project, have enabled a number of advances in sensing applications and are expected to lead to new applications in remote sensing and other DoD interests.

DTIC

Detection; Fabrication; Nanofabrication; Nanostructures (Devices)

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*.

20070032999 Army Tank-Automotive Research and Development Command, Warren, MI USA

Standardizing the Next Generation of Military Vehicle Cooling System Simulation

Goryca, Mary; Slyva, Neil; Oct 26, 2006; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469190; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469190

Next Steps - Observations: (1) Simulation accurately represents cooling system performance; (2) Thermal simulation simplified complex interactions; (3) Initial validation process utilized: Pre-processed component test data * Comprehensive vehicle test data; (4) Process enables rapid and accurate analysis: Heat exchanger options * Multiple vehicle variants; (5) Validating process for future heat exchanger evaluation.

DTIC

Cooling; Cooling Systems; Simulation; Standardization

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*.

20070032878 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Value, Cost, and Sharing: Open Issues in Constrained Clustering

Wagstaff, Kiri L.; September 18, 2006; 7 pp.; In English; 5th International Workshop on Knowledge Discovery in Inducative Databases (KDID'06), 18 Sep. 2006, Berlin, Germany; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF ITR-03-25329; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40255

Clustering is an important tool for data mining, since it can identify major patterns or trends without any supervision (labeled data). Over the past five years, semi-supervised (constrained) clustering methods have become very popular. These methods began with incorporating pairwise constraints and have developed into more general methods that can learn appropriate distance metrics. However, several important open questions have arisen about which constraints are most useful,

how they can be actively acquired, and when and how they should be propagated to neighboring points. This position paper describes these open questions and suggests future directions for constrained clustering research.
Author
Data Mining; Cluster Analysis; Constraints

20070034014 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Family Science Night: Changing Perceptions One Family at a Time
Pesnell, W. D.; Drobnes, E.; Mitchell, S.; Colina-Trujillo, M.; [2007]; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

If students are not encouraged to succeed in science, mathematics, and technology classes at school, efforts to improve the quality of content and teaching in these subjects may be futile. Parents and families are in a unique position to encourage children to enroll and achieve in these classes. The NASA Goddard Space Flight Center Family Science Night program invites middle school students and their families to explore the importance of science and technology in our daily lives by providing a venue for families to comfortably engage in learning activities that change their perception and understanding of science - making it more practical and approachable for participants of all ages. Family Science Night strives to change the way that students and their families participate in science, within the program and beyond.
Author
Education; NASA Programs; Parents; Science; Mathematics; Technologies; Perception

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20070032795 Research and Technology Organization, Neuilly-sur-Seine, France
Methods and Models for Life Cycle Costing
June 2007; 226 pp.; In English; Original contains color and black and white illustrations
Report No.(s): RTO-TR-SAS-054; AC/323(SAS-054)TP/51; Copyright; Avail.: CASI: C01, CD-ROM: A11, Hardcopy

This report is the product of the System Analysis and Studies (SAS) Task Group SAS-054 review of NATO and Partner nations cost forecasting methods and models. The Task Group's core objectives were to understand NATO and Partner nations methods and models for life cycle costing, and to promulgate best practice within the NATO Phased Armaments Programming System (NAPS). The SAS-054 report provides a comprehensive view on the application and use of life cycle costing from an early conceptual phase in the product life cycle through to the disposal phase. It provides illustrations on the types of life cycle cost studies that can be conducted and examples to demonstrate the benefits of such analysis. The treatment of uncertainty and risk within the context of developing the life cycle cost estimate is also explained within the report. The report concludes with a number of recommendations to improve the use and understanding of life cycle costing in the decision making process.
Author
Life Cycle Costs; Cost Analysis; Cost Estimates; Decision Making; Budgeting

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*.

20070032729 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Virtual Space Physics Observatory: Quick Access to Data and Tools
Cornwell, Carl; Roberts, D. Aaron; McGuire, Robert E.; December 11, 2006; 1 pp.; In English; American Geophysical Union Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Virtual Space Physics Observatory (VSPO) see http://vspo.gsfc.nasa.gov has grown to provide a way to find and access about 375 data products and services from over 100 spacecraft/observatories in space and solar physics. The datasets are mainly chosen to be the most requested, and include most of the publicly available data products from operating NASA Heliophysics spacecraft as well as from solar observatories measuring across the frequency spectrum. Service links include

a ‘quick orbits’ page that uses SSCWeb Web Services to provide a rapid answer to questions such as ‘What spacecraft were in orbit in July1992?’ and ‘Where were Geotail, Cluster, and Polar on 2 June 2001?’ These queries are linked back to the data search page. The VSPO interface provides many ways of looking for data based on terms used in a registry of resources using the SPASE Data Model that will be the standard for Heliophysics Virtual Observatories. VSPO itself is accessible via an API that allows other applications to use it as a Web Service; this has been implemented in one instance using the ViSBARD visualization program. The VSPO will become part of the Space Physics Data Facility, and will continue to expand its access to data. A challenge for all VOs will be to provide uniform access to data at the variable level, and
Author
Solar Observatories; Web Services; On-Line Systems; World Wide Web; Information Dissemination; Information Transfer; Internet Resources; Websites

20070033048 Joint Chiefs of Staff, Washington, DC USA
Department of Defense Dictionary of Military and Associated Terms
Mar 22, 2007; 763 pp.; In English
Report No.(s): AD-A469271; JCS-JP-1-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469271

The Department of Defense Dictionary of Military and Associated Terms (short title: Joint Pub 1-02 or JP 1-02) sets forth standard US military and associated terminology to encompass the joint activity of the Armed Forces of the USA in both US joint and allied joint operations, as well as to encompass the Department of Defense (DOD) as a whole. These military and associated terms, together with their definitions, constitute approved DOD terminology for general use by all components of the Department of Defense. The Secretary of Defense, by DOD Directive 5025.12, 23 August 1989, Standardization of Military and Associated Terminology, has directed the use of JP 1-02 throughout the Department of Defense to ensure standardization of military and associated terminology. This publication supplements standard English-language dictionaries with standard terminology for military and associated use. However, it is not the intent of this publication to restrict the authority of the joint force commander (JFC) from organizing the force and executing the mission in a manner the JFC deems most appropriate to ensure unity of effort in the accomplishment of the overall mission.
DTIC
Defense Program; Dictionaries

20070033064 University of West Bohemia, Plzen, Czechoslovakia
Speaker Adaptation of Language Models for Automatic Dialog Act Segmentation of Meetings
Kolar, Jachym; Liu, Yang; Shriberg, Elizabeth; Jan 2007; 5 pp.; In English
Report No.(s): AD-A469307; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469307

Abstract Dialog act (DA) segmentation in meeting speech is important for meeting understanding. In this paper, we explore speaker adaptation of hidden event language models (LMs) for DA segmentation using the ICSI Meeting Corpus. Speaker adaptation is performed using a linear combination of the generic speaker independent LM and an LM trained on only the data from individual speakers. We test the method on 20 frequent speakers, on both reference word transcripts and the output of automatic speech recognition. Results indicate improvements for 17 speakers on reference transcripts, and for 15 speakers on automatic transcripts. Overall, the speaker-adapted LM yields statistically significant improvement over the baseline LM for both test conditions.
DTIC
Segments; Speech Recognition

20070033103 Army War Coll., Carlisle Barracks, PA USA
Defense Readiness Reporting System: A Better Way to Measure Readiness?
Dewey, John T; Mar 28, 2007; 24 pp.; In English
Report No.(s): AD-A469396; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469396

Is there a better way to measure defense readiness? This Strategy Research Project (SRP) examines the Defense Readiness Report System (DRRS) to see if it (a) provides an objective assessment of capabilities to meet the mission priorities established by the Office of the Secretary of Defense (OSD) (b) meets the objectives of the National Security Strategy prescribed by the President and (c) carries outs the objectives of the National Military Strategy by the Chairman of the Joint

Chiefs of Staff. This SRP then analyzes DRRS indicators of lagging, coincident, and leading to determine their validity for measuring readiness. Finally, this SRP considers the relevance of assessing Mission Essential Task List (METL) to accomplish a Combatant Commanders (CCDR) mission.
DTIC
Combat; Information Management; Maintainability

20070034115 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Information Management Principles Applied to the Ballistic Missile Defense System
Koehler, John M; Mar 2007; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A467407; AFIT/GSS/ENV/07-M2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information systems (IS) have evolved over the last 50 plus years from individual components with single functionality to grand architectures that integrate multiple individual business functions into global organizational enterprises. Similarly several military systems with the single mission of missile defense have evolved in service stovepipes, and are now being integrated into a national and global missile defense architecture. The Missile Defense Agency (MDA) is currently tasked with developing an integrated Ballistic Missile Defense System (BMDS) capable of defending against all ranges of ballistic missiles in all phases of flight in defense of the homeland, our deployed forces, and our allies. While this initiative has been proceeding since before Ronald Reagan's Strategic Defense Initiative, the full momentum has only recently been achieved through the withdrawal of the Anti-Ballistic Missile Treaty and demonstrated threats from North Korea and Iran. This study draws parallels between the evolution of IS and the BMDS. Further it compiles information management (IM) principles, investigates if they apply to the BMDS, and investigates if they can be used to achieve a better integrated system. Initial indications are that IM principles do apply, but it is questionable if they are being applied.
DTIC
Antimissile Defense; Ballistic Missiles; Information Management; Information Systems; Missile Defense

20070034127 Office of the Director of National Intelligence, Washington, DC USA
The National Intelligence Strategy of the USA of America: Transformation Through Integration and Innovation
Oct 2005; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469392; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469392

The new concept of 'national intelligence' codified by the Intelligence Reform and Terrorism Prevention Act passed by Congress in 2004 has its origins in the tragedy of September 11, 2001 and President Bush's National Security Strategy of the USA of America. The President signed the new law with the expectation that 'our vast intelligence enterprise will become more unified, coordinated, and effective.' Our strategy is to integrate, through intelligence policy, doctrine, and technology, the different enterprises of the Intelligence Community. It encompasses current intelligence activities as well as future capabilities to ensure that we are more effective in the years ahead than we are today. The fifteen strategic objectives outlined in this strategy can be differentiated as mission objectives and enterprise objectives. Mission objectives relate to our efforts to predict, penetrate, and preempt threats to our national security and to assist all who make and implement US national security policy, fight our wars, protect our nation, and enforce our laws in the implementation of national policy goals. Enterprise objectives relate to our capacity to maintain competitive advantages over states and forces that threaten the security of our nation.
DTIC
Intelligence; Security; United States

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20070032943 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Decision Making Methods in Space Economics and Systems Engineering
Shishko, Robert; February 22, 2006; 95 pp.; In English; Invited Lectures at International Space University, 22-23 Feb. 2006, Strasbourg, France; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40200

This viewgraph presentation reviews various methods of decision making and the impact that they have on space

economics and systems engineering. Some of the methods discussed are: Present Value and Internal Rate of Return (IRR); Cost-Benefit Analysis; Real Options; Cost-Effectiveness Analysis; Cost-Utility Analysis; Multi-Attribute Utility Theory (MAUT); and Analytic Hierarchy Process (AHP).
CASI
Cost Analysis; Cost Effectiveness; Decision Making; Decision Support Systems; Management Analysis; Space Logistics; Aerospace Engineering; Systems Engineering

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20070032883 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Assessing Technology Maturity for ST-9 Technology Validation Experiments
Stocky, John F.; November 11, 2005; 21 pp.; In English; ST 9 Technology Review Board, 11 Nov. 2005, Pasadena, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40196

This viewgraph presentation reviews the process of assessing the maturity of a technology for use in NASA missions. The NASA New Millennium Program (NMP) identifies and flight validates breakthrough technologies that will significantly benefit future operational Space and Earth Science missions NMP conducts two types of flight validation projects for the Space Science Enterprise: (1) Integrated System Validation Projects, and (2) Stand-Alone Subsystem Validation Projects.
CASI
NASA Programs; Research and Development; Technologies; Technology Assessment; Feasibility Analysis

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*.

20070032827 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
NASA's RPS Design Reference Mission Set for Solar System Exploration
Balint, Tibor S.; February 12, 2007; 9 pp.; In English; Space Technology and Applications International Forum (STAIF-2007), 12-15 Feb. 2007, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40267

NASA's 2006 Solar System Exploration (SSE) Strategic Roadmap identified a set of proposed large Flagship, medium New Frontiers and small Discovery class missions, addressing key exploration objectives. These objectives respond to the recommendations by the National Research Council (NRC), reported in the SSE Decadal Survey. The SSE Roadmap is down-selected from an over-subscribed set of missions, called the SSE Design Reference Mission (DRM) set. Missions in the Flagship and New Frontiers classes can consider Radioisotope Power Systems (RPSs), while small Discovery class missions are not permitted to use them, due to cost constraints. In line with the SSE DRM set and the SSE Roadmap missions, the RPS DRM set represents a set of missions, which can be enabled or enhanced by RPS technologies. At present, NASA has proposed the development of two new types of RPSs. These are the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG), with static power conversion; and the Stirling Radioisotope Generator (SRG), with dynamic conversion. Advanced RPSs, under consideration for possible development, aim to increase specific power levels. In effect, this would either increase electric power generation for the same amount of fuel, or reduce fuel requirements for the same power output, compared to the proposed MMRTG or SRG. Operating environments could also influence the design, such that an RPS on the proposed Titan Explorer would use smaller fins to minimize heat rejection in the extreme cold environment; while the Venus Mobile Explorer long-lived in-situ mission would require the development of a new RPS, in order to tolerate the extreme hot environment, and to simultaneously provide active cooling to the payload and other electric components. This paper discusses NASA's SSE RPS DRM set, in line with the SSE DRM set. It gives a qualitative assessment regarding the impact of various

RPS technology and configuration options on potential mission architectures, which could support NASA's RPS technology development planning, and provide an understanding of fuel need trades over the next three decades.
Author
Space Exploration; Support Systems; High Temperature Environments; Electric Generators; Solar System; Technological Forecasting; Payloads; Thermoelectric Generators

20070032835 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cassini-Huygens Maneuver Experience: Second Year of Saturn Tour
Wagner, Sean V.; Gist, Emily M.; Goodson, Troy D.; Hahn, Yungsun; Stumpf, Paul W.; Williams, Powtawche N.; August 21, 2006; 22 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, 20-25 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40289

This paper documents the maneuver experience during the second year of the Cassini-Huygens mission at Saturn. Since Saturn arrival in July 2004, the Cassini orbiter has made many flybys of Titan and Saturn's icy satellites. From August 2005 to June 2006, there were 39 planned maneuvers designed to target Cassini to aimpoints near Titan, Hyperion, Dione, and Rhea. Highlights of this paper include maneuver designs and strategies, maneuver performance, maneuver cancellation rationales, and a new maneuver execution-error model based on maneuvers executed to date.
Author
Cassini Mission; Icy Satellites; Rhea (Astronomy); Hyperion; Flyby Missions; Error Analysis

20070032839 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mitigating Extreme Environments for In-Situ Jupiter and Venus Missions
Balint, Tibor S.; Kolawa, Elizabeth A.; Cutts, James A.; October 2, 2006; 16 pp.; In English; 57th International Astronautical Congress, 1-6 Oct. 2006, Valencia, Spain; Original contains color illustrations
Report No.(s): IAC-06-C2.P.2.07; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40285

In response to the recommendations by the National Research Council (NRC), NASA's Solar System Exploration (SSE) Roadmap identified the in situ exploration of Venus and Jupiter as high priority science objectives. For Jupiter, deep entry probes are recommended, which would descend to approx.250 km - measured from the 1 bar pressure depth. At this level the pressure would correspond to approx.100 bar and the temperature would reach approx.500(deg)C. Similarly, at the surface of Venus the temperature and pressure conditions are approx.460(deg)C and approx.90 bar. Lifetime of the Jupiter probes during descent can be measured in hours, while in{situ operations at and near the surface of Venus are envisioned over weeks or months. In this paper we discuss technologies, which share commonalities in mitigating these extreme conditions over proposed mission lifetimes, specially focusing on pressure and temperature environments.
Author
Jupiter Probes; Venus Surface; Space Exploration

20070032869 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Integrating National Space Visions
Sherwood, Brent; October 1, 2006; 8 pp.; In English; 57th International Astronautical Congress, 1 Oct. 2006, Valencia, Spain; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40256

This paper examines value proposition assumptions for various models nations may use to justify, shape, and guide their space programs. Nations organize major societal investments like space programs to actualize national visions represented by leaders as investments in the public good. The paper defines nine 'vision drivers' that circumscribe the motivations evidently underpinning national space programs. It then describes 19 fundamental space activity objectives (eight extant and eleven prospective) that nations already do or could in the future use to actualize the visions they select. Finally the paper presents four contrasting models of engagement among nations, and compares these models to assess realistic pounds on the pace of human progress in space over the coming decades. The conclusion is that orthogonal engagement, albeit unlikely because it is unprecedented, would yield the most robust and rapid global progress.
Author
Space Programs; Spacecrews; Progress; Motivation

20070032888 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Demand Access Protocol for Space Applications

Gao, Jay L.; Leang, Dee; March 3, 2007; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color illustrations

Report No.(s): IEEEAC Paper 1313; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40323

This paper describes a demand access protocol for space communications, which is a messaging procedure that facilitates the exchange of resource requests and grants between users and service providers. A minimal set of operational and environmental needs and constraints are assumed since the intent is to keep the protocol flexible and efficient for a wide-range of envisioned NASA robotic and human exploration missions. The protocol described in this document defines the message format and procedures used to ensure proper and correct functioning of a demand access communications system, which must operate under customized resource management policies applied by the users and service providers. This protocol also assumes a minimal set of capabilities from the underlying communications system so that no unique requirements are imposed on the communications sub-systems.

Author

Protocol (Computers); Space Communication; Robotics; Resources Management

20070032969 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Space-Based Near-Infrared CO2 Measurements: Testing the Orbiting Carbon Observatory Retrieval Algorithm and Validation Concept Using SCIAMACHY Observations over Park Falls, Wisconsin

Bosch, H.; Toon, G. C.; Sen, B.; Washenfelder, R. A.; Wennberg, P. O.; Buchwitz, M.; deBeek, R.; Burrows, J. P.; Crisp, D.; Christi, M.; Connor, B. J.; Natraj, V.; Yung, Y. L.; Journal Of Geophysical Research; December 6, 2006; ISSN 0148-0227; Volume 111; 17 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): DLR/BMBF-50EE0027; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40389; http://dx.doi.org/10.1029/2006JD007080

Space-based measurements of reflected sunlight in the near-infrared (NIR) region promise to yield accurate and precise observations of the global distribution of atmospheric CO2. The Orbiting Carbon Observatory (OCO) is a future NASA mission, which will use this technique to measure the column-averaged dry air mole fraction of CO2 (XCO2) with the precision and accuracy needed to quantify CO2 sources and sinks on regional scales (approx.1000 x 1000 sq km and to characterize their variability on seasonal timescales. Here, we have used the OCO retrieval algorithm to retrieve XCO2 and surface pressure from space-based Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY) measurements and from coincident ground-based Fourier transform spectrometer (FTS) measurements of the O2 A band at 0.76 mm and the 1.58 mm CO2 band for Park Falls,Wisconsin. Even after accounting for a systematic error in our representation of the O2 absorption cross sections, we still obtained a positive bias between SCIAMACHY and FTS XCO2 retrievals of approx.3.5%. Additionally, the retrieved surface pressures from SCIAMACHY systematically underestimate measurements of a calibrated pressure sensor at the FTS site. These findings lead us to speculate about inadequacies in the forward model of our retrieval algorithm. By assuming a 1% intensity offset in the O2 A band region for the SCIAMACHY XCO2 retrieval, we significantly improved the spectral fit and achieved better consistency between SCIAMACHY and FTS XCO2 retrievals. We compared the seasonal cycle of XCO2 at Park Falls from SCIAMACHY and FTS retrievals with calculations of the Model of Atmospheric Transport and Chemistry/Carnegie-Ames-Stanford Approach (MATCH/CASA) and found a good qualitative agreement but with MATCH/CASA underestimating the measured seasonal amplitude. Furthermore, since SCIAMACHY observations are similar in viewing geometry and spectral range to those of OCO, this study represents an important test of the OCO retrieval algorithm and validation concept using NIR spectra measured from space. Finally, we argue that significant improvements in precision and accuracy could be obtained from a dedicated CO2 instrument such as OCO, which has much higher spectral and spatial resolutions than SCIAMACHY. These measurements would then provide critical data for improving our understanding of the carbon cycle and carbon sources and sinks.

Author

Carbon Dioxide Concentration; Atmospheric Composition; Carbon Dioxide; Sunlight; Imaging Spectrometers; Remote Sensing; Carbon Cycle; Atmospheric Models

20070032970 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Implementation of Cloud Retrievals for Tropospheric Emission Spectrometer (TES) Atmospheric Retrievals: Part 1. Description and Characterization of Errors on Trace Gas Retrievals

Kulawik, Susan S.; Worden, John; Eldering, Annmarie; Bowman, Kevin; Gunson, Michael; Osterman, Gregory B.; Zhang, Lin; Clough, Shepard A.; Shephard, Mark W.; Beer, Reinhard; Journal Of Geophysical Research; December 22, 2006; ISSN

0148-0227; Volume 111; 13 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40387; http://dx.doi.org/10.1029/2005JD006733

We develop an approach to estimate and characterize trace gas retrievals in the presence of clouds in high spectral measurements of upwelling radiance in the infrared spectral region (650-2260/cm). The radiance contribution of clouds is parameterized in terms of a set of frequency-dependent nonscattering optical depths and a cloud height. These cloud parameters are retrieved jointly with surface temperature, emissivity, atmospheric temperature, and trace gases such as ozone from spectral data. We demonstrate the application of this approach using data from the Tropospheric Emission Spectrometer (TES) and test data simulated with a scattering radiative transfer model. We show the value of this approach in that it results in accurate estimates of errors for trace gas retrievals, and the retrieved values improve over the initial guess for a wide range of cloud conditions. Comparisons are made between TES retrievals of ozone, temperature, and water to model fields from the Global Modeling and Assimilation Office (GMAO), temperature retrievals from the Atmospheric Infrared Sounder (AIRS), tropospheric ozone columns from the Goddard Earth Observing System (GEOS) GEOS-Chem, and ozone retrievals from the Total Ozone Mapping Spectrometer (TOMS). In each of these cases, this cloud retrieval approach does not introduce observable biases into TES retrievals.
Author
Trace Elements; Spectral Bands; Atmospheric Composition; Radiative Transfer; Total Ozone Mapping Spectrometer; Infrared Instruments; Spectrum Analysis

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20070032721 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Magnetar Nature and the Outburst Mechanism of a Transient Anomalous X-ray Pulsar
Guver, Tolga; Ozel, Feryal; Gogus, Ersin; Kouveliotou, Chryssa; May 25, 2007; 9 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): E.G/TUBA-GEBIP/2004.11
Report No.(s): arXiv:0705.3713v1; Copyright; Avail.: CASI: A02, Hardcopy

Anomalous X-ray Pulsars (AXPs) belong to a class of neutron stars believed to harbor the strongest magnetic fields in the universe, as indicated by their energetic bursts and their rapid spindowns. However, a direct measurement of their surface field strengths has not been made to date. It is also not known whether AXP outbursts result from changes in the neutron star magnetic field or crust properties. Here we report the first, spectroscopic measurement of the surface magnetic field strength of an AXP, XTE J1810-197, and solidify its magnetar nature. The field strength obtained from detailed spectral analysis and modeling is remarkably close to the value inferred from the rate of spindown of this source and remains nearly constant during numerous observations spanning over two orders of magnitude in source flux. The surface temperature, on the other hand, declines steadily and dramatically following the 2003 outburst of this source. Our findings demonstrate that heating occurs in the upper neutron star crust during an outburst and sheds light on the transient behaviour of AXPs.
Author
Magnetars; Pulsars; X Ray Astronomy; Neutron Stars; Stellar Magnetic Fields

20070032802 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Soliton Properties of Coupled g-Mode Oscillations
Wolff, Charles L.; [2007]; 1 pp.; In English; American Astronomical Society 210 Meeting, 28-31 May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

Several features typical of solitons are also exhibited by stellar g-modes when coupled into ‘sets’ that have unique rotation rates relative to the star. Enhanced nuclear burning due to weakly nonlinear amplitudes in a small portion of the stellar core holds each set together against dispersion. As the nonlinear regions of each set rotate past each other they have a complex interaction (shown in a video), yet emerge from this with their original wave forms. Other similarities with solitons we

mentioned, including the physical origin of a phase shift. in longitude due to the interaction. These similarities suggest that a fully nonlinear derivation of g-mode sets may be able to show that their large amplitude regions approach true solitons. Author

Oscillations; Stars; Coupled Modes; Phase Shift; Rotation

20070032820 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Using Virtual Observatory Services in Sky View

McGlynn, Thomas A.; [2007]; 5 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032820

For over a decade Skyview has provided astronomers and the public with easy access to survey and imaging data from all wavelength regimes. SkyView has pioneered many of the concepts that underlie the Virtual Observatory. Recently SkyView has been released as a distributable package which uses VO protocols to access image and catalog services. This chapter describes how to use the Skyview as a local service and how to customize it to access additional VO services and local data. Derived from text

Astronomical Observatories; Sky Surveys (Astronomy); Imaging Techniques; Astronomical Catalogs

20070032832 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Suppression of Speckles at High Adaptive Correction Using Speckle Symmetry

Bloemhof, Eric E.; August 13, 2006; 9 pp.; In English; SPIE Annual Meeting, 13-18 Aug. 2006, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40281

Focal-plane speckles set important sensitivity limits on ground- or space-based imagers and coronagraphs that may be used to search for faint companions, perhaps ultimately including exoplanets, around stars. As speckles vary with atmospheric fluctuations or with drifting beamtrain aberrations, they contribute speckle noise proportional to their full amplitude. Schemes to suppress speckles are thus of great interest. At high adaptive correction, speckles organize into species, represented by algebraic terms in the expansion of the phase exponential, that have distinct spatial symmetry, even or odd, under spatial inversion. Filtering speckle patterns by symmetry may eliminate a disproportionate fraction of the speckle noise while blocking (only) half of the image signal from the off-axis companion being sought. The fraction of speckle power and hence of speckle noise in each term will vary with degree of correction, and so also will the net symmetry in the speckle pattern. Author

Speckle Patterns; Coronagraphs; Extrasolar Planets; Symmetry; Focusing

20070032872 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Overview of the Mock LISA Data Challenges

Arnaud, Keith A.; Babak, Stanislav; Baker, John G.; Benacquista, Matthew J.; Cornish, Neil J.; Cutler, Curt; Larson, Shane L.; Sathyaprakash, B. S.; Vallisneri, Michele; Vecchio, Alberto; Vinet, Jean-Yves; June 19, 2006; 6 pp.; In English; Sixth International LISA Symposium, 19-23 Jun. 2006, Greenbelt, MD, USA; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40247

The LISA International Science Team Working Group on Data Analysis (LIST-WG1B) is sponsoring several rounds of mock data challenges, with the purpose of fostering the development of LISA data-analysis capabilities, and of demonstrating technical readiness for the maximum science exploitation of the LISA data. The first round of challenge data sets were released at this Symposium. We describe the objectives, structure, and timeline of this program.

Author

Gravitational Waves; LISA (Observatory); Black Holes (Astronomy); Galactic Mass; Frequency Ranges; Galactic Nuclei; Red Shift

20070032884 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Cassini RADAR Observations of Enceladus, Tethys, Dione, Rhea, Iapetus, Hyperion, and Phoebe

Ostro, Steven J.; West, Richard D.; Janssen, Michael A.; Lorenz, Ralph D.; Zebker, Howard A.; Black, Gregory J.; Lunine, Jonathan I.; Wye, Lauren C; Lopes, Rosaly M.; Wall, Stephen D.; Elachi, Charles; Roth, Laci; Hensley, Scott; Kelleher, Kathleen; Hamilton, Gary A.; Gim, Yonggyu; Anderson, Yanhua Z.; Boehmer, Rudy A; Johnson, William T. K.; Icarus; April

27, 2006; ISSN 0019-1035; Volume 183, pp. 479-490; In English; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40235; http://dx.doi.org/10.1016/j.icarus.2006.02.019

The Cassini mission includes 34 investigations of Saturn's icy satellites by the 2.2-cm-wavelength (13.8-GHz) RADAR instrument, operating both as a scatterometric radar and a passive radiometer. These measurements are sensitive to near-surface electrical properties and structure at scales about six times smaller than the only groundbased radar wavelength available to study the satellites (13 cm) and 22 times longer than the millimeter wavelengths at the limit of Cassini's Composite Infrared Spectrometer (CIRS). Here we present Cassini's first radar results for seven of the satellites.
Author
Cassini Mission; Icy Satellites; Rhea (Astronomy); Radar Tracking; Millimeter Waves

20070032913 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Monitoring the Violent Activity from the Inner Accretion Disk of the Seyfert 1.9 Galaxy NGC 2992 with RXTE
Mruphy, Kendrah D.; Yaqoob, Tahir; Terashima, Yuichi; [2007]; 35 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG05GM34G; NNG0GB78A; NRA-00-01-LTSA-034; Copyright; Avail.: CASI: A03, Hardcopy

We present the results of a one year monitoring campaign of the Seyfert 1.9 galaxy NGC 2992 with RXTE. Historically, the source has been shown to vary dramatically in 2-10 keV flux over timescales of years and was thought to be slowly transitioning between periods of quiescence and active accretion. Our results show that in one year the source continuum flux covered almost the entire historical range, making it unlikely that the low-luminosity states correspond to the accretion mechanism switching off. During flaring episodes we found that a highly redshifted Fe K line appears, implying that the violent activity is occurring in the inner accretion disk, within 100 gravitational radii of the central black hole. We also found that the Compton y parameter for the X-ray continuum remained approximately constant during the large amplitude variability. These observations make NGC 2992 well-suited for future multi-waveband monitoring, as a test-bed for constraining accretion models.
Author
Accretion Disks; Seyfert Galaxies; X Ray Timing Explorer; Astronomy; Emission Spectra

20070032961 Space Telescope Science Inst., Baltimore, MD, USA
Progress by the JWST Science Working Group
Gardner, Jonathan P.; [2007]; 1 pp.; In English; JWST Conference, 23-28 Sep. 2007, Tucson, AZ, USA; No Copyright; Avail.: Other Sources; Abstract Only

The JWST Science Working Group recently published a comprehensive, top-level review of JWST science in the journal Space Science Reviews (Gardner et al. 2006, SSR, 123, 485). That review paper gives details of the 4 JWST science themes, and describes the design of the observatory and ground system. Since publication, the SWG, working with members of the astronomical community, has continued to develop the science case for JWST, giving more details in a series of white papers. The white paper topics include first light, galaxy surveys, AGN, supernovae, stellar populations, and exoplanets. The white papers are in various stages of completion. In this poster, I will review recent progress.
Author
Astronomy; Extrasolar Planets; Galaxies; Supernovae; Stars

20070034013 Maryland Univ., Greenbelt, MD, USA
The Synergy between the LAT and GBM in GLAST's Study of Gamma-Ray Bursts
Band, David L.; [2007]; 2 pp.; In English
Contract(s)/Grant(s): NNG06EO90A; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034013

Using semi-analytic calculations I characterize the gamma-ray bursts to which GLAST's LAT and GBM detectors will be sensitive. The thresholds of both instruments are at approximately the same vfv proportional to E(sup 2)N(E) values, i.e., the thresholds can be connected by an E(sup -2) spectrum. Therefore simultaneous detections by both instruments will be biased towards spectral components flatter than E(sup -2).
Author
Gamma Ray Bursts; Telescopes; Detectors; Sensitivity; Energy Bands

20070034031 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Effects of Space Weathering at UV Wavelengths: S-Class Asteroids

Hendrix, Amanda R.; Vilas, Faith; The Astronomical Journal; September 2006; Volume 132, pp. 1396-1404; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-26555; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40360

We present evidence that space weathering manifests itself at near-UV wavelengths as a bluing of the spectrum, in contrast with the spectral reddening that has been seen at visible-near-IR wavelengths. Furthermore, the effects of space weathering at UV wavelengths tend to appear with less weathering than do the longer wavelength effects, suggesting that the UV wavelength range is a more sensitive indicator of weathering, and thus age. We report results from analysis of existing near-UV (approx.220-350 nm) measurements of S-type asteroids from the International Ultraviolet Explorer and the Hubble Space Telescope and comparisons with laboratory measurements of meteorites to support this hypothesis. Composite spectra of S asteroids are produced by combining UV spacecraft data with ground-based longer wavelength data. At visible-near-IR wavelengths, S-type asteroids are generally spectrally redder (and darker) than ordinary chondrite meteorites, whereas the opposite is generally true at near-UV wavelengths. Similarly, laboratory measurements of lunar samples show that lunar soils (presumably more weathered) are spectrally redder at longer wavelengths, and spectrally bluer at near-UV wavelengths, than less weathered crushed lunar rocks. The UV spectral bluing may be a result of the addition of nanophase iron to the regolith through the weathering process. The UV bluing is most prominent in the 300-400 nm range, where the strong UV absorption edge is degraded with weathering.

Author

Space Weathering; Ultraviolet Spectra; Asteroids; Stellar Spectra; Near Infrared Radiation; Ultraviolet Absorption; Lunar Rocks; Lunar Soil

20070034051 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Dynamic Evolution in the Symbiotic R Aquarii

DePasquale, J. M.; Nichols, J. S.; Kellogg, E. M.; Bulletin of the American Astronomical Society; [2007]; Volume 37, No. 4, pp. 1173; In English

Contract(s)/Grant(s): NNG05GN43G; Copyright; Avail.: Other Sources

We report on multiple Chandra observations spanning a period of 5 years as well as a more recent XMM observation of the nearby symbiotic binary R Aqr. Spectral analysis of these four observations reveals considerable variability in hardness ratios and in the strength and ionization levels of emission lines which provides insight into white dwarf accretion processes as well as continuum and line formation mechanisms. Chandra imaging of the central source also shows the formation and evolution of a new south west jet. This growing body of high-resolution X-ray data of R Aqr provides a unique glimpse into white dwarf wind-accretion processes and jet formation.

Author

Symbiotic Stars; X Ray Astrophysics Facility; Stellar Evolution

20070034052 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

The Outer X-ray and Radio Jets in R Aquarii

Kellogg, E.; Anderson, C.; DePasquale, J.; Korreck, K.; Nichols, J.; Sokoloski, J.; Krauss, M.; Pedelty, J.; Bulletin of the American Astronomical Society; [2007]; Volume 37, pp. 1275; In English

Contract(s)/Grant(s): NNG05GN43G; Copyright; Avail.: Other Sources

The symbiotic star R Aquarii has been known to emit collimated outflow in the form of jets for many years. We report on five years of observations in x-rays and radio using Chandra, VLA and XMM-Newton. We discuss the evolution of the outer thermal jets, including new observations performed in June and October 2005. We see motion of the NE x-ray jet at a projected velocity of about 600 km (sup -1). The SW x-ray jet has almost disappeared between 2000.7 and 2004.0. An XMM grating spectrum of the NE jet confirms the existence of O VII He-like lines, and offers the possibility of doing plasma density diagnostics. We comment on on the physics of cooling in the SW jet and implications for the density of the x-ray emitting gas, the heating mechanism, and mass and kinetic energy in the jets and its implications for the system as a whole. This work was supported by NASA and NSF.

Author

Radio Jets (Astronomy); Symbiotic Stars; X Ray Astronomy

20070034056 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
A Study of the Mass Loss Rates of Symbiotic Star Systems
Korreck, K. E.; Kellogg, E.; Sokoloski, J. L.; AIP Conference Proceedings; [2007]; Volume 924, pp. 903-906; In English
Contract(s)/Grant(s): NNG05GN43G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1063/1.2774962

The amount of mass loss in symbiotic systems is investigated, specifically mass loss via the formation of jets in R Aquarii (R Aqr). The jets in R Aqr have been observed in the X-ray by Chandra over a four year time period. The jet changes on times scales of a year and new outflows have been observed. Understanding the amount of mass and the frequency of ejection further constrain the ability of the white dwarf in the system to accrete enough mass to become a Type la supernova progenitor. The details of multi-wavelength studies, such as speed, density and spatial extent of the jets will be discussed in order to understand the mass balance in the binary system. We examine other symbiotic systems to determine trends in mass loss in this class of objects.
Author
Symbiotic Stars; Astrophysics; Binary Stars; Mass Balance

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070032790 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MHD Flow Visualization of Magnetopause and Polar Cusps Vortices
Collado-Vega, Y. M.; Kessel, R. L.; Shao, X.; Boller, R. A.; December 11, 2006; 1 pp.; In English; American Geophysical Union Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Detailed analysis of Wind, Geotail, and Cluster data shows how magnetopause boundary and polar cusps vortices associated with high speed streams can be a carrier of energy flux to the Earth s magnetosphere. For our analysis time interval, March 29 . - April 5 2002, the Interplanetary Magnetic Field (IMF) is primarily northward and MHD simulations of vortices along the flanks within nine hours of the time interval suggest that a Kelvin Helmholtz (KH) instability is likely present. Vortices were classified by solar wind input provided by the Wind satellite located 70-80 RE upstream from Earth. We present statistics for a total of 304 vortices found near the ecliptic plane on the magnetopause flanks, 273 with northward IMF and 31 with southward IMF. The vortices generated under northward IMF were more driven into the dawnside than into the duskside, being substantially more ordered on the duskside. Most of the vortices were large in scale, up to 10 RE, and with a rotation axis closely aligned with the ZGSE direction. They rotated preferentially clockwise on the dawnside, and. counter-clockwise on the duskside. Those generated under southward IMF were less ordered, fewer in number, and also smaller in diameter. Significant vortex activity occurred on the nightside region of the magnetosphere for these southward cases in contrast to the northward IMF cases on which most of the activity was driven onto the magnetopause flanks. Magnetopause crossings seen by the Geotail spacecraft for the time interval were analyzed and compared with the MHD simulation to validate our results. Vortices over the polar cusps are also being analyzed and the simulation results will be compared to the multi-point measurements of the four Cluster satellites.
Author
Magnetopause; Flux Density; Magnetohydrodynamic Flow; Polar Cusps; Flow Visualization; Earth Magnetosphere

20070032885 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Spitzer MIPS Limits on Asteroidal Dust in the Pulsar Planetary System PSR B1257+12
Bryden, G.; Beichman, C. A.; Rieke, G. H.; Stansberry, J. A.; Stapelfeldt, K. R.; Trilling, D. E.; Turner, N. J.; Wolszczan, A.; The Astrophysical Journal; August 1, 2006; Volume 646, pp. 1038-1042; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NASA 1407; NAS7-960785; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40236

With the MIPS camera on Spitzer, we have searched for far-infrared emission from dust in the planetary system orbiting pulsar PSR B1257+12. With accuracies of 0.05 mJy at 24 microns and 1.5 mJy at 70 microns, photometric measurements find no evidence for emission at these wavelengths. These observations place new upper limits on the luminosity of dust with temperatures between 20 and 1000 K. They are particularly sensitive to dust temperatures of 100-200 K, for which they limit

the dust luminosity to below 3 x 10(exp -5) of the pulsar's spin-down luminosity, 3 orders of magnitude better than previous limits. Despite these improved constraints on dust emission, an asteroid belt similar to the solar system's cannot be ruled out. Author

Photometry; Cameras; Far Infrared Radiation; Radiant Flux Density; Luminosity; Asteroids; Asteroid Belts

20070032887 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Terrestrial Planet Finder Coronagraph 2005: Overview of Technology Development and System Design Studies

Ford, Virginia G.; August 31, 2005; 14 pp.; In English; Optical Science and Technology, 31 Aug. - 31 Sep. 2007, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40213

Technology research, design trades, and modeling and analysis guide the definition of a Terrestrial Planet Finder Coronagraph Mission that will search for and characterize earth-like planets around near-by stars. Operating in visible wavebands, this mission will use coronagraphy techniques to suppress starlight to enable capturing and imaging the reflected light from a planet orbiting in the habitable zone of its parent star. The light will be spectrally characterized to determine the presence of life-indicating chemistry in the planet atmosphere.

Author

Coronagraphs; Terrestrial Planets; Design Analysis; Systems Engineering

20070032954 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Binary Black Holes, Gravitational Waves, and Numerical Relativity

Centrella, Joan; [2007]; 1 pp.; In English; DOE Scientific Discovery through Advanced Computing (SciDAC) 2007 Conference, 24-28 Jun. 2007, Boston, MA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The final merger of two black holes releases a tremendous amount of energy and is one of the brightest sources in the gravitational wave sky. Observing these sources with gravitational wave detectors requires that we know the radiation waveforms they emit. Since these mergers take place in regions of very strong gravitational fields, we need to solve Einstein's equations of general relativity on a computer in order to calculate these waveforms. For more than 30 years, scientists have tried to compute these waveforms using the methods of numerical relativity. The resulting computer codes have been plagued by instabilities, causing them to crash well before the black holes in the binary could complete even a single orbit. Recently this situation has changed dramatically, with a series of amazing breakthroughs. This talk will take you on this quest for the holy grail of numerical relativity, showing how a spacetime is constructed on a computer to build a simutation laboratory for binary black hole mergers. We will focus on the recent advances that are revealing these waveforms, and the dramatic new potential for discoveries that arises when these sources will be observed by LIGO and LISA.

Author

Black Holes (Astronomy); Gravitational Waves; Waveforms; Relativity; Space-Time Functions; Gravitational Fields

20070032971 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Relation between the Mid-Infrared [Ne v] 14.3 Micrometers and [Ne III] 15.6 Micrometer Lines in Active Galactic Nuclei

Gorjian, V.; Cleary, K.; Werner, M. W.; Lawrence, C. R.; The Astrophysical Journal Letters; January 18, 2007; Volume 655, pp. L73-L76; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40385

We present a strong correlation between the [Ne v] 14.3 mm and [Ne III] 15.6 mm emission lines arising from the narrow-line regions (NLRs) of active galactic nuclei (AGNs), spanning 4 orders of magnitude in luminosity. The data are compiled primarily from Spitzer Space Telescope observations of nearby Seyfert galaxies (median z p 0.01) and 3C radio sources (median z p 0.52). This correlation is consistent with earlier studies in the optical/UV bands showing that line ratios arising in the NLRs are remarkably constant across AGNs. We also show that the correlation allows only a very narrow range in ionization parameter for simple photoionization models. The observed correlation will place tight constraints on alternative models, which predict constant line ratios over a broader range in ionization parameter.

Author

Active Galactic Nuclei; Seyfert Galaxies; Emission Spectra; Photoionization; Space Infrared Telescope Facility

20070032976 NASA Marshall Space Flight Center, Huntsville, AL, USA

High-Energy Astrophysics: An Overview

Fishman, Gerald J.; May 13, 2007; 62 pp.; In English; General Colloquium Stockholm Observatory and Uppsala University, 13-19 May 2007, Stockholm, Sweden; Original contains black and white illustrations; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032976

High-energy astrophysics is the study of objects and phenomena in space with energy densities much greater than that found in normal stars and galaxies. These include black holes, neutron stars, cosmic rays, hypernovae and gamma-ray bursts. A history and an overview of high-energy astrophysics will be presented, including a description of the objects that are observed. Observing techniques, space-borne missions in high-energy astrophysics and some recent discoveries will also be described. Several entirely new types of astronomy are being employed in high-energy astrophysics. These will be briefly described, along with some NASA missions currently under development.

Author

Astrophysics; Cosmic Rays; Black Holes (Astronomy); Neutron Stars

20070033047 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Optimal Control of a Circular Satellite Formation Subject to Gravitational Perturbations

Baldwin, Jason L; Mar 2007; 112 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469270; AFIT/GA/ENY/07-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469270

Satellite formations, otherwise known in the space community as satellite clusters or distributed satellite systems, have been studied extensively over the last 10 to 15 years. For use in remote sensing applications, formations consisting of smaller, simpler satellites provide numerous advantages over individual satellites. The image resolution capabilities of small-satellite formations constitute a significant technological leap in the ability to synthesize critical information. This research utilizes the nonlinear satellite dynamics, including gravitational perturbations, to search for the optimal fuel cost for maintaining a circular formation. The system dynamics were developed in an earth-centered inertial coordinate frame using the methods of Hamiltonian dynamics. Continuous dynamic optimization theory was used to minimize fuel requirements, resulting in a continuous thrust, open-loop control law. The uncontrolled reference trajectory off which the formation is based was restricted to a circular, inclined orbit. Given initial conditions which match the mean motion of every member of the formation, it is shown that 1-km circular formation configurations can be maintained for control costs on the order of 40-50 m/s/year at an altitude of 400 km. Additionally, further fuel savings are possible with modifications to orbit altitude, formation radius, and variations in the defined performance index.

DTIC

Artificial Satellites; Evolution; Gravitational Fields; Natural Satellites; Optimal Control; Perturbation

20070034065 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Going Beyond Einstein with the Constellation-X Mission

White, Nicholas; June 10, 2007; 1 pp.; In English; From Quantum to Cosmos2, 10-13 Jun. 2007, Bremen, Germany; No Copyright; Avail.: Other Sources; Abstract Only

The Constellation-X mission will address the questions: 'What happens to matter close to a black hole?' and 'What is Dark Energy?' These questions are central to the NASA Beyond Einstein Program, where Constellation-X plays a central role. The mission will address these questions by using high throughput X-ray spectroscopy to observe the effects of strong gravity close to the event horizon of black holes, and to observe the formation and evolution of clusters of galaxies in order to precisely determine Cosmological parameters. To achieve these primary science goals requires a factor of 25-100 increase in sensitivity for high resolution X-ray spectroscopy.'The mission will also perform routine high-resolution X-ray spectroscopy of faint 2nd extended X-ray source populations. This will provide diagnostic information such as density, elemental abundances, velocity; and ionization state for a wide range of astrophysical problems, including new constraints on the Neutron Star equation of state.

Author

Black Holes (Astronomy); Constellation-X; X Ray Spectroscopy; High Resolution; Astrophysics; Gravitational Effects; Galactic Clusters

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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*.

20070032699 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Platforms for Discovery: Exploring Titan and Venus
Aerospace America; June 2007; ISSN 0740-722X, pp. 32-37; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Saturn's largest moon and Earth's 'sister planet' are the focus of NASA studies for exploration missions. Planners seeking to unloclc the secrets of these mysterious worlds face daunting challenges, from extremes of heat and cold to dense cloud cover to highly corrosive atmospheric conditions. Mobile atmospheric platforms may allow the needed technologies to thrive in these harsh environments.
Author
Venus (Planet); Space Missions; NASA Space Programs; Titan; Space Platforms; Space Exploration

20070032706 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA's Lunar Impact Monitoring Program
Suggs, Robert M.; Cooke, William; Swift, Wesley; Hollon, Nicholas; June 11, 2007; 19 pp.; In English; Meteoroids 2007, 11-15 Jun. 2007, Barcelona, Spain; Copyright; Avail.: CASI: A03, Hardcopy

NASA's Meteoroid Environment Office nas implemented a program to monitor the Moon for meteoroid impacts from the Marshall Space Flight Center. Using off-the-shelf telescopes and video equipment, the moon is monitored for as many as 10 nights per month, depending on weather. Custom software automatically detects flashes which are confirmed by a second telescope, photometrically calibrated using background stars, and published on a website for correlation with other observations, Hypervelocity impact tests at the Ames Vertical Gun Facility have been performed to determine the luminous efficiency ana ejecta characteristics. The purpose of this research is to define the impact ejecta environment for use by lunar spacecraft designers of the Constellation (manned lunar) Program. The observational techniques and preliminary results will be discussed.
Author
Hypervelocity Impact; Impact Tests; Lunar Programs; NASA Space Programs; Telescopes; Monitors

20070032709 NASA Marshall Space Flight Center, Huntsville, AL, USA
Optimization of Crew Shielding Requirement in Reactor-Powered Lunar Surface Missions
Barghouty, Abdulnasser F.; June 24, 2007; 19 pp.; In English; Proceedings of Space Nuclear Conference 2007, 24-28 Jun. 2007, Boston, MA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032709

On the surface of the moon -and not only during heightened solar activities- the radiation environment As such that crew protection will be required for missions lasting in excess of six months. This study focuses on estimating the optimized crew shielding requirement for lunar surface missions with a nuclear option. Simple, transport-simulation based dose-depth relations of the three (galactic, solar, and fission) radiation sources am employed in a 1-dimensional optimization scheme. The scheme is developed to estimate the total required mass of lunar-regolith separating reactor from crew. The scheme was applied to both solar maximum and minimum conditions. It is shown that savings of up to 30% in regolith mass can be realized. It is argued, however, that inherent variation and uncertainty -mainly in lunar regolith attenuation properties in addition to the radiation quality factor- can easily defeat this and similar optimization schemes.
Author
Lunar Surface; Radiation Shielding; Spacecrews; Optimization; Requirements; Power Reactors

20070032712 NASA Marshall Space Flight Center, Huntsville, AL, USA

Measurement of Primary Ejecta From Normal Incident Hypervelocity Impact on Lunar Regolith Simulant

Edwards, David L.; Cooke, William; Moser, Danielle; Swift, Wesley; June 11, 2007; 7 pp.; In English; Meteoroids 2007/Institut d'Estudis Espacials de Catalunya (IEEC), 11-15 Jun. 2007, Barelona, Spain; Original contains color illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070032712

The National Aeronautics and Space Administration (NASA) continues to make progress toward long-term lunar habitation. Critical to the design of a lunar habitat is an understanding of the lunar surface environment. A subject for further definition is the lunar primary ejecta environment. The document NASA SP-8013 was developed for the Apollo program and is the latest definition of the primary ejecta environment. There is concern that NASA SP-8013 may over-estimate the lunar primary ejecta environment. NASA's Meteoroid Environment Office (MEO) has initiated several tasks to improve the accuracy of our understanding of the lunar surface primary ejecta environment. This paper reports the results of experiments on projectile impact into pumice targets, simulating lunar regolith. The Ames Vertical Gun Range (AVGR) was used to accelerate spherical Pyrex projectiles of 0.29g to velocities ranging between 2.5 km/s and 5.18 km/s. Impact on the pumice target occurred at normal incidence. The ejected particles were detected by thin aluminum foil targets placed around the pumice target in a 0.5 Torr vacuum. A simplistic technique to characterize the ejected particles was formulated. Improvements to this technique will be discussed for implementation in future tests.

Author

Ejecta; Hypervelocity Impact; Lunar Rocks; Regolith; Hypervelocity Projectiles

20070032713 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA'S Simulant Development Program Evolution and Overview

McLemore, Carole; Fikes, John; Owens, Charles; Rickman, Doug; June 10, 2007; 2 pp.; In English; Planetary and Mining Science Symposium Northern Centre for Advanced Technology, Inc., 10-13 Jun. 2007, Ontario, Canada; Copyright; Avail.: CASI: A01, Hardcopy

Since its origination under NASA's previous Human System Research and Technology program, the Lunar Simulant Development Program has undergone several changes. NASA recognized as early as the Apollo Program, and even more so as a result of the Apollo missions, that a viable dust and lunar simulant program is critical to the success of its space exploration goals. Unfortunately, this program has suffered the same problems that all programs share from time to time including uncertain budgets, shifting of priorities, and schedule fluctuations. To compound the problem, the process for developing simulants is being redefined and is not a trivial pursuit. Before now, NASA had not attempted to develop a suitable standard simulant since the 1990s when JSC-1 was produced. Although several other simulants have been developed by various groups both before and after the production of JSC-1, JSC-1 had become the de facto standard even though it has some limitations. The development and production of new simulants will address some of these limitations by starting with an assessment of NASA's needs and understanding the required processing in order to make these simulants.

Author

NASA Programs; General Overviews; Lunar Programs; Simulation; Lunar Exploration

20070032824 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

The Future of Asset Management for Human Space Exploration: Supply Classification and an Integrated Database

Shull, Sarah A.; Gralla, Erica L.; deWeck, Olivier L.; Shishko, Robert; September 19, 2006; 15 pp.; In English; Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNK05OA50C; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40269

One of the major logistical challenges in human space exploration is asset management. This paper presents observations on the practice of asset management in support of human space flight to date and discusses a functional-based supply classification and a framework for an integrated database that could be used to improve asset management and logistics for human missions to the Moon, Mars and beyond.

Author

Space Exploration; Moon; Mars Missions; Logistics

20070032864 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Can We Power Future Mars Missions?

Balint, Tibor S.; Sturm, Erick J., II; Woolley, Ryan C.; Jordan, James F.; October 2, 2006; 16 pp.; In English; 57th International Astrnautical Congress, 2-6 Oct. 2006, Valencia, Spain; Original contains color illustrations

Report No.(s): AC-06-A5.2.06; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40251

The Vision for Space Exploration identified the exploration of Mars as one of the key pathways. In response, NASAs Mars Program Office is developing a detailed mission lineup for the next decade that would lead to future explorations. Mission architectures for the next decade include both orbiters and landers. Existing power technologies, which could include solar panels, batteries, radioisotope power systems, and in the future fission power, could support these missions. Second and third decade explorations could target human precursor and human in-situ missions, building on increasingly complex architectures. Some of these could use potential feed forward from earlier Constellation missions to the Moon, discussed in the ESAS study. From a potential Mars Sample Return mission to human missions the complexity of the architectures increases, and with it the delivered mass and power requirements also amplify. The delivered mass at Mars mostly depends on the launch vehicle, while the landed mass might be further limited by EDL technologies, including the aeroshell, parachutes, landing platform, and pinpoint landing. The resulting in-situ mass could be further divided into payload elements and suitable supporting power systems. These power systems can range from tens of watts to multi-kilowatts, influenced by mission type, mission configuration, landing location, mission duration, and season. Regardless, the power system design should match the power needs of these surface assets within a given architecture. Consequently, in this paper we will identify potential needs and bounds of delivered mass and architecture dependent power requirements to surface assets that would enable future in-situ exploration of Mars.

Author

Space Exploration; Mars Sample Return Missions; Mars Missions; Launch Vehicles; Payloads; Systems Engineering; Solar Cells; Constellations

20070032870 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Europa Explorer - An Exceptional Mission Using Existing Technology

Clark, Karla B.; March 3, 2007; 17 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40246

A mission to Europa has been identified as a high priority by the science community for several years. The difficulty of an orbital mission, primarily due to the propulsive requirements and Jupiter's trapped radiation, led to many studies which investigated various approaches to meeting the science goals. The Europa Orbiter Mission studied in the late 1990's only met the most fundamental science objectives. The science objectives have evolved with the discoveries from the Galileo mission. JPL studied one concept, Europa Explorer, for a Europa orbiting mission which could meet a much expanded set of science objectives. A study science group was formed to verify that the science objectives and goals were being adequately met by the resulting mission design concept. The Europa Explorer design emerged primarily from two key self-imposed constraints: 1) meet the full set of identified nonlander science objectives and 2) use only existing technology.

Author

Europa; Mission Planning; Galileo Project; Space Exploration; Space Missions

20070032882 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Gravity Fields and Interiors of the Saturnian Satellites

Rappaport, N. J.; Armstrong, J. W.; Asmar, Sami W.; Iess, L.; Tortora, P.; Somenzi, L.; Zingoni, F.; July 15, 2006; 32 pp.; In English; Third Annual Meeting of the Asia--Oceania Geosciences Society, 10-14 Jul. 2006, Singapore; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/39828

This viewgraph presentation reviews the Gravity Science Objectives and accomplishments of the Cassini Radio Science Team: (1) Mass and density of icy satellites (2) Quadrupole field of Titan and Rhea (3) Dynamic Love number of Titan (4) Moment of inertia of Titan (in collaboration with the Radar Team) (5) Gravity field of Saturn. The proposed measurements for the extended tour are: (1) Quadrupole field of Enceladus (2) More accurate measurement of Titan k2 (3) Local gravity/topography correlations for Iapetus (4) Verification/disproof of 'Pioneer anomaly'

CASI

Gravitational Fields; Icy Satellites; Saturn (Planet); Saturn Satellites; Mass

20070032945 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Radioisotope Electric Propulsion (REP) for Selected Interplanetary Science Missions

Oh, David; Bonfiglio, Eugene; Cupples, Mike; Belcher, Jeremy; Witzberger, Kevin; Fiehler, Douglas; Artis, Gwen; October 31, 2005; 36 pp.; In English; 29th International Electric Propulsion Conference (IEPC-2005-181), 31 Oct. - 4 Nov. 2005, Princeton, NJ, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40190

This viewgraph presentation analyzes small body targets (Trojan Asteroids), Medium Outer Planet Class (Jupiter Polar Orbiter with Probes), and Main Belt Asteroids and Comets (Comet Surface Sample Return), for Radioisotope Electric Propulsion (REP).

CASI

Electric Propulsion; Sample Return Missions; Jupiter (Planet); Interplanetary Spacecraft; Radioactive Isotopes; Technology Utilization

20070032963 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Cassini Imaging of Saturn: Southern Hemisphere Winds and Vortices

Vasavada, A. R.; Horst, S. M.; Kennedy, M. R.; Ingersoll, A. P.; Porco, C. C.; DelGenio, A. D.; West, R. A.; Journal Of Geophysical Research; April 19, 2006; ISSN 0148-0227; Volume 111; 13 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40368; http://dx.doi.org/10.1029/2005JE002563

High-resolution images of Saturn's southern hemisphere acquired by the Cassini Imaging Science Subsystem between February and October 2004 are used to create maps of cloud morphology at several wavelengths, to derive zonal winds, and to characterize the distribution, frequency, size, morphology, color, behavior, and lifetime of vortices. Nonequatorial wind measurements display only minor differences from those collected since 1981 and reveal a strong, prograde flow near the pole. The region just southward of the velocity minimum at 40.7 deg S is especially active, containing numerous vortices, some generated in the proximity of convective storms. The two eastward jets nearest the pole display periodicity in their longitudinal structure, but no direct analogs to the northern hemisphere's polar hexagon or ribbon waves were observed. Characteristics of winds and vortices are compared with those of Saturn's northern hemisphere and Jupiter's atmosphere.

Author

Saturn (Planet); Wind Measurement; Imaging Techniques; Cassini Mission; Morphology; Vortices; Jupiter Atmosphere

20070032968 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Dust Devil Tracks and Wind Streaks in the North Polar Region of Mars: A Study of the 2007 Phoenix Mars Lander Sites

Drake, Nathan B.; Tamppari, Leslie K.; Baker, R. David; Cantor, Bruce A.; Hale, Amy S.; Geophysical Research Letters; September 8, 2006; ISSN 0094-826; Volume 33; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40380; http://dx.doi.org/10.1029/2006GL026270

The 65-72 latitude band of the North Polar Region of Mars, where the 2007 Phoenix Mars Lander will land, was studied using satellite images from the Mars Global Surveyor (MGS) Mars Orbiter Camera Narrow-Angle (MOC-NA) camera. Dust devil tracks (DDT) and wind streaks (WS) were observed and recorded as surface evidence for winds. No active dust devils (DDs) were observed. 162 MOC-NA images, 10.3% of total images, contained DDT/WS. Phoenix landing Region C (295-315W) had the highest concentration of images containing DDT/WS per number of available images (20.9%); Region D (130-150W) had the lowest (3.5%). DDT and WS direction were recorded for Phoenix landing regions A (110-130W), B (240-260W), and C to infer local wind direction. Region A showed dominant northwest-southeast DDT/WS, Region B showed dominant north-south, east-west and northeast-southwest DDT/WS, and region C showed dominant west/northwest - east/southeast DDT/ WS. Results indicate the 2007 Phoenix Lander has the highest probability of landing near DDT/WS in landing Region C. Based on DDT/WS linearity, we infer Phoenix would likely encounter directionally consistent background wind in any of the three regions.

Author

Satellite Imagery; Wind Direction; Ground Wind; Dust; Mars Surface; Mars Global Surveyor

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070032730 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Electron Velocity Distribution Function in Magnetic Clouds in the Solar Wind
Nieves-Chinchil, Teresa; Vinas, Adolfo F.; Bale, Stuart D.; December 11, 2006; 1 pp.; In English; American Geophysical Union Fall 2006 Meeting, 11-15 Dec. 2006, San Francisco, CA, USA
Report No.(s): AGU-10208381; Copyright; Avail.: Other Sources; Abstract Only

We present a study of the kinetic properties of the electron velocity distribution functions within magnetic clouds, since they are the dominant thermal component. The study is based on high time resolution data from the GSFC WIND/SWE electron spectrometer and the Berkeley 3DP electron plasma instruments. Recent studies on magnetic clouds have shown observational evidence of anti-correlation between the total electron density and electron temperature, which suggest a polytrope law P(sub e) = alpha(Nu(sub e) (sup gamma)) for electrons with the constant gamma approximates 0.5 < 1. This anti-correlation and small polytropic gamma-values is interpreted in the context of the presence of highly non-Maxwellian electron distributions (i.e. non-thermal) within magnetic clouds. These works suggested that the non-thermal electrons can contribute as much as 50% of the total electron pressure within magnetic clouds. We have revisited some of the magnetic cloud events previously studied and attempted to quantify the nature of the non-thermal electrons by modeling the electron velocity distribution function using a kappa distribution function to characterize the kinetic non-thermal effects. If non-thermal tail effects are the source for the anti-correlation between the moment electron temperature and density and if the kappa distribution is a reasonable representative model of non-thermal effects, then the electron velocity distribution within magnetic clouds should show indication for small K-values when gamma < 1.
Author
Distribution Functions; Electron Distribution; Electrons; Magnetic Clouds; Solar Wind; Velocity Distribution; Coronal Mass Ejection; Interplanetary Magnetic Fields; Solar Terrestrial Interactions; Space Plasmas

20070032737 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Understanding X-Ray Source Motions in a Solar Flare Loop
Holman, Gordon D.; Sui, L.; Dennis, B. R.; May 16, 2006; 1 pp.; In English; AAS SPD Summer School and AAS SPD Meeting, 21-30 Jun. 2006, Durham, NH, USA; Copyright; Avail.: Other Sources; Abstract Only

RHESSI images of a solar flare on 2002 November 28 showed a 3-6 keV hard X-ray source that was initially located at the flare loop top, split and propagated to the foot points of the loop during the flare rise phase, and then propagated back up to the loop top during the declining phase of the flare (Sai, Holman, & Dennis 2006). Higher energy X-ray sources were located lower in the legs of the loop during this period of source evolution, with X-rays above 25 keV seen only at the foot points. Sui, Holman, & Dennis suggested that this spatial evolution reflected the evolution of the spectral index and low-energy cutoff to the distribution of accelerated electrons in the flare. We construct a model flare loop and electron distribution injected at the top of this loop to reproduce the source evolution of the November 28 flare. We determine the constraints on the loop model and the evolution of the accelerated electron distribution. We also study the implications of the model for energy deposition into the loop plasma, and the integrated and imaged X-ray spectra. This work is supported in part by the RHESSI Project and the NASA Guest Investigator Program.
Author
Solar Flares; X Ray Sources; Imaging Techniques; Electron Distribution

20070032798 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Absolute Radiometric Calibration of EUNIS-06
Thomas, R. J.; Rabin, D. M.; Kent, B. J.; Paustian, W.; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

The Extreme-Ultraviolet Normal-Incidence Spectrometer (EUNIS) is a soundingrocket payload that obtains imaged high-resolution spectra of individual solar features, providing information about the Sun's corona and upper transition region. Shortly after its successful initial flight last year, a complete end-to-end calibration was carried out to determine the instrument's absolute radiometric response over its Longwave bandpass of 300 - 370A. The measurements were done at the Rutherford-Appleton Laboratory (RAL) in England, using the same vacuum facility and EUV radiation source used in the pre-flight calibrations of both SOHO/CDS and Hinode/EIS, as well as in three post-flight calibrations of our SERTS sounding

rocket payload, the precursor to EUNIS. The unique radiation source provided by the Physikalisch-Technische Bundesanstalt (PTB) had been calibrated to an absolute accuracy of 7% (l-sigma) at 12 wavelengths covering our bandpass directly against the Berlin electron storage ring BESSY, which is itself a primary radiometric source standard. Scans of the EUNIS aperture were made to determine the instrument's absolute spectral sensitivity to +- 25%, considering all sources of error, and demonstrate that EUNIS-06 was the most sensitive solar E W spectrometer yet flown. The results will be matched against prior calibrations which relied on combining measurements of individual optical components, and on comparisons with theoretically predicted 'insensitive' line ratios. Coordinated observations were made during the EUNIS-06 flight by SOHO/CDS and EIT that will allow re-calibrations of those instruments as well. In addition, future EUNIS flights will provide similar calibration updates for TRACE, Hinode/EIS, and STEREO/SECCHI/EUVI.
Author
Extreme Ultraviolet Radiation; Sounding Rockets; Payloads; Solar Spectrometers; Calibrating; Radiation Sources; Accuracy; Radiometers

20070032804 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stratospheric Ozone Variations Caused by Solar Proton Events between 1963 and the Present
Jackman, Charles H.; Fleming, Eric L.; [2007]; 1 pp.; In English; Workhop: Climate Variability and Extremes during the Past 100 Years, 22-28 Jul. 2006, Gwatt, Switzerland; No Copyright; Avail.: Other Sources; Abstract Only

Solar proton fluxes have been measured by satellites for over forty years (1963-present). Several satellites, including the Interplanetary Monitoring Platforms (1963-1993) and the NOAA Geostationary Operational Environmental Satellites (1994-present), have been used to compile this long-term dataset. Some solar storms lead to solar proton events (SPEs) at the Earth, which typically last a few days. High energy solar protons associated with SPEs precipitate on the Earth's atmosphere and cause increases in odd hydrogen (HO(x)) and odd nitrogen (NO(y)) in the polar cap region (>60 degrees geomagnetic). The enhanced HO(x) leads to short-lived ozone depletion (-days) due to the short lifetime of HOx constituents. The enhanced NO(y) leads to long-lived ozone changes because of the long lifetime of the NO(y) family in the stratosphere and lower mesosphere. Very large SPEs occurred in 1972, 1989, 2000, 2001, and 2003 and were predicted to cause significant polar upper stratospheric ozone depletion (>10%), which lasted for several weeks past the events. Several satellite instruments (BUV, SBUV, SBUV/2, SAGE II, HALOE, SCIAMACHY, MIPAS, GOMOS, etc.) have measured ozone changes as a result of SPEs. The long-term influence of SPEs on ozone will be discussed in this presentation.
Author
Stratosphere; Solar Protons; Ozone; Hydrogen Compounds; Atmospheric Composition; Proton Energy; Geosynchronous Orbits; Ultraviolet Radiation

20070034012 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Cycle 24 and the Solar Dynamo
Pesnell, W. D.; Schatten, K.; April 03, 2007; 1 pp.; In English; American Astronomical Society 210th meeting, 26-31 A=May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

We will discuss the polar field precursor method for solar activity prediction, which predicts cycle 24 will be significantly lower than recent activity cycles, and some new ideas rejuvenating Babcock's shallow surface dynamo. The polar field precursor method is based on Babcock and Leighton's dynamo models wherein the polar field at solar minimum plays a major role in generating the next cycle's toroidal field and sunspots. Thus, by examining the polar fields of the Sun near solar minimum, a forecast for the next cycle's activity is obtained. With the current low value for the Sun's polar fields, this method predicts solar cycle 24 will be one of the lowest in recent times, with smoothed F10.7 radio flux values peaking near 135 plus or minus 35 (2 sigma), in the 2012-2013 timeframe (equivalent to smoothed Rz near 80 plus or minus 35 [2 sigma]). One may have to consider solar activity as far back as the early 20th century to find a cycle of comparable magnitude. We discuss unusual behavior in the Sun's polar fields that support this prediction. Normally, the solar precursor method is consistent with the geomagnetic precursor method, wherein geomagnetic variations are thought to be a good measure of the Sun's polar field strength. Because of the unusual polar field, the Earth does not appear to be currently bathed in the Sun's extended polar field (the interplanetary field), hence negating the primal cause behind the geomagnetic precursor technique. We also discuss how percolation may support Babcock's original shallow solar dynamo. In this process ephemeral regions from the solar magnetic carpet, guided by shallow surface fields, may collect to form pores and sunspots.
Author
Dynamo Theory; Solar Cycles; Geomagnetism; Sun; Polar Regions

20070034057 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Solar Heating of Suspended Particles and the Dynamics of Martian Dust Devils
Fuerstenau, Stephen D.; Geophysical Research Letters; October 16, 2006; ISSN 0094-8276; Volume 33, No. 19; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40375; http://dx.doi.org/10.1029/2006gl026798

The heat input to Martian dust devils due to solar warming of suspended particles is assessed based on a prior estimate of dust loading and from an analysis of shadows cast by dust devils in images taken from orbit. Estimated values for solar heating range from 0.12 to 0.57 W/m3 with associated temperature increases of 0.011 to 0.051(deg)C per second. These warming rates are comparable to the adiabatic cooling rate expected for a gas parcel rising on Mars with a vertical velocity of 10 m/s. Solar warming of suspended dust serves to maintain buoyancy in a rising dust plume and may be one cause for the large scale of dust devils observed on Mars.
Author
Solar Heating; Mars Surface; Buoyancy; Dust

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20070032702 NASA Marshall Space Flight Center, Huntsville, AL, USA
Can the Equivalent Sphere Model Approximate Organ Doses in Space Radiation Environments?
Zi-Wei, Lin; June 24, 2007; 26 pp.; In English; Proceedings of the Space Nuclear Conference 2007, 24-28 Jun. 2007, Boston, MA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC8-200; NNM05AA22A; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032702

In space radiation calculations it is often useful to calculate the dose or dose equivalent in blood-forming organs (BFO). the skin or the eye. It has been customary to use a 5cm equivalent sphere to approximate the BFO dose. However previous studies have shown that a 5cm sphere gives conservative dose values for BFO. In this study we use a deterministic radiation transport with the Computerized Anatomical Man model to investigate whether the equivalent sphere model can approximate organ doses in space radiation environments. We find that for galactic cosmic rays environments the equivalent sphere model with an organ-specific constant radius parameter works well for the BFO dose equivalent and marginally well for the BFO dose and the dose equivalent of the eye or the skin. For solar particle events the radius parameters for the organ dose equivalent increase with the shielding thickness, and the model works marginally for BFO but is unacceptable for the eye or the skin The ranges of the radius parameters are also shown and the BFO radius parameters are found to be significantly larger than 5 cm in all eases.
Author
Extraterrestrial Radiation; Radiation Dosage; Models; Organs; Aerospace Environments; Electromagnetic Radiation

20070032741 NASA Langley Research Center, Hampton, VA, USA
Numerical Uncertainty Quantification for Radiation Analysis Tools
Anderson, Brooke; Blattnig, Steve; Clowdsley, Martha; July 09, 2007; 9 pp.; In English; 37th International Conference on Environmental Systems (ICES), 9-12 Jul. 2007, Chicago, IL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 644423.02.38.03.04
Report No.(s): SAE Paper 07ICES-92; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032741

Recently a new emphasis has been placed on engineering applications of space radiation analyses and thus a systematic effort of Verification, Validation and Uncertainty Quantification (VV&UQ) of the tools commonly used for radiation analysis for vehicle design and mission planning has begun. There are two sources of uncertainty in geometric discretization addressed in this paper that need to be quantified in order to understand the total uncertainty in estimating space radiation exposures. One

source of uncertainty is in ray tracing, as the number of rays increase the associated uncertainty decreases, but the computational expense increases. Thus, a cost benefit analysis optimizing computational time versus uncertainty is needed and is addressed in this paper. The second source of uncertainty results from the interpolation over the dose vs. depth curves that is needed to determine the radiation exposure. The question, then, is what is the number of thicknesses that is needed to get an accurate result. So convergence testing is performed to quantify the uncertainty associated with interpolating over different shield thickness spatial grids.
Author
Radiation Dosage; Numerical Analysis; Extraterrestrial Radiation; Reliability; Interpolation; Galactic Cosmic Rays

20070032934 Air Force Research Lab., USA
Radiometric and Radiation Response of Visible FPAs
Hubbs, John; April 2007; 77 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032934

The readout integrated circuit (ROIC) used in these devices was originally developed for use in space based infrared systems operating at deep cryogenic temperatures and was selected because of its proven tolerance to total ionizing radiation? The detectors are a 128 x 128 array of 60 pm x 60 pm pixel elements that have been anti-reflection (AR) coated to improve the response at very short wavelengths. These visible focal plane arrays were operated at -40 C (233 K). Two focal planes were characterized using cobalt-60 radiation to produce ionizing total dose damage in the VFPAs. Both operational and performance data were obtained as functions of total dose. The first device tested showed no appreciable change in responsivity or noise up to 300 krad(Si). However, at the next dose level of 600 krad(Si), the readout was non-operational due to failure in the digital circuitry. The second device was characterized to a total dose of 750 krad(Si) with no observed change in responsivity. An increase dark current was observed in both devices, and in the second device, the dark current caused an increase in noise at low irradiance at 400 krad(Si) and above. The increase in dark current was somewhat un-expected for visible PIN detectors. The median dark current increased more than two orders of magnitude at 300 krad(Si) for the first device and a factor of 350 at 750 krad(Si) for pixels near the edge for the second device. The dark current was found to be a strong function of detector bias, with pixels near the edge of the array showing a greater increase in dark current with bias than those near the center. Since the optical response was not a function of bias, it is hypothesized that the dark current is a surface effect and that the variation in dark current with location is due to a variation in pixel bias, caused by a voltage drop across the pixel common lead. As the total dose increased, the dark current and the voltage drop increased
Author
Radiometers; Infrared Instruments; Integrated Circuits; Ionizing Radiation; Irradiance; Focal Plane Devices; Circuits

20070032978 NASA Marshall Space Flight Center, Huntsville, AL, USA
Nuclear Fragmentation Processes Relevant for Human Space Radiation Protection
Lin, Zi-Wei; April 15, 2007; 20 pp.; In English; American Physical Society Annual April Meeting 2007, 14-17 Apr. 2007, Jacksonville, FL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070032978

Space radiation from cosmic ray particles is one of the main challenges for human space explorations such-as a moon base or a trip to Mars. Models have been developed in order to predict the radiation exposure to astronauts and to evaluate the effectiveness of different shielding materials, and a key ingredient in these models is the physics of nuclear fragmentations. We have developed a semi-analytical method to determine which partial cross sections of nuclear fragmentations most affect the radiation dose behind shielding materials due to exposure to galactic cosmic rays. The cross sections thus determined will require more theoretical and/or experimental studies in order for us to better predict, reduce and mitigate the radiation exposure in human space explorations.
Author
Galactic Cosmic Rays; Radiation Dosage; Radiation Shielding; Space Exploration; Radiation Effects

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.

20070032826 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Architecting Ourselves: Schema to Facilitate Growth of the International Space Architecture Community

Sherwood, Brent; September 21, 2006; 11 pp.; In English; AIAA Space 2nd Space Architecture Symposium, 21 Sep. 2006, San Jose, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40268

This paper develops a conceptual model, adapted from the way research and development non-profits and universities tend to be organized, that could help amplify the reach and effectiveness of the international space architecture community. The model accommodates current activities and published positions, and increases involvement by allocating accountability for necessary professional and administrative activities. It coordinates messaging and other outreach functions to improve brand management. It increases sustainability by balancing volunteer workload. And it provides an open-ended structure that can be modified gracefully as needs, focus, and context evolve. Over the past 20 years, Space Architecture has attained some early signs of legitimacy as a discipline: an active, global community of practicing and publishing professionals; university degree programs; a draft undergraduate curriculum; and formal committee establishment within multiple professional organizations. However, the nascent field has few outlets for expression in built architecture, which exacerbates other challenges the field is experiencing in adolescence: obtaining recognition and inclusion as a unique contributor by the established aerospace profession; organizing and managing outreach by volunteers; striking a balance between setting admittance or performance credentials and attaining a critical mass of members; and knowing what to do, beyond sharing common interests, to actually increase the market demand for space architecture. This paper develops a conceptual model, adapted from the way research-anddevelopment non-profits and universities tend to be organized, that could help amplify the reach and effectiveness of the international space architecture community. The model accommodates current activities and published positions, and increases involvement by allocating accountability for necessary professional and administrative activities. It coordinates messaging and other outreach functions to improve brand management. It increases sustainability by balancing volunteer workload. And it provides an open-ended structure that can be modified gracefully as needs, focus, and context evolve. This organizational model is offered up for consideration, debate, and toughening by the space architecture community at large.
Author

Organizations; University Program; Workloads (Psychophysiology); Coordinates; Space Logistics

Subject Term Index

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