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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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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to R&D results reported in:

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

The NASA STI Program

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

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

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NASA Center for AeroSpace Information (CASI)

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

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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.

The Federal Depository Library Program (FDLP)

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

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

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

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20070034167 NASA Langley Research Center, Hampton, VA, USA

Overview of Fundamental High-Lift Research for Transport Aircraft at NASA

Leavitt, L. D.; Washburn, A. E.; Wahls, R. A.; September 13, 2007; 41 pp.; In English; First CEAS European Air and Space Conference, 10-13 September 2007, Berlin, Germany; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034167

NASA has had a long history in fundamental and applied high lift research. Current programs provide a focus on the validation of technologies and tools that will enable extremely short take off and landing coupled with efficient cruise performance, simple flaps with flow control for improved effectiveness, circulation control wing concepts, some exploration into new aircraft concepts, and partnership with Air Force Research Lab in mobility. Transport high-lift development testing will shift more toward mid and high Rn facilities at least until the question: 'How much Rn is required' is answered. This viewgraph presentation provides an overview of High-Lift research at NASA.

Derived from text

Aeronautical Engineering; NASA Programs; Transport Aircraft; Aircraft Configurations

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.

20070034451 Naval Undersea Warfare Center, Newport, RI USA

Adaptive Material Actuators for Coanda Effect Circulation Control Slots

Krol, Jr , William P, Inventor; Mar 13, 2006; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020296; No Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADD020296

A system and method of use are provided for introducing tangential control fluid flows along the surface of an aerodynamic member. The fluid flows are directed toward a coanda surface disposed at the trailing edge of the aerodynamic member. At least two injection slots are provided on opposite sides of the aerodynamic member to produce opposing forces. Control of the flow of fluid from each slot determines the net effect of these opposing forces. Smart material actuators are used to control the flow of fluid from each slot by varying the size of each slot.

DTIC

Actuators; Aerodynamics; Coanda Effect; Control Surfaces; Fluid Flow; Patent Applications; Slots; Wings

20070034496 Air Force Flight Test Center, Edwards AFB, CA USA

USAF TPS L-23 Super Blanik Aerodynamic Determination, Evaluation, and Reporting Program (HAVE BLADDER)

Yam-Shahor, Aviv; Smith, Eric; Dabrowski, Vincent; Cain, Scott; Woodcock, Michele; Wilson, Benjamin; Dec 2005; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469903; AFFTC-TIM-05-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The HAVE BLADDER TMP was conducted at the request of the USAF TPS as part of a NASA investigation into the

viability of UAV endurance enhancement through the extraction of energy from atmospheric wind gradients. Forty-three test sorties were performed from 4-19 October 2005 under Job Order Number (JON) MC05C4000. The five-member HAVE BLADDER test team from TPS Class 05A performed the testing at Edwards AFB. Testing occurred at North Base in an altitude block up to 10,000 ft pressure altitude. Flight testing gathered stability derivative data at three different angle of attacks (AoAs). Rap and doublet time histories were recorded in-flight for parameter identification post-flight.
DTIC
Drone Vehicles; Extraction; Pilotless Aircraft; Wind (Meteorology)

20070034827 NASA Langley Research Center, Hampton, VA, USA
Computational Aeroelastic Modeling of Airframes and TurboMachinery: Progress and Challenges
Bartels, R. E.; Sayma, A. I.; [2006]; 26 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Computational analyses such as computational fluid dynamics and computational structural dynamics have made major advances toward maturity as engineering tools. Computational aeroelasticity is the integration of these disciplines. As computational aeroelasticity matures it too finds an increasing role in the design and analysis of aerospace vehicles. This paper presents a survey of the current state of computational aeroelasticity with a discussion of recent research, success and continuing challenges in its progressive integration into multidisciplinary aerospace design. This paper approaches computational aeroelasticity from the perspective of the two main areas of application: airframe and turbomachinery design. An overview will be presented of the different prediction methods used for each field of application. Differing levels of nonlinear modeling will be discussed with insight into accuracy versus complexity and computational requirements. Subjects will include current advanced methods (linear and nonlinear), nonlinear flow models, use of order reduction techniques and future trends in incorporating structural nonlinearity. Examples in which computational aeroelasticity is currently being integrated into the design of airframes and turbomachinery will be presented.
Author
Aeroelasticity; Computational Fluid Dynamics; Dynamic Structural Analysis; Turbomachinery; Airframes

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.

20070034171 Monterey Technologies, Inc., Monterey, CA, USA; NASA Ames Research Center, Moffett Field, CA, USA
Pilot Navigation Errors on the Airport Surface: Identifying Contributing Factors and Mitigating Solutions
Hooey, Becky L.; Foyle, David C.; International Journal of Aviation Psychology; January 2006; Volume 16, No. 1; 28 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNA06CB16A; Copyright; Avail.: Other Sources

A taxonomy of navigation errors (pilot deviations) during taxi operations was developed that defines 3 classes of errors: planning, decision, and execution errors. This taxonomy was applied to error data from 2 full-mission simulation studies that included trials that replicated current-day operations and trials with advanced cockpit technologies including datalink, electronic moving maps (EMM), and head-up displays (HUDs). Pilots committed navigation errors on 17% of current-day operations trials (in low-visibility and night), distributed roughly equally across the 3 error classes. Each error class was associated with a unique set of contributing factor s and mitigating solutions. Planning errors were mitigated by technologies that provided an unambiguous record of the clearance (datalink and the EMM, which possessed a text-based clearance). Decision errors were mitigated by technologies that provided both local and global awareness including information about the distance to and direction of the next turn, current township location, and a graphical depiction of the route (as provided by the EMM and HUD together). Execution errors were best mitigated by the HUD, which disambiguated the environment and depicted the clear ed taxi route. Implications for technology design and integration are provided.
Author
Errors; Head-Up Displays; Navigation; Pilot Error; Runways; Runway Incursions; Airfield Surface Movements; Situational Awareness

20070034201 NASA Ames Research Center, Moffett Field, CA, USA

Simulation of Terminal-Area Flight Management System Arrivals with Airborne Spacing

Callantine, Todd J.; Lee, Paul U.; Mercer, Joey S.; Palmer, Everett A.; Prevot, Thomas; Air Traffic Control Quarterly (Abstracts); [2007]; Volume 14, No. 1, pp. 47-67; In English

Contract(s)/Grant(s): NNA06CB28A; Copyright; Avail.: Other Sources

A simulation evaluated the feasibility and potential benefits of using decision support tools to support time-based airborne spacing and merging for aircraft arriving in the terminal area on charted Flight Management System (FMS) routes. Sixteen trials were conducted in each treatment combination of a 2X2 repeated-measures design. In trials 'with ground tools' air traffic controller participants managed traffic using sequencing and spacing tools. In trials 'with air tools' approximately seventy-five percent of aircraft assigned to the primary landing runway were equipped for airborne spacing, including flight simulators flown by commercial pilots. The results indicate that airborne spacing improves spacing accuracy and is feasible for FMS operations and mixed spacing equipage. Controllers and pilots can manage spacing clearances that contain two call signs without difficulty. For best effect, both decision support tools and spacing guidance should exhibit consistently predictable performance, and merging traffic flows should be well coordinated.

Author

Flight Management Systems; Air Traffic Control; Aircraft Approach Spacing; Approach Control; Collision Avoidance; Flight Paths; Aircraft Guidance; Simulation

20070034828 Alabama Univ., Huntsville, AL, USA; NASA Langley Research Center, Hampton, VA, USA

Aviation Applications for Satellite-Based Observations of Cloud Properties, Convection Initiation, In-flight Icing, Turbulence and Volcanic Ash

Mecikalski, John R.; Feltz, Wayne F.; Murray, John J.; Johnson, David B.; Bedka, Kristopher M.; Bedka, Sarah M.; Wimmers, Anthony J.; Pavolonis, Michael; Berendes, Todd A.; Haggerty, Julie; Minnis, Pat; Bernstein, Ben; Williams, Earl; [2006]; 53 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A04, Hardcopy

Advanced Satellite Aviation Weather Products (ASAP) was jointly initiated by the NASA Applied Sciences Program and the NASA Aviation Safety and Security Program in 2002. The initiative provides a valuable bridge for transitioning new and existing satellite information and products into Federal Aviation Administration (FAA) Aviation Weather Research Program (AWRP) efforts to increase the safety and efficiency of the airspace system. The ASAP project addresses hazards such as convective weather, turbulence (clear-air and cloud-induced), icing and volcanic ash and is particularly applicable in extending the monitoring of weather over data-sparse areas such as the oceans and other observationally remote locations. ASAP research is conducted by scientists from NASA, the FAA AWRP's Product Development Teams (PDT), NOAA and the academic research community. In this paper we provide a summary of activities since the inception of ASAP that emphasize the use of current-generation satellite technologies toward observing and mitigating specified aviation hazards. A brief overview of future ASAP goals is also provided in light of the next generation of satellite sensors (e.g., hyperspectral; high spatial resolution) to become operational in the 2006-2013 timeframe.

Author

Satellite Observation; Aircraft Hazards; Weather; Aircraft Safety; Aviation Meteorology; Meteorological Services

20070034953 San Jose State Univ., Moffett Field, CA, USA; NASA Ames Research Center, Moffett Field, CA, USA

Pressing the Approach: A NASA Study of 19 Recent Accidents Yields a New Perspective on Pilot Error

Berman, Benjamin A.; Dismukes, R. Key; Aviation Safety World; [2007], pp. 28-33; In English

Contract(s)/Grant(s): NNA06CH30A; Copyright; Avail.: Other Sources

This article begins with a review of two sample airplane accidents that were caused by pilot error. The analysis of these and 17 other accidents suggested that almost all experienced pilot operating in the same environment in which the accident crews were operating and knowing only what the accident crews knew at each moment of the flight, would be vulnerable to making a similar decision and similar errors. Whether a particular crew in a given situation makes errors depends on somewhat random interaction of factors. Two themes that seem to be prevalent in these cases are: Plan Continuation Bias, and Snowballing Workload.

CASI

Aircraft Accidents; Aircraft Pilots; Pilot Error; Approach Control; Human Performance; Human Factors Engineering

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20070034158 NASA Dryden Flight Research Center, Edwards, CA, USA
Ground Support for the Space-Based Range Flight Demonstration 2
Burkes, Darryl A.; October 22, 2007; 13 pp.; In English; International Telemetering Conference 2007, 22-25 October 2007, Las Vegas, NV, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034158

The primary objective of the NASA Space-Based Range Demonstration and Certification program was to develop and demonstrate space-based range capabilities. The Flight Demonstration 2 flights at NASA Dryden Flight Research Center were conducted to support Range Safety (commanding and position reporting) and high-rate (5 Mbps) Range User (video and data) requirements. Required ground support infrastructure included a flight termination system computer, the ground-data distribution network to send range safety commands and receive range safety and range user telemetry data and video, and the ground processing systems at the Dryden Mission Control Center to process range safety and range user telemetry data and video.
Author
Range Safety; Telemetry; TDR Satellites; Flight Tests; F-15 Aircraft; Ground Support Systems

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

20070034211 Army War Coll., Carlisle Barracks, PA USA
Unmanned Aerial Vehicles - Revolutionary Tools in War and Peace
Schwing, Richard P; Mar 30, 2007; 22 pp.; In English
Report No.(s): AD-A469608; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469608

The unmanned aerial vehicle's (UAV) operational impact is growing as compared to manned weapon systems. Historical evolution of the UAV has been marked by a series of inconsistent periods of technological development followed by stagnation. It was not until Vietnam that the UAV had a measurable impact on military operations. However, following the technological progress spurred on by the Vietnam War, the UAV was again forsaken by military leadership. Tremendously successful employment of UAVs by the Israel is, combined with the changing nature of warfare, once again evoked interest from the USA in UAV development and employment. Finally, UAVs emerged from the shadow of manned aircraft in the mid-1990s, and became an integral weapon in the global war on terror. This paper will examine the future doctrinal, organizational, and operational effects of the UAV across the Department of Defense. The examination will include: (I) an overview of the background and historical development of UAVs and the concept of the revolution in military affairs"; (2) a review of current major DoD UAV systems and operational concepts; (3) an analysis of the strategic impact of UAV systems, assessing whether the UAV can be considered a revolutionary instrument for the military services.
DTIC
Defense Program; Drone Vehicles; Military Operations; Peacetime; Pilotless Aircraft; System Effectiveness; Warfare

20070034221 Army War Coll., Carlisle Barracks, PA USA
Military Unmanned Aircraft Systems in Support of Homeland Security
Weiger, Rusty L; Mar 30, 2007; 24 pp.; In English
Report No.(s): AD-A469646; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469646

There are a multitude of opportunities for consistent UAS surveillance within the USA. Potential roles would include

border patrols, drug interdiction, illegal fishing/whaling, oil spills, disaster relief missions, long-term airborne communications nodes in times of national emergency, search and rescue, as well as many commercial applications. The US Army UAS available after Hurricane Katrina were unable to be used because of airspace and command and control concerns at that time. Flying UAS within National Airspace will require Federal Aviation Administration (FAA) approval for unrestricted flight. Command and control of military assets within the USA is being assessed to ensure we are in compliance with the posse comitatus requirements. There may also be times, such as border patrol or drug interdiction, that armed systems may be of value. While those issues are being addressed it doesn't appear that any organization is focusing on the major issues of bandwidth and airspace management. This paper begins by reviewing UAS history, current use, and regulations. The Department of Defense (DoD) UAS Roadmap and Department of Homeland Security (DHS) potential missions are assessed. Finally, the primary hurdles to expanded military UAS propagation are reviewed and recommendations are offered.
DTIC
Drone Vehicles; Security; Surveillance; Unmanned Aircraft Systems

20070034234 Army War Coll., Carlisle Barracks, PA USA
Keeping the Air Reserve Component Relevant
Eissler, Howard L; Mar 22, 2007; 18 pp.; In English
Report No.(s): AD-A469683; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469683

The Air Force has developed a 20-year force structure plan that could potentially result in a significant reduction in the number of existing fighter aircraft which reside in the air reserve component. As the Air Force works through the process of retiring these legacy aircraft, downsizing its active component, and bringing new weapon systems on line, it must consider follow-on missions for reserve units losing their flying missions. As it stands today, there are Air National Guard (ANG) units losing their flying missions but still have yet to be aligned to a follow-on mission. This essay will explain how the U.S. Air Force presents its forces to combatant commanders, show the reserve and Air National Guard success in fitting into this system, and address the question of why we have an air reserve component, specifically an ANG. Finally it will present one possible solution to leverage the proven capabilities of the ANG and reserves, which is to keep a major portion of its combat flying wings, specifically fighter units, dispersed throughout the states in the air reserve component.
DTIC
Armed Forces (United States); Combat; Fighter Aircraft; Reserves; Weapon Systems

20070034246 Air Force Research Lab., Wright-Patterson AFB, OH USA
Investigation and Root Cause Analysis Guideline
Brausch, John; Butkus, Larry; Jan 2007; 69 pp.; In English
Report No.(s): AD-A469701; AFRL-ML-WP-TR-2007-4113; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469701

This document provides guidance for investigating and conducting root cause analyses of safety-related incidents associated with Air Force maintenance actions. The impetus for and sole focus of this document are incidents in which detectable cracks in safety-of-flight aircraft structure have been missed by approved nondestructive inspection (NDI) techniques. The tools defined herein, however, can be adapted and utilized for the investigation of any maintenance-related incident. The role of root cause analysis in incident investigation is emphasized in this document. Root cause analysis is intended to answer the questions 'What?,' 'How?,' and, most importantly, 'Why?' regarding an incident. A successful root cause analysis will identify the, controllable, causal factors that can be corrected to eliminate the recurrence of similar incidents in the future.
DTIC
Inspection; Maintenance; Nondestructive Tests; Safety

20070034249 Federal Aviation Administration, Oklahoma City, OK USA
Participant Assessments of Aviation Safety Inspector Training for Technically Advanced Aircraft
Chidester, Thomas; Hackworth, Carla; Knecht, William; Jun 2007; 14 pp.; In English
Report No.(s): AD-A469706; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469706

Technically advanced 'glass cockpit' aircraft are making their way into general aviation. Aside from technical challenges

presented by learning any new system, pilots report some difficulty in acquiring a conceptual understanding of the functions offered by the avionics, developing system monitoring skills and habits, developing mode management and awareness skills, understanding when and when not to use automation, and maintaining manual flying skills. Operating aircraft with advanced avionics requires an additional set of knowledge elements and skills. Currently, Federal Aviation Administration (FAA) aviation safety inspectors are required to inspect technically advanced aircraft, check certified flight instructors, and conduct surveillance of designated pilot examiners who are certifying pilots operating technically advanced aircraft. Therefore, the FAA collaborated with researchers from National Aeronautics and Space Administration and Embry-Riddle Aeronautical University to develop and implement training for aviation safety inspectors on technically advanced aircraft. This paper reports initial participant evaluations of the course.
DTIC
Aircraft; Aircraft Safety; Flight Safety; Flight Training; Inspection; Safety; Training Aircraft

20070034270 Louisiana State Univ., Baton Rouge, LA USA
Supercritical Fuel Pyrolysis
Womat, Mary J; Somers, Michelle L; McClaine, Jennifer W; Ona, Jorge O; Ledesma, Elmer B; May 28, 2007; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0005; Proj-2308
Report No.(s): AD-A469734; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469734

Supercritical pyrolysis experiments were conducted with three model fuels at temperatures up to 585 degrees C and pressures up to 110 atm. The products were analyzed by gas chromatography and high-pressure liquid chromatography with diode-array ultraviolet-visible absorbance and mass spectrometric detection, a technique ideally suited for the isomer-specific analysis of polycyclic aromatic hydrocarbons (PAH), which can serve as precursors to carbonaceous solids. Thirty-nine individual 2- to 9-ring PAH were identified in the supercritical 1-methylnaphthalene pyrolysis products-seventeen of which, for the first time. Reaction pathways involving 1-naphthylmethyl, methyl, and naphthyl radicals were developed to account for the formation of the observed PAH products and explain why unobserved PAH were not formed in the supercritical 1 -methylnaphthalene pyrolysis environment. Likewise, reaction pathways involving benzyl, methyl, and phenyl radicals were developed that accounted for the formation of the forty-four individual PAH identified as supercritical toluene pyrolysis products and explained why unobserved PAH were not formed. The PAH product distribution from methylcyclohexane was extremely similar to that of toluene, indicating that the PAH formation mechanisms devised for toluene applied to supercritical methylcyclohexane as well.
DTIC
Fuels; Pyrolysis; Synthetic Fuels

20070034314 Army Research Lab., Aberdeen Proving Ground, MD USA
Controlling Unmanned Systems in a Simulated Counter-Insurgency Environment
Sterling, Bruce S; Perala, Chuck H; Jul 2007; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7MB25R
Report No.(s): AD-A469791; ARL-TR-4145; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469791

The U.S. Army is planning for future operations in a counter-insurgency (COIN) environment. A characteristic of this environment is random encounters with small bands of insurgents who are conducting hit-and-run missions, versus more conventional enemy formations or more conventional terrain-oriented missions. In a virtual reality experiment, we examined the workload and stress of participants controlling unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and unmanned ground sensors in a COIN environment. Results showed that workload and stress for all the independent variables that we examined were less than half the possible scale level. Workload and mental stress were higher for specific COIN-type missions (e.g., over-watch raid on safe house, locate vehicle-borne improvised explosive devices) than for more conventional missions (e.g., route or site reconnaissance). Workload was higher for participants in combat vehicles than at headquarters and for participants in infantry vehicles in particular. Mental stress was highest for participants in mounted combat vehicles. Workload was higher for participants controlling both UAVs and UGVs. Stress was about equally high for operation of one or both types of sensors. Workload and stress were about equally high for simultaneous versus sequential operation of sensors, but because of the type of control involved, participants could only view images from one camera at a time in both types of

operations. Recommended interface improvement included the ability to easily change unmanned vehicle (UV) routes, automatically track a target, rotate the camera while flying, send a UV to a given grid coordinate, see grid coordinates more easily, improve simulated night vision, provide multiple simultaneous video camera feeds, and provide an interface to improve situation awareness (e.g., mission overlays, chat capability).
DTIC
Drone Aircraft; Remotely Piloted Vehicles

20070034477 General Accounting Office, Washington, DC USA
Unmanned Aircraft Systems. Advanced Coordination and Increased Visibility Needed to Optimize Capabilities
Pickup, Sharon L; Lentini, Patty; Brown, Renee; Khanna, Jamie; Lenane, Kate; Lindsey, LaShawnda; Matvay, Elisha; Tindall, Susan; Jul 2007; 38 pp.; In English
Report No.(s): AD-A469871; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DOD components have developed guidance to facilitate the integration of UAS into combat operations; however, further steps are needed to fully coordinate the deployment of these assets. For example, DOD developed a Multi-Service Tactics, Techniques, and Procedures for the Tactical Employment of Unmanned Aircraft Systems and a Joint Concept of Operations for Unmanned Aircraft Systems.5 This guidance represents an important first step for the use of UAS in combat operations and DOD officials acknowledge these documents will continue to evolve as DOD learns more about the capabilities of UAS and other ISR assets and their application in combat operations. However, the guidance does not address, on a DOD-wide basis, the issue of advance coordination, which CENTCOM has recognized is a critical factor in integrating UAS into combat operations by enabling efficient deployment and utilization of assets and by allowing the combatant commander time to plan to support incoming assets. In the absence of such guidance, CENTCOM has established procedures for the services to coordinate system requirements prior to ISR assets arriving into CENTCOM s theater of operations. These procedures apply only to CENTCOM s theater of operations. However, we found that CENTCOM s procedures for advance coordination were not always followed because the services indicated that they were not aware of the requirement. According to CENTCOM officials, they distributed these procedures to each of CENTCOM s service components, such as Central Command Air Forces and U.S. Naval Forces Central Command, but were not aware if they were distributed further, and the service officials we interviewed were not aware of the requirement.
DTIC
Coordination; Drone Vehicles; Military Operations; Planning; Tactics; Unmanned Aircraft Systems; Visibility

20070034488 Air Force Research Lab., Wright-Patterson AFB, OH USA
Risk Quantified Structural Design and Evaluation
Tuegel, Eric J; Olson, Steven E; Braisted, William R; May 2007; 40 pp.; In English
Contract(s)/Grant(s): Proj-A07X
Report No.(s): AD-A469891; AFRL-VA-WP-TR-2007-3040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this program is to demonstrate the benefits of a probabilistic design/risk assessment framework during all stages of aircraft structural design and evaluation. This objective is to be accomplished by performing a series of deterministic and probabilistic analyses for various levels of design refinement from conceptual design to preliminary design to detailed design. A benchmark problem of current interest to AFRL/VA has been selected to demonstrate the framework. This problem is a design application relating to the thermal buckling response of a representative exhaust-washed aft deck structure. In addition to using this benchmark problem to demonstrate the benefits of a probabilistic design/risk assessment framework, practical methods for reliability-based design of aerospace structures are investigated.
DTIC
Evaluation; Risk; Structural Analysis; Structural Design; System Effectiveness

20070034524 Surrey Univ., Guildford, UK
Low Cost Constellations to Assist the Warfighter
Eves, Stuart; Carter, David; Beard, David; Aug 1, 2006; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469948; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The future surveillance is likely to involve increasing reliance on a range of unmanned platforms. Improving the responsiveness of the surveillance component means increasing the number of assets and diversifying their capabilities, e.g.,

you need both eyes and ears. Increasing the number of assets within a fixed budget means reducing the size of the individual platforms. In the space domain, this driver dictates a move from a small number of large satellites to a constellation of small ones.
DTIC
Constellations; Low Cost; Military Technology

20070034754 Air Univ., Maxwell AFB, AL USA
10 Propositions Regarding Air Power
Meilinger, Phillip S; Jan 1995; 92 pp.; In English
Report No.(s): AD-A469807; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469807

Though we are still within the first century of powered flight, air power has already become the dominant form of military power projection in the modern world. The doctrinal underpinnings of air power thought are traditionally ascribed to the three great theorists of air power application: Douhet, Trenchard, and Mitchell. Since WWII, the air power community has not often explored the doctrinal implications of air power development. Lord Tedder's lectures at Cambridge, and the writings of Air Vice Marshal R. A. Mason, and Colonel John A. Warden III constitute notable exceptions. Now comes Colonel Phillip Meilinger, who has posited a group of provocative propositions that will instill an appreciation for air power for those who seek to understand it and challenge the assumptions of those who do not yet appreciate what it offers. This book has been deliberately designed in a small format so that it can be readily carried in the pocket of a flight suit or a BDU. Readers are encouraged to discuss these propositions and, if so moved, to communicate directly with Colonel Meilinger via the School of Advanced Airpower Studies, Maxwell AFB, Alabama. The 10 propositions are as follows: (1) Whoever controls the air generally controls the surface; (2) Air Power is an inherently strategic force; (3) Air Power is primarily an offensive weapon; (4) In essence, Air Power is targeting, targeting is intelligence, and intelligence is analyzing the effects of air operations; (5) Air Power produces physical and psychological shock by dominating the fourth dimension -- time; (6) Air Power can conduct parallel operations at all levels of war, simultaneously; (7) Precision air weapons have redefined the meaning of mass; (8) Air Power's unique characteristics necessitate that it be centrally controlled by airmen; (9) Technology and air power are integrally and synergistically related; and (10) Air Power includes not only military assets, but an aerospace industry and commercial aviation.
DTIC
Warfare; Aerospace Industry

20070034996 NASA Dryden Flight Research Center, Edwards, CA, USA
Adaptive Control Law Development for Failure Compensation Using Neural Networks on a NASA F-15 Aircraft
Burken, John J.; October 03, 2005; 19 pp.; In English; SAE Aero Tech 2005, 3-6 Oct. 2005, Dallas, TX, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034996

This viewgraph presentation covers the following topics: 1) Brief explanation of Generation II Flight Program; 2) Motivation for Neural Network Adaptive Systems; 3) Past/ Current/ Future IFCS programs; 4) Dynamic Inverse Controller with Explicit Model; 5) Types of Neural Networks Investigated; and 6) Brief example
CASI
Adaptive Control; Control Theory; F-15 Aircraft; Failure; Neural Nets; Aircraft Design

20070035019 NASA Dryden Flight Research Center, Edwards, CA, USA
UAVSAR System Overview
Cutler, Frank; October 25, 2007; 20 pp.; In English; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070035019

The Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR) project began as an Instrument Incubator Program (IIP) out of the NASA ESTO Program Office. After a year of study JPL presented to NASA an instrument concept that could be accommodated on the desired class of platforms, that would meet the original IIP science and instrument objectives and could be expanded to meet future airborne radar science needs. The UAVSAR project is a four year program consisting of a 3 year phase in which the radar system is designed and fabricated, the platform is modified, radar is installed on the aircraft

and an initial flight testing program is begun. The last year of the program is designed to collect repeat pass data, to improve system robustness and to validate that the scientific objectives of the sensor are being met.
Derived from text
Pilotless Aircraft; Synthetic Aperture Radar; General Overviews; Systems Engineering; Fabrication; Flight Tests

20070035040 NASA Dryden Flight Research Center, Edwards, CA, USA
On the Minimum Induced Drag of Wings
Bowers, Albion H.; August 16, 2007; 41 pp.; In English; AIAA/SFTE AV Chapters, 16 Aug. 2007, Lancaster, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070035040

This viewgraph presentation reviews the minimum induced drag of wings. The topics include: 1) The History of Spanload Development of the optimum spanload Winglets and their implications; 2) Horten Sailplanes; and 3) Flight Mechanics & Adverse yaw.
CASI
Induced Drag; Minimum Drag; Wings; Wing Span; Gliders

20070035041 NASA Dryden Flight Research Center, Edwards, CA, USA
Full-Scale Flight Test
Bosworth, John T.; October 10, 2007; 27 pp.; In English; MASA Aviation Safety Program Technical Conference, 10-12 Oct. 2007, Saint Louis, MO, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070035041

This viewgraph presentation reviews full-scale flight tests of the F/15 837 and F/A-18 853 aircrafts. A photograph of the C-17 T1 (USAF asset) is also provided.
CASI
Flight Tests; Full Scale Tests; Aircraft Design; F-15 Aircraft; F-18 Aircraft

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.

20070034156 NASA Dryden Flight Research Center, Edwards, CA, USA
Enhanced Flight Termination System Flight Demonstration and Results
Tow, David; Arce, Dennis; October 22, 2007; 11 pp.; In English; International Telemetering Conference 2007, 22-25 October 2007, Las Vegas, NV, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This paper discusses the methodology, requirements, tests, and implementation plan for the live demonstration of the Enhanced Flight Termination System (EFTS) using a missile program at two locations in Florida: Eglin Air Force Base (AFB) and Tyndall AFB. The demonstration included the integration of EFTS Flight Termination Receivers (FTRs) onto the missile and the integration of EFTS-program-developed transmitter assets with the mission control system at Eglin and Tyndall AFBs. The initial test stages included ground testing and captive-carry flights, followed by a launch in which EFTS was designated as the primary flight termination system for the launch.
Author
Flight Tests; Systems Integration; Abort Apparatus; Missiles; Transmitter Receivers

20070034948 NASA Glenn Research Center, Cleveland, OH, USA
Feedback Control Systems Loop Shaping Design with Practical Considerations
Kopsakis, George; September 2007; 37 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.20.02
Report No.(s): NASA/TM-2007-215007; E-16201; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034948

This paper describes loop shaping control design in feedback control systems, primarily from a practical stand point that

considers design specifications. Classical feedback control design theory, for linear systems where the plant transfer function is known, has been around for a long time. But it s still a challenge of how to translate the theory into practical and methodical design techniques that simultaneously satisfy a variety of performance requirements such as transient response, stability, and disturbance attenuation while taking into account the capabilities of the plant and its actuation system. This paper briefly addresses some relevant theory, first in layman s terms, so that it becomes easily understood and then it embarks into a practical and systematic design approach incorporating loop shaping design coupled with lead-lag control compensation design. The emphasis is in generating simple but rather powerful design techniques that will allow even designers with a layman s knowledge in controls to develop effective feedback control designs.
Author
Control Systems Design; Feedback Control; Specifications; Design Analysis; Control Theory

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.

20070034949 Saratoga Control Systems, Saratoga Springs, NY, USA
User's Guide for the Commercial Modular Aero-Propulsion System Simulation (C-MAPSS)
Frederick, Dean K.; DeCastro, Jonathan A.; Litt, Jonathan S.; October 2007; 47 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 457280.02.07.03.04.03
Report No.(s): NASA/TM-2007-215026; E-16205; Copyright; Avail.: CASI: A03, Hardcopy

This report is a Users Guide for the NASA-developed Commercial Modular Aero-Propulsion System Simulation (C-MAPSS) software, which is a transient simulation of a large commercial turbofan engine (up to 90,000-lb thrust) with a realistic engine control system. The software supports easy access to health, control, and engine parameters through a graphical user interface (GUI). C-MAPSS provides the user with a graphical turbofan engine simulation environment in which advanced algorithms can be implemented and tested. C-MAPSS can run user-specified transient simulations, and it can generate state-space linear models of the nonlinear engine model at an operating point. The code has a number of GUI screens that allow point-and-click operation, and have editable fields for user-specified input. The software includes an atmospheric model which allows simulation of engine operation at altitudes from sea level to 40,000 ft, Mach numbers from 0 to 0.90, and ambient temperatures from -60 to 103 F. The package also includes a power-management system that allows the engine to be operated over a wide range of thrust levels throughout the full range of flight conditions.
Author
Turbofan Engines; Computerized Simulation; Engine Control; Engine Design; Aircraft Engines; Access Control

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

20070034494 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Automated Carrier Landing of an Unmanned Combat Aerial Vehicle Using Dynamic Inversion
Denison, Nicholas A; Jun 2007; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469901; AFIT/GAE/ENY/07-J06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Dynamic Inversion (DI) is a powerful nonlinear control technique which has been applied to several modern flight control systems. This research utilized concepts of DI in order to develop a controller to land an Unmanned Combat Aerial Vehicle (UCAV) on an aircraft carrier. The Joint Unmanned Combat Air System (J-UCAS) Equivalent Model was used as the test aircraft. An inner-loop DI controller was developed to control the pitch, roll, and yaw rate dynamics of the aircraft, while an outer-loop DI controller was developed to provide flight path commands to the inner-loop. The controller design and simulation were conducted in the MATLAB/Simulink environment. Simulations were conducted for various starting positions near the carrier and for varying wind, wind turbulence, and sea state conditions. In the absence of wind and sea state

turbulence, the controller performed well. After adding wind and sea state turbulence, the controller performance was degraded. Future work in this area should include a more robust disturbance rejection technique to compensate for wind turbulence effects and a method of carrier motion prediction to compensate for sea state effects.
DTIC
Aircraft Carriers; Aircraft Landing; Combat; Flight Control; Inversions; Pilotless Aircraft

20070034506 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optimal Spacecraft Attitude Control Using Aerodynamic Torques
Gargasz, Michael L; Mar 2007; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469919; AFIT/GA/ENY/07-M08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis introduces a method of three-axis spacecraft attitude control using only aerodynamic torques. Attitude actuation is achieved using four control panels mounted on the rear of a cubical spacecraft bus. The controller consists of an outer loop using linear state feedback to determine desired control torque and an inner loop to choose appropriate control panel angles. The inner loop uses a Jacobian-based approach to invert the nonlinear relationship between panel angles and generated torque. Controller performance is evaluated via simulations, which show that three-axis control is possible over a range of initial angles and angular rates. The analysis used partial accommodation theory as the basis for aerodynamic torque calculations and assumed a rotating atmosphere with an exponential density profile.
DTIC
Aerodynamic Drag; Attitude Control; Control Boards; Optimal Control; Spacecraft Control; Torque

20070034518 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of Cursor-on-Target Control for Semi-Autonomous Unmanned Aircraft Systems
Crouse, Joshua D; Jun 2007; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469942; AFIT/GAE/ENY/07-J04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research presented in this thesis focuses on developing, demonstrating, and evaluating the concept of a Cursor-on-Target control system for semi-autonomous unmanned aircraft systems. The Department of Defense has mapped out a strategy in which unmanned aircraft systems will increasingly replace piloted aircraft. During most phases of flight autonomous unmanned aircraft control reduces operator workload, however, real-time information exchange often requires an operator to relay decision changes to the unmanned aircraft. The goal of this research is to develop a preliminary Cursor-on-Target control system to enable the operator to guide the unmanned aircraft with minimal workload during high task phases of flight and then evaluate the operator?s ability to conduct the mission using that control system. For this research, the problem of Cursor-on-Target control design has multiple components. Initially, a Cursor-on-Target controller is developed in Simulink. Then, this controller is integrated into the Aviator Visual Design Simulator to develop an operator-in-the-loop test platform. Finally, a ground target is simulated and tracked to validate the Cursor-on-Target controller. The Cursor-on-Target control system is then evaluated using a proposed operator rating scale.
DTIC
Autonomous Navigation; Autonomy; Drone Vehicles; Flight Control; Targets; Unmanned Aircraft Systems

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*.

20070034229 Army War Coll., Carlisle Barracks, PA USA
Spacepower: A Strategic Assessment and Way Forward
Farnsworth, Jeffrey A; Mar 29, 2007; 24 pp.; In English
Report No.(s): AD-A469671; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469671

Space capabilities will probably provide the greatest added value to national power, wealth, and military lethality in the 21st Century. The USA does not have a National Security Space Strategy to guide its activities and has largely followed its

technological prowess to exploit the space medium. Meanwhile, the number of government, commercial, and non-state entities engaged in space activities has multiplied. The strategic environment is increasingly influenced by spacepower. In this age of astropolitics, failure to understand the nature of spacepower and how to wield it could lead to serious miscalculations by strategic leaders and tragic consequences for peace and stability. This paper first examines the strategic environment's most pressing global and domestic factors influencing the development and employment of spacepower. Secondly, national purpose, space interests, and current space policy are examined, followed by a survey of strategic thinking that has influenced defense space policy, programs, and doctrine. Finally, major issues are assessed and specific recommendations are offered to guide the formulation of a valid National Security Space Strategy that can give substance to the National Space Policy, positively influence the strategic environment, and enable a favorable future.
DTIC
Aerospace Engineering; Commerce; Policies; Security; United States; Warfare

20070034231 Army War Coll., Carlisle Barracks, PA USA
Avoiding Collisions in Space: Is It Time for an International Space Integration Center?
Cox, Lee-Volker; Mar 30, 2007; 28 pp.; In English
Report No.(s): AD-A469676; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469676

For decades the 'Big Space-Little Satellite' theory has maintained that there is adequate room in space to operate an ever-increasing number of satellites. According to this theory, which is believed by many governments and commercial organizations, it is possible to maintain spacecraft and space debris separation and ensure that there are no collisions. Currently, there are hundreds of satellites in space operated by dozens of international organizations and no standard process or organization established to integrate, communicate, or analyze threats to these valuable assets. As the global economy continues to rapidly expand, connecting billions of people, organizations, and machines with the ability to transfer and process information at an ever-faster rate, world governments, militaries, nongovernmental and international organizations, and even individuals are endangered by a threat that no one sees and few are aware exists. The potential consequences of the loss of space-based capabilities in communications, navigation, timing, imagery, surveillance, warning, reconnaissance, weather and/or scientific satellite payloads are catastrophic. This paper will identify current space surveillance, tracking, and collision avoidance and deconfliction programs and processes that are currently in use. In addition, it will review space law and its application to freedom of navigation and spacecraft operations. Finally, the author proposes a solution that would significantly reduce the likelihood of collisions in space, the establishment of an International Space Integration Center (I-SPIC). The discussion opens with an overview of the space operating environment followed by a review of applicable space law and policy. The final section focuses on creating an I-SPIC, including challenges and benefits to its establishment.
DTIC
Artificial Satellites; Collision Avoidance; Collisions; Debris; Policies; Satellite Tracking; Space Debris; Vulnerability

20070034462 GMV S.A., Madrid, Spain
LAREDO: LAunching, REndezvous and DOcking Simulation Tool
Molina, Miguel A; Prieto, Jose; Garcia, Gonzalo; Beech, Theresa; Aug 1, 2006; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469820; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Computerized Simulation; Launching; Orbital Rendezvous; Rendezvous Spacecraft; Simulation; Software Development Tools; Spacecraft Docking

13
ASTRODYNAMICS

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

20070034478 STS Consulting, Rome, Italy
Bistatic Space Borne Radar for Early Warning
Picardi, G; Masdea, A; Tofone, L; Borgarelli, L; Cereoli, L; Aug 1, 2006; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469873; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Early Warning Systems; Multistatic Radar; Synthetic Aperture Radar

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)*.

20070034176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Lunar Reconnaissance Orbiter Contamination Sensitivity Training
Rivera, Rachel; [2007]; 31 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034176

The following packet is a contamination control training intended for personnel handling or coming to contact with Lunar Reconnaissance Orbiter (LRO) flight hardware. This training is being implemented to familiarize personnel, coming into contact with LRO hardware, what its contamination sensitivities are and what can be done by all to maintain its cleanliness levels.
Derived from text
Cleanliness; Contamination; Education; Clean Rooms; Lunar Observatories; Lunar Satellites; Lunar Spacecraft

20070034489 Auburn Univ., AL USA
Design Optimization of Space Launch Vehicles Using a Genetic Algorithm
Bayley, Douglas J; Jun 1, 2007; 197 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469892; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force (USAF) continues to have a need for assured access to space. In addition to flexible and responsive spacelift, a reduction in the cost per launch of space launch vehicles is also desirable. For this purpose, an investigation of the design optimization of space launch vehicles has been conducted. Using a suite of custom codes, the performance aspects of an entire space launch vehicle were analyzed. A genetic algorithm (GA) was employed to optimize the design of the space launch vehicle. A cost model was incorporated into the optimization process with the goal of minimizing the overall vehicle cost. The other goals of the design optimization included obtaining the proper altitude and velocity to achieve a low-Earth orbit. Specific mission parameters that are particular to USAF space endeavors were specified at the start of the design optimization process. Solid propellant motors, liquid fueled rockets, and air-launched systems in various configurations provided the propulsion systems for two, three and four-stage launch vehicles. Mass properties models, an aerodynamics model, and a six-degree-of-freedom (6DOF) flight dynamics simulator were all used to model the system. The results show the feasibility of this method in designing launch vehicles that meet mission requirements. Comparisons to existing real world systems provide the validation for the physical system models. However, the ability to obtain a truly minimized cost was elusive. The cost model uses an industry standard approach, however, validation of this portion of the model was challenging due to the proprietary nature of cost figures and due to the dependence of many existing systems on surplus hardware.
DTIC
Algorithms; Design Analysis; Design Optimization; Genetic Algorithms; Launch Vehicles; Launching Sites; Optimization; Spacecraft Launching

20070034525 GMV S.A., Madrid, Spain
Framework Concept for Satellite Operations
Molina, Miguel A; Prieto, Jose; Garcia, Gonzalo; Beech, Theresa; Aug 1, 2006; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469949; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Computer Programming; Control; Satellite Networks; Software Engineering

20070034843 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Registered File Support for Critical Operations Files at (Space Infrared Telescope Facility) SIRTF
Turek, G.; Handley, Tom; Jacobson, J.; Rector, J.; September 30, 2001; 6 pp.; In English; Astronomical Data Analysis Software and Systems XI, Astronomical Society of the Pacific, 30 Sep. - 3 Oct. 2001, Victoria, British Columbia, Canada; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40430

The SIRTF Science Center's (SSC) Science Operations System (SOS) has to contend with nearly one hundred critical

operations files via comprehensive file management services. The management is accomplished via the registered file system (otherwise known as TFS) which manages these files in a registered file repository composed of a virtual file system accessible via a TFS server and a file registration database. The TFS server provides controlled, reliable, and secure file transfer and storage by registering all file transactions and meta-data in the file registration database. An API is provided for application programs to communicate with TFS servers and the repository. A command line client implementing this API has been developed as a client tool. This paper describes the architecture, current implementation, but more importantly, the evolution of these services based on evolving community use cases and emerging information system technology.
Author
Space Infrared Telescope Facility; Information Systems; Data Bases

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*.

20070034179 NASA Dryden Flight Research Center, Edwards, CA, USA
Launch Abort System Flight Test Overview
Hayes, Peggy Williams; August 21, 2007; 26 pp.; In English; AIAA Guidance, Navigation and Control Conference, 20-23 August 2007, Hilton Head, SC, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034179

This viewgraph presentation is an overview of the Launch Abort System (LAS) for the Constellation Program. The purpose of the paper is to review the planned tests for the LAS. The program will evaluate the performance of the crew escape functions of the Launch Abort System (LAS) specifically: the ability of the LAS to separate from the crew module, to gather flight test data for future design and implementation and to reduce system development risks.
CASI
Flight Tests; Launch Escape Systems; Abort Apparatus; Escape Systems

20070034214 INASMET, San Sebastian, Spain
Nanomaterials: Opportunities and Challenges for Aerospace
Obieta, Isabel; Marcos, J; Oct 2005; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469619; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469619

No abstract available
Aerospace Systems; Composite Materials; Nanocomposites; Nanostructures (Devices); Nanotechnology

20070034274 Michigan Univ., Ann Arbor, MI USA
Rapid Assessment of the Role of Microstructural Variability in the Fatigue Behavior of Structural Alloys using Ultrasonic Fatigue
Jones, J W; Jun 23, 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0069
Report No.(s): AD-A469738; F007992; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469738

Ultrasonic fatigue (20kHz) has been used to investigate the role of microstructural variability on fatigue life variability for very long fatigue lives, between 10(to the 7th power) and 10(to the 9th power) cycles, in structural aerospace materials. This AFOSR program has been augmented by support from DARPA (Dr. Leo Christodoulou) and a summary of the results from the combined support is described in this report. Four distinctly different structural alloys have been studied: (1) a particle reinforced aluminum alloy, 2009Al/15SiCp, where clustering of SiC particles and the presence of processing-related inclusions is expected to control fatigue life, (2) an alpha/beta titanium disk alloy, Ti-6Al-2Sn-4Zr-6Mo, that has been processed to have a fine, homogeneous, two-phase microstructure that is essentially free of inclusions or other defects; (3) a polycrystalline nickel-base disk alloy, Rene 88DT which has a small but finite number of large grains that influence fatigue crack initiation; and a single crystal nickel-base superalloy for blade applications, PWA 1484. In this program, an advanced ultrasonic fatigue system capable of fatigue testing aerospace materials at 20 kHz and at temperatures form ambient to 1000 degrees C has been developed. For the polycrystalline materials, the magnitude of fatigue life variability was observed to be

strongly dependent on the microstructure-dependent crack initiation processes, which, in turn, were different for each material. For 2009Al/15SiCp, crack initiation occurred in almost all cases at 20-30 micrometers diameter inclusions. Less than half an order of magnitude variation in fatigue life at 10(to the 9th power) cycles was observed and is explained by the absence of a significant crack initiation lifetime.
DTIC
Acoustic Fatigue; Aerospace Systems; Fatigue Life; Metal Fatigue; Microstructure; Ultrasonics; Variability

20070034289 Massachusetts Inst. of Tech., Cambridge, MA USA
An Application of Linear Covariance Analysis to the Design of Responsive Near-Rendezvous Missions
Visser, Benjamin L; Jun 2007; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469759; CI07-0054; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469759

This thesis investigates a new class of launch vehicles capable of being released from an aircraft which ultimately have the goal of achieving near-rendezvous conditions at orbital altitudes up to 800 km. These launch vehicles would be capable of carrying small payloads, on the order of two to six kilograms, and would be much more responsive to a customer's needs than the current space launch infrastructure, in which it may take months of preparation for a launch. To fully describe the mission in this thesis, it is broken up into three phases: atmospheric launch, orbit raising, and near-rendezvous operations. An analysis method known as Linear Covariance analysis is introduced to provide a platform of estimating the navigation covariance and dispersion of the spacecraft during the second and third phases, while the first phase, up to main-engine cutoff, is examined using a three degree-of-freedom simulation. The goal of this thesis is to demonstrate the utility of Linear Covariance analysis to responsive space mission planning. This is accomplished by first explaining the mathematics that underlie the method. Next the software used for the analysis, Lincov Tools, is explained in detail, the mission is examined more closely, and the hardware for both the payload and launch vehicle are briefly discussed. Finally, the combination of the three degree-of-freedom simulation and Lincov Tools are employed to the space mission and the results are presented.
DTIC
Covariance; Launch Vehicles; Space Missions

20070034292 Army War Coll., Carlisle Barracks, PA USA
Space Technology and Network Centric Warfare: A Strategic Paradox
Ginter, Karl; Feb 22, 2007; 22 pp.; In English
Report No.(s): AD-A469763; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469763

The Department of Defense (DoD) force transformation is in large measure predicated on harnessing and exploiting the benefits of shared information on the battlefield to develop a common operating picture. The DoD's aggressive pursuit of information technologies to enable network-centric warfare (NCW) will generate a significant warfighting advantage as well as potential pitfalls. The Global Information Grid (GIG) is the telecommunications infrastructure -- the network backbone -- by which the USA facilitates NCW and executes its dominant forms of strategic power, both economically and militarily. A significant portion of the GIG relies upon space-based assets and technologies that expose the USA to vulnerabilities -- the very same space-based technologies that enable NCW. This paper addresses threats to the GIG, vulnerabilities of our space-based assets, and examines concerns about the implicit reliance upon space-based technologies to execute NCW. It evaluates the strengths and weaknesses of employing space technology in a network-centric environment, considers future threats posed by adversaries using asymmetric warfare, and examines the impacts on warfighting capabilities and national security. Finally, this paper identifies and recommends measures that mitigate risk to the USA' principal enabler of NCW -- space-based technology.
DTIC
Aerospace Engineering; Communication Networks; Paradoxes; Vulnerability

20070034520 Garvey Spacecraft Corp., Long Beach, CA USA
Initial Results from the Demonstration and Analysis of Reusable Nanosat Launch Vehicle Operations
Garvey, J M; Besnard, E; Apr 16, 2007; 29 pp.; In English
Contract(s)/Grant(s): FA9300-05-M-3010; FA9300-06-C-0009; Proj-3005
Report No.(s): AD-A469944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Flight testing of prototype reusable launch vehicles (RLVs) has declined significantly since a period in the mid-1990s that

was marked by ambitious projects but uneven results. Consequently, a new program has been established with the objective of investigating RLV-type fast turn-around flight operations. Major distinctions from these earlier efforts include the use of a smaller class of vehicles and payloads, along with an initial emphasis on operations as opposed to advanced technologies. This focus on a hybrid-type (reusable first stage and expendable second stage) 'nanosat launch vehicle' (NLV) that ultimately could deliver 10 kg to low Earth orbit has already produced tangible results. These include initial operational capability of a new prototype vehicle just six months after project start, two flights of this vehicle within 3.5 hours, a total of four flights within an eleven month period, pathfinding operations from a new launch site and the manifesting of numerous technology and academic experiments. Lessons learned from this first round of demonstration and analysis are now guiding the development of several next-generation prototype reusable NLVs that will enter flight testing later this year.
DTIC
Launch Vehicles; Nanosatellites; Reusable Launch Vehicles

20070034547 Centro Interforze Telerilevamento Satellitare, Pomezia, Italy
Optical and SAR Ground Segment Integration - An Italian Experience
Trolese, Roberto; Aiello, Fabrizio; Aug 1, 2006; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469982; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Italy; Reconnaissance

20070034548 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Concepts for Monitoring and Surveillance using Space Borne SAR Systems
van den Broek, Albertus; Dekker, Rob; Steeghs, Philippe; Aug 1, 2006; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469983; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Aerospace Systems; Reconnaissance; Surveillance; Synthetic Aperture Radar

20070034896 NASA Dryden Flight Research Center, Edwards, CA, USA
Computational Fluid Dynamics-Based Aeroservoelastic Analysis with Hyper-X Applications
Gupta, K. K.; Bach, C.; AIAA Journal; July 2007; Volume 45, No. 7, pp. 1459-1471; In English; AIAA Aerospace Science Conference and Exhibit, 5-9 January 2004, Reno, NV, USA; Original contains color and black and white illustrations
Report No.(s): Paper 884; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.2514/1.21992
A finite element computational fluids dynamics-based aeroservoelastic analysis methodology is presented in this paper, in which both structural and fluids discretization are achieved by the finite element method, and their interaction is modeled by the transpiration boundary condition technique. In the fluids discipline either inviscid or viscous flow may be accounted for, usually employing unstructured grids.Adescription of a novel viscous flow solver employing unstructured grids is given in detail. Provisions are made for digital as well as analog controllers. These new aeroservoelastic analysis techniques are next applied for the solution of a number of example problems including the novel Hyper-X launch vehicle. Experimental and actual flight test data are also compared with analysis results that signify to the efficacy and accuracy of the newly developed solution procedures.
Author
Aeroservoelasticity; Launch Vehicles; Computational Fluid Dynamics; Viscous Flow; Inviscid Flow; Flight Tests

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*.

20070034165 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

DTN [Delay-Tolerant Networking]

Burleigh, Scott; August 10, 2006; 39 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources ONLINE: http://hdl.handle.net/2014/40270

This viewgraph presentation provides an overview of delay tolerant networking as it relates to deep space communication.

CASI

Space Communication; Delay; Transmission Rate (Communications); Time Lag; Communication Networks

20070034175 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Useful Sensor Web Capabilities to Enable Progressive Mission Autonomy

Mandl, Dan; July 17, 2007; 17 pp.; In English; Space Mission Challenges for Information Technology 2006, 17-20 July 2006, Pasadena, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy ONLINE: http://hdl.handle.net/2060/20070034175

This viewgraph presentation reviews using the Sensor Web capabilities as an enabling technology to allow for progressive autonomy of NASA space missions. The presentation reviews technical challenges for future missions, and some of the capabilities that exist to meet those challenges. To establish the ability of the technology to meet the challenges, experiments were conducted on three missions: Earth Observing 1 (EO-1), Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) and Space Technology 5 (ST-5). These experiments are reviewed.

CASI

Aerospace Engineering; Autonomy; NASA Space Programs; Satellite Communication; Space Technology Experiments

20070034698 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Deep Space Network, Cryogenic HEMT LNAs

Bautista, J. Javier; August 17, 2006; 24 pp.; In English; Simposium Internacional de Telematica, 17 Aug. 2006, Ensanda, Mexico; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources ONLINE: http://hdl.handle.net/2014/40245

Exploration of the Solar System with automated spacecraft that are more than ten astronomical units (1 AU = 149,597,870.691 km) from earth requires very large antennae employing extremely sensitive receivers. A key figure of merit in the specification of the spacecraft-to-earth telecommunications link is the ratio of the antenna gain to operational noise temperature (G/Top) of the system. The Deep Space Network (DSN) receivers are cryogenic, low-noise amplifiers (LNAs) which address the need to maintain Top as low as technology permits. Historically, the extra-ordinarily sensitive receive systems operated by the DSN have required ctyogenically cooled, ruby masers, operating at a physical temperature near the boiling point of helium, as the LNA. Although masers continue to be used today, they are hand crafted at JPL and expensive to manufacture and maintain. Recent advances in the development of indium phosphide (InP) based high electron mobility transistors (HEMTs) combined with cryogenic cooling near the boiling point of hydrogen have made this alternate technology comparable with and a fraction of the cost of maser technology. InP HEMT LNA modules are demonstrating noise temperatures less than ten times the quantum noise limit (10hf/k) from 1 to 100 GHz. To date, the lowest noise LNA modules developed for the DSN have demonstrated noise temperatures of 3.5 K and 8.5 K at 8.5 K at 32 GHz, respectively. Front-end receiver packages employing these modules have demonstrated operating system noise temperatures of 17 K at 8.4 GHz (on a 70m antenna at zenith) and 39 K at 32 GHz (on a 34m antenna at zenith). The development and demonstration of cryogenic, InP HEMT based front-end amplifiers for the DSN requires accurate component and module characterization, and modeling from 1 to 100 GHz at physical temperatures down to 12 K. The characterization and modeling begins with the HEMT chip, proceeds to the multi-stage HEMT LNA module, and culminates with the complete front-end cryogenic receiver package for the antenna. This presentation will provide an overview of this development process. Examples will be shown for devices, LNA modules, front-end receiver packages, antennae employing these packages and the improvements to the down-link capacity.

Author

Deep Space Network; High Electron Mobility Transistors; Noise Temperature; Receivers; Antenna Design; Amplifiers

20070034877 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Development Roadmap of an Evolvable and Extensible Multi-Mission Telecom Planning and Analysis Framework

Cheung, Kar-Ming; Tung, Ramona H.; Lee, Charles H.; July 8, 2003; 8 pp.; In English; The Fifth International Symposium on Reducing the Cost of Spacecraft Ground Systems and Operations (RCSGSO), 8-11 Jul. 2003, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40407

In this paper, we describe the development roadmap and discuss the various challenges of an evolvable and extensible multi-mission telecom planning and analysis framework. Our long-term goal is to develop a set of powerful flexible telecommunications analysis tools that can be easily adapted to different missions while maintain the common Deep Space Communication requirements. The ability of re-using the DSN ground models and the common software utilities in our adaptations has contributed significantly to our development efforts measured in terms of consistency, accuracy, and minimal effort redundancy, which can translate into shorter development time and major cost savings for the individual missions. In our roadmap, we will address the design principles, technical achievements and the associated challenges for following telecom analysis tools (i) Telecom Forecaster Predictor - TFP (ii) Unified Telecom Predictor - UTP (iii) Generalized Telecom Predictor - GTP (iv) Generic TFP (v) Web-based TFP (vi) Application Program Interface - API (vii) Mars Relay Network Planning Tool - MRNPT.

Author

Space Communication; Deep Space Network; Design Analysis; Telecommunication; Utilities

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*.

20070034164 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Analysis of a Possible Future Degradation in the DORIS Geodetic Results Related to Changes in the Satellite Constellation

Willis, Pascal; July 16, 2006; 12 pp.; In English; 36th COSPAR Sceintific Assembly, 16-23 Jul. 2006, Beijing, China; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40294

This viewgraph presentation reviews the consequences of losing one or more of the 4 remaining Doppler & Ranging Information System (DORIS) satellites and any impact such a loss might have on geodesy. The goals of this program are to analyze the sensitivity of the current DORIS geodetic results (station position and polar motion) to the size of the DORIS constellation and to verify if some satellites are most important or less important than others. The conclusions of the study are summarized.

CASI

Degradation; Geodesy; Satellite Constellations; Geodetic Accuracy

20070034767 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Entry Attitude Controller for the Mars Science Laboratory

Brugarolas, Paul B.; SanMartin, A. Miguel; Wong, Edward C.; March 3, 2007; 6 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 1500, Version 3; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40343

This paper describes the preliminary concept for the RCS 3-axis attitude controller for the exo-atmospheric and guided entry phases of the Mars Science Laboratory Entry, Descend and Landing. The entry controller is formulated as three independent channels in the control frame, which is nominally aligned with the stability frame. Each channel has a feedfoward and a feedback. The feedforward path enables fast response to large bank commands. The feedback path stabilizes the vehicle

angle of attack and sideslip around its trim position, and tracks bank commands. The feedback path has a PD/D structure with deadbands that minimizes fuel usage. The performance of this design is demonstrated via simulation.
Author
Atmospheric Entry; Feedforward Control; Stability; Sideslip; Angle of Attack; Attitude (Inclination); Controllers

20070034861 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Attitude Dynamics and Control of Solar Sails with Articulated Vanes
Mettler, Edward; Acikmese, A. Behcet; Ploen, Scott R.; January 10, 2005; 4 pp.; In English; AIAA Guidance, Navigation, and Control Conference\, 15 Aug.2005, San Francisco, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40437

In this paper we develop a robust nonlinear algorithm for the attitude control of a solar sailcraft with M single degree-of-freedom articulated control vanes. A general attitude controller that tracks an admissible trajectory while rejecting disturbances such as torques due to center-of-mass to center-of-pressure offsets is applied to this problem. We then describe a methodology based on nonlinear programming to allocate the required control torques among the control vanes. A simplified allocation strategy is then applied to a solar sail with four articulated control vanes, and simulation results are given. The performance of the control algorithm and possible limitations of vane-only control are then discussed.
Author
Solar Sails; Attitude Control; Attitude (Inclination); Degrees of Freedom; Dynamic Control; Control Simulation; Vanes

20070034870 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Reconnaissance Orbiter Navigation
You, Tung-Han; Halsell, Allen; Highsmith, Dolan; Moriba, Jah; Demcak, Stuart; Higa, Earl; Long, Stacia; Bhaskaran, Shyam; August 16, 2004; 21 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, 16-19 Aug. 2004, Providence, RI, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 04-2566; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40425

Mars Reconnaissance Orbiter will launch in August 2005 at Cape Canaveral Air Force Station. The heavyweight spacecraft will use a Lockheed-Martin Atlas V-401 launch vehicle. It will be the first mission in a low Mars Orbit to characterize the surface, subsurface, and atmospheric properties. The intensive science operation imposes a great challenge for Navigation to satisfy the stringent requirements. This paper describes navigation key requirements, major challenges, and the sophisticated dynamic modeling. It also details navigation strategy and processes for various mission phases. Mars Reconnaissance Orbiter will return significant amount of scientific data in support of the objectives set by the Mars Exploration Program. A robust and precise navigation is the key to the success of this mission.
Author
Mars Reconnaissance Orbiter; Navigation; Dynamic Models; Surface Properties; Meteorological Parameters; Mars Exploration; Atmospheric Chemistry

20070034873 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Analysis of Thrust Vectoring Capabilities for the Jupiter Icy Moons Orbiter
Quadrelli, Marco B .; Gromov, Konstantin; Murray, Emmanuell; August 2005; 6 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, August 2005, Lake Tahoe, NV, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40436

A strategy to mitigate the impact of the trajectory design of the Jupiter Icy Moons Orbiter (JIMO) on the attitude control design is described in this paper. This paper shows how the thrust vectoring control torques, i.e. the torques required to steer the vehicle, depend on various parameters (thrust magnitude, thrust pod articulation angles, and thrust moment arms). Rather than using the entire reaction control system (RCS) system to steer the spacecraft, we investigate the potential utilization of only thrust vectoring of the main ion engines for the required attitude control to follow the representative trajectory. This study has identified some segments of the representative trajectory where the required control torque may exceed the designed ion engine capability, and how the proposed mitigation strategy succeeds in reducing the attitude control torques to within the existing capability.
Author
Thrust Vector Control; Attitude Control; Trajectories; Torque

20070034952 NASA Dryden Flight Research Center, Edwards, CA, USA

Free Enterprise: Contributions of the Approach and Landing Test (ALT) Program to the Development of the Space Shuttle Orbiter

Merlin, Peter W.; September 19, 2006; 14 pp.; In English; Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains color and black and white illustrations

Report No.(s): AIAA Paper-2006-7467; Copyright; Avail.: CASI: A03, Hardcopy

The space shuttle orbiter was the first spacecraft designed with the aerodynamic characteristics and in-atmosphere handling qualities of a conventional airplane. In order to evaluate the orbiter's flight control systems and subsonic handling characteristics, a series of flight tests were undertaken at NASA Dryden Flight Research Center in 1977. A modified Boeing 747 Shuttle Carrier Aircraft carried the Enterprise, a prototype orbiter, during eight captive tests to determine how well the two vehicles flew together and to test some of the orbiter s systems. The free-flight phase of the ALT program allowed shuttle pilots to explore the orbiter's low-speed flight and landing characteristics. The Enterprise provided realistic, in-flight simulations of how subsequent space shuttles would be flown at the end of an orbital mission. The fifth free flight, with the Enterprise landing on a concrete runway for the first time, revealed a problem with the space shuttle flight control system that made it susceptible to pilot-induced oscillation, a potentially dangerous control problem. Further research using various aircraft, particularly NASA Dryden's F-8 Digital-Fly-By-Wire testbed, led to correction of the problem before the first Orbital Test Flight.

Author

Boeing 747 Aircraft; Flight Tests; Free Flight; Control Systems Design; Approach and Landing Tests (STS); F-8 Aircraft; Spacecraft Design; Enterprise (Orbiter)

20070034984 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

ASATS [Antisatellites]: Bad for Business

Caceres, Marco; Aerospace America; April 2007; ISSN 0740-722X; Volume 45, No. 4, pp. 16-18; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

With the recent destruction of China's aging Feng Yun 1C meteorological satellite on January 11 by a medium-range ballistic missile launched by the Chinese government attention is brought again to the possible use of antisatellite (ASAT) weapons. The US Air Force has launched microsatellites for servicing other satellites, and the Missile Defense Agency is scheduled to launch a satellite, Near Field Infrared Experiment (NFIRE), that will test navigation, guidance, and control systems, that could be used to improve the capabilities of future ground-based, kinetic-kill missle defense interceptor vehicles. With this stepped up interest in ASATs, this article reviews some of the problems that ASAT could have on the satellite business

CASI

Microsatellites; Spacecraft Defense; Spacecraft Breakup; Space Debris; Destruction

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*.

20070034738 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Integrating Automation into a Multi-Mission Operations Center

Surka, Derek M.; Jones, Lori; Crouse, Patrick; Cary, Everett A, Jr.; Esposito, Timothy C.; May 07, 2007; 9 pp.; In English; Infotech\@Aerospace 2007 Conference, 7-10 May 2007, Sonoma, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04DA01C; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034738

NASA Goddard Space Flight Center's Space Science Mission Operations (SSMO) Project is currently tackling the challenge of minimizing ground operations costs for multiple satellites that have surpassed their prime mission phase and are well into extended mission. These missions are being reengineered into a multi-mission operations center built around modern information technologies and a common ground system infrastructure. The effort began with the integration of four SMEX missions into a similar architecture that provides command and control capabilities and demonstrates fleet automation and

control concepts as a pathfinder for additional mission integrations. The reengineered ground system, called the Multi-Mission Operations Center (MMOC), is now undergoing a transformation to support other SSMO missions, which include SOHO, Wind, and ACE. This paper presents the automation principles and lessons learned to date for integrating automation into an existing operations environment for multiple satellites.
Author
Automatic Control; Systems Integration; Aerospace Sciences; Space Missions; Spacecraft Control

20070034880 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Development of an Operational System for the Retrieval of Aerosol and Land Surface Properties from the Terra Multi-Angle Imaging SpectroRadiometer
Crean, Kathleen A.; July 13, 2003; 7 pp.; In English; International Conference on Space Mission Challenges for Information Technology (SMC-IT), 13-16 Jul. 2003, Pasadena, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40414

An operational system to retrieve atmospheric aerosol and land surface properties using data from the Multi-angle Imaging SpectroRadiometer (MISR) instrument, currently flying onboard NASA's Terra spacecraft, has been deployed. The system is in full operation, with new data products generated daily and distributed to science users worldwide. This paper describes the evolution of the system, from initial requirements definition and prototyping through design, implementation, testing, operational deployment, checkout and maintenance activities. The current status of the system and future plans for enhancement are described. Major challenges encountered during implementation are detailed.
Author
Aerosols; Atmospheric Chemistry; MISR (Radiometry); Surface Properties; Terra Spacecraft; Earth Surface

20070034981 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Stepping Up Space Surveillance
Canan, James W.; Aerospace America; April 2007, pp. 33-37; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

With a proliferating number of spacecraft being built and launched worldwide, there is a growing threat of hostile action from enemies who would use them to disable or destroy vital U.S. Satellites. But the nation's ability to see and track the movements of space-based objects is currently inadequate. The Pentagon's hopes for a remedy currently ride on a new satellite system whose optical sensors will see above the clouds from space itself.
Derived from text
Military Spacecraft; Space Surveillance (Spaceborne); Spacecraft Defense

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SPACECRAFT PROPULSION AND POWER

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

20070034845 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Propulsion Instruments for Small Hall Thruster Integration
Johnson, Lee K.; Conroy, David G.; Spanjers, Greg G.; Bromaghim, Daron R.; October 15, 2001; 20 pp.; In English; 27th International Electric Propulsion Conference(IEPC), 15-19 Oct. 2001, Pasadena, CA, USA; Original contains color illustrations
Report No.(s): IEPC-01-169; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40398

Planning and development are underway for the propulsion instrumentation necessary for the next AFRL electric propulsion flight project, which includes both a small Hall thruster and a micro-PPT. These instruments characterize the environment induced by the thruster and the associated data constitute part of a 'user's manual' for these thrusters. Several instruments probe the back-flow region of the thruster plume, and the data are intended for comparison with detailed numerical models in this region. Specifically, an ion probe is under development to determine the energy and species distributions, and a Langmuir probe will be employed to characterize the electron density and temperature. Other instruments directly measure

the effects of thruster operation on spacecraft thermal control surfaces, optical surfaces, and solar arrays. Specifically, radiometric, photometric, and solar-cell-based sensors are under development. Prototype test data for most sensors should be available, together with details of the instrumentation subsystem and spacecraft interface.
Author
Hall Thrusters; Electric Propulsion; Plumes; Ion Probes; Mathematical Models; Radiometers; Energy Distribution; Electrostatic Probes

20070034925 NASA Glenn Research Center, Cleveland, OH, USA
A Microfabricated Involute-Foil Regenerator for Stirling Engines
Tew, Roy; Ibrahim, Mounir; Danila, Daniel; Simon, Terrence; Mantell, Susan; Sun, Liyong; Gedeon, David; Kelly, Kevin; McLean, Jeffrey; Qiu, Songgang; October 2007; 37 pp.; In English; Fifth International Energy Conversion Engineering Conference and Exhibit (IECEC), 25-27 Jun. 2007, St. Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 138494.04.01.01
Report No.(s): NASA/TM-2007-214973; AIAA Paper-2007-4739; E-16146; Copyright; Avail.: CASI: A03, Hardcopy

A segmented involute-foil regenerator has been designed, microfabricated and tested in an oscillating-flow rig with excellent results. During the Phase I effort, several approximations of parallel-plate regenerator geometry were chosen as potential candidates for a new microfabrication concept. Potential manufacturers and processes were surveyed. The selected concept consisted of stacked segmented-involute-foil disks (or annular portions of disks), originally to be microfabricated from stainless-steel via the LiGA (lithography, electroplating, and molding) process and EDM. During Phase II, re-planning of the effort led to test plans based on nickel disks, microfabricated via the LiGA process, only. A stack of nickel segmented-involute-foil disks was tested in an oscillating-flow test rig. These test results yielded a performance figure of merit (roughly the ratio of heat transfer to pressure drop) of about twice that of the 90 percent random fiber currently used in small approx.100 W Stirling space-power convertors-in the Reynolds Number range of interest (50 to 100). A Phase III effort is now underway to fabricate and test a segmented-involute-foil regenerator in a Stirling convertor. Though funding limitations prevent optimization of the Stirling engine geometry for use with this regenerator, the Sage computer code will be used to help evaluate the engine test results. Previous Sage Stirling model projections have indicated that a segmented-involute-foil regenerator is capable of improving the performance of an optimized involute-foil engine by 6 to 9 percent; it is also anticipated that such involute-foil geometries will be more reliable and easier to manufacture with tight-tolerance characteristics, than random-fiber or wire-screen regenerators. Beyond the near-term Phase III regenerator fabrication and engine testing, other goals are (1) fabrication from a material suitable for high temperature Stirling operation (up to 850 C for current engines; up to 1200 C for a potential engine-cooler for a Venus mission), and (2) reduction of the cost of the fabrication process to make it more suitable for terrestrial applications of segmented involute foils. Past attempts have been made to use wrapped foils to approximate the large theoretical figures of merit projected for parallel plates. Such metal wrapped foils have never proved very successful, apparently due to the difficulties of fabricating wrapped-foils with uniform gaps and maintaining the gaps under the stress of time-varying temperature gradients during start-up and shut-down, and relatively-steady temperature gradients during normal operation. In contrast, stacks of involute-foil disks, with each disk consisting of multiple involute-foil segments held between concentric circular ribs, have relatively robust structures. The oscillating-flow rig tests of the segmented-involute-foil regenerator have demonstrated a shift in regenerator performance strongly in the direction of the theoretical performance of ideal parallel-plate regenerators.
Author
Stirling Engines; Metal Foils; Regenerators; Oscillating Flow; Engine Tests; Fabrication; Lithography; Electroplating; Parallel Plates

20070034956 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Very High Isp Thruster with Anode Layer (VHITAL): An Overview
Marrese-Reading, Colleen M.; Frisbee, Robert; Sengupta, Anita; Cappelli, Mark A.; Tverdoklebov, Sergey; Semenkin, Sasha; Boyd, Iain; September 28, 2004; 6 pp.; In English; AIAA Space 2004, 28-30 Sep. 2004, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40499

This article describes the two stage bismuth fueled Hall thruster technology that was developed at TsNIIMASH [1] and the Very High Isp Thruster with Anode Layer (VHITAL) technology assessment program that is funded by NASA Exploration Systems Mission Directorate (ESMD)' Prometheus program. The overall objective of this program is to evaluate the potential for this Russian-developed thruster technology to enable near-term, Nuclear Electric Propulsion (NEf)-enabled ESMD

missions to the outer planets. This 2.5 year program will provide the technology basis for the development of even higher power anode layer thrusters for rapid outer planet exploration missions and, ultimately, human exploration of the solar system. The first 6 month phase is currently in progress. If this phase is successful, the second (1 year) and third (1 year) phase of the proposed program will follow.
Author
Hall Thrusters; Nuclear Electric Propulsion; Bismuth

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*.

20070034225 Air Force Research Lab., Edwards AFB, CA USA
Morphology and Phase Transitions in Styrene-Butadiene-Styrene Triblock Copolymer Grafted with Isobutyl Substituted Polyhedral Oligomeric Silsesquioxanes (preprint)
Drazkowski, Daniel B; Lee, Andre; Haddad, Timothy S; Nov 7, 2006; 21 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A469652; AFRL-PR-ED-JA-2006-439; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469652

Two symmetric triblock polystyrene-butadiene-polystyrene (SBS) copolymers with different styrene content were grafted with varying amounts of isobutyl-substituted polyhedral oligomeric silsesquioxane (POSS) molecules. The POSS octamers, R'R7Si8O12 were designed to contain a single silane functional group, R', which was used to graft onto the dangling 1,2 butadienes in the polybutadiene block and seven identical organic groups, R=isobutyl (iBu). Morphology and phase transitions of these iBu-POSS modified SBS were investigated using small angle X-ray scattering and rheological methods. It was observed that POSS with isobutyl moiety, when grafted to the polybutadiene (PB), appears to show a high affinity to stay within the PB domain; effectively, they enhance the segregation between butadiene and styrene domains. This causes a shift in the phase diagram to lower styrene content. From the rheology, we observed that values of storage modulus, G', at temperatures below the order-disorder transition increase due to the grafting of iBu-POSS. These observations lead us to conclude that the local order morphology between styrene and butadiene domains was better preserved due to the enhanced segregation forced by iBu-POSS.
DTIC
Butadiene; Copolymers; Grafting; Morphology; Phase Transformations; Styrenes

20070034308 Army Research Lab., Aberdeen Proving Ground, MD USA
Performance Assessment of Two Different Aviation CARC Coating Systems on Steel When Cadmium Plating Is Eliminated
Placzankis, Brian E; Miller, Chris E; Grendahl, Scott M; Kane, Michael J; Bhansali, Kirit J; Jun 2007; 54 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469785; ARL-TR-4136; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469785

Corrosion-test specimens of AISI 4130 and 4340 steel with and without cadmium plating were prepared for evaluation using two different aviation versions of the chemical agent resistant coating system. Both coating systems used MIL-PRF-23377 high solids primer and MIL-DTL-64159 type II waterborne topcoat. One system incorporated the established MIL-PRF-23377 primer formula with hexavalent chromium (class C), while the other utilized an improved nonchromate (class N) MIL-PRF- 23377 formulation that recently passed the specification performance criteria. The 4130 steel specimens were used to assess performance for general corrosion, throwing power, and crevice corrosion all under GM 9540P accelerated cyclic-corrosion conditions. In addition, thick 4130 steel panels were prepared using a variety of surface preparation conditions to assess pull off coating adhesion, in accordance with ASTM-D-4541. AISI 4340 material was fabricated in accordance with ASTM-F-519. Type 1d C-rings were utilized to assess hydrogen embrittlement tolerance differences between

the various coating systems under GM 9540P conditions. (Note: the complete reference information for all standards and specifications mentioned here can be found in the report.)
DTIC
Cadmium; Coating; Coatings; Corrosion Resistance; Plating; Steels

20070034312 Army Research Lab., Aberdeen Proving Ground, MD USA
Effect of Substituents on UV-Vis Spectra and RSA Properties of Phthalocyanine Compounds
Andzelm, Jan; Rawlett, Adam; Orlicki, Joshua; Snyder, James; Baldridge, Kim; May 2007; 24 pp.; In English
Contract(s)/Grant(s): Proj-AH16
Report No.(s): AD-A469789; ARL-TN-278; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469789

The use of optically transparent materials to modulate or impede laser light in a real-time setting is significant. This goal stimulates an interest in metalloporphyrins, phthalocyanines (PCs), naphthalocyanins, and their derivatives. The most desired derivatives would be optically transparent, absorb laser light, and also be soluble in water. PCs, with their stable, planar square structure and highly delocalized pi-electron system, are being used in numerous technological applications, such as pigments, in chemical sensors, and more recently, as photosensitizers for photodynamic therapy. The nonlinear optical properties (NLO) of these compounds are of particular importance. Using quantum chemistry methods, we study both visual and NLO properties of phthalocyanines complexes with Si as a central atom. The effect of hydrophilic axial substituents of the material on their optical properties is examined. We are mainly interested in the PEG poly(ethylene oxide) as an axial substituent because it is used in our laboratory to synthesize soluble PC complexes.
DTIC
Phthalocyanin; Ultraviolet Spectra

20070034549 Colorado School of Mines, Golden, CO USA
Mass Transfer from Entrapped DNAPL Sources Undergoing Remediation: Characterization Methods and Prediction Tools
Illangasekare, Tissa H; Marr, Junko M; Siegrist, Robert L; Soga, Kenichi; Glover, Kent L; Moreno-Barbero, Elena; Heiderscheidt, Jeffery L; Saenton, Satawat; Matthew, Mini; Kaplan, Ann R; Aug 31, 2006; 437 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-SERDP-CU-1294
Report No.(s): AD-A469984; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary goal of this research was to understand and characterize mass transfer and tracer partitioning in physically heterogeneous DNAPL sources undergoing remediation. Four source zone treatment technologies were evaluated: (1) bio-treatment, (2) in situ chemical oxidation (ISCO), (3) surfactant enhanced dissolution and (4) thermal treatment. Fundamental knowledge was generated to improve and develop tools for evaluating the impact of remediation technologies on DNAPL distribution in heterogeneous systems. Experiments and modeling at column, flow cell and large tank scales were designed to understand how parameters that quantify laboratory-scale processes contributing to mass transfer and parameters that quantify the processes can be upscaled to describe and simulate the field-scale behavior, and to test hypotheses that mass transfer coefficients for entrapped DNAPL sources change during remediation. Large-tank experiments generated accurate data sets under controlled conditions suitable for model development and validation, and to obtain insight to mass transfer in physically heterogeneous system.
DTIC
Characterization; Contamination; Mass Transfer

20070034786 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Kinetic and Product Study of the Cl + HO2 Reaction
Hickson, Kevin M.; Keyser, Leon F.; Journal of Physical Chemistry A; June 20, 2005; Volume 109, No. 31, pp. 6887-6900; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40304; http://dx.doi.org/10.1021/jp051176w

Absolute rate data and product branching ratios for the reactions Cl + HO2 to HCl + O2 (k1a) and Cl + HO2 to OH + ClO (k1b) have been measured from 226 to 336 K at a total pressure of 1 Torr of helium using the discharge flow resonance fluorescence technique coupled with infrared diode laser spectroscopy. For kinetic measurements, pseudo-first-order conditions were used with both reagents in excess in separate experiments. HO2 was produced by two methods: through the

termolecular reaction of H atoms with O2 and also by the reaction of F atoms with H2O2. Cl atoms were produced by a microwave discharge of Cl2 in He. HO2 radicals were converted to OH radicals prior to detection by resonance fluorescence at 308 nm. Cl atoms were detected directly at 138 nm also by resonance fluorescence. Measurement of the consumption of HO2 in excess Cl yielded k1a and measurement of the consumption of Cl in excess HO2 yielded the total rate coefficient, k1. Values of k1a and k1 derived from kinetic experiments expressed in Arrhenius form are (1.6 +/- 0.2) x 10-11 exp[(249 +/- 34)/T] and (2.8 +/- 0.1) x 10-11 exp[(123 +/- 15)/T] cm3 molecule-1 s-1, respectively. As the expression for k1 is only weakly temperature dependent, we report a temperature-independent value of k1 = (4.5 +/- 0.4) x 10-11 cm3 molecule-1 s-1. Additionally, an Arrhenius expression for k1b can also be derived: k1b = (7.7 +/- 0.8) x 10-11 exp[-(708 +/- 29)/T] cm3 molecule-1 s-1. These expressions for k1a and k1b are valid for 226 K T 336 and 256 K T 296 K, respectively. The cited errors are at the level of a single standard deviation. For the product measurements, an excess of Cl was added to known concentrations of HO2 and the reaction was allowed to reach completion. HCl product concentrations were determined by IR absorption yielding the ratio k1a/k1 over the temperature range 236 K T 296 K. OH product concentrations were determined by resonance fluorescence giving rise to the ratio k1b/k1 over the temperature range 226 K T 336 K. Both of these ratios were subsequently converted to absolute numbers. Values of k1a and k1b from the product experiments expressed in Arrhenius form are (1.5 +/- 0.1) x 10-11 exp[(222 +/- 17)/T] and (10.6 +/- 1.5) x 10-11 exp[-(733 +/- 41)/T] cm3 molecule-1 s-1, respectively. These expressions for k1a and k1b are valid for 256 K T 296 and 226 K T 336 K, respectively. A combination of the kinetic and product data results in the following Arrhenius expressions for k1a and k1b of (1.4 +/- 0.3) x 10-11 exp[(269 +/- 58)/T] and (12.7 +/- 4.1) x 10-11 exp[-(801 +/- 94)/T] cm3 molecule-1 s-1, respectively. Numerical simulations were used to check for interferences from secondary chemistry in both the kinetic and product experiments and also to quantify the losses incurred during the conversion process HO2 to OH for detection purposes.
Author
Hydrochloric Acid; Reaction Kinetics; Resonance Fluorescence; Laser Spectroscopy; Temperature Dependence; Helium

20070034982 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Cooling Off Orion's Fiery Return
Sietzen, Frank, Jr.; Aerospace America; April 2007; ISSN 0740-722X; Volume 45, No. 4, pp. 28-32; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

To protect the Orion crew exploration vehicle from the intense heat of atmospheric reentry, designers are looking backward to the method used in the early days of the space program. But the updated version of that ablative technology will feature some major differences, including advanced materials that are still being tested. To make a selection, study teams are subjecting candidate materials to the same fiery temperatures the CEV will face on its return from space missions.
Derived from text
Atmospheric Entry; Thermal Protection; Ablation; Reentry Shielding; Spacecraft Shielding; Ablative Materials; Heat Shielding; Reentry Effects

24
COMPOSITE MATERIALS

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

20070034699 NASA Glenn Research Center, Cleveland, OH, USA
Environmental/Thermal Barrier Coatings for Ceramic Matrix Composites: Thermal Tradeoff Studies
Murthy, Pappu L. M.; Brewer, David; Shah, Ashwin R.; July 2007; 18 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS3-26385; WBS 984754.02.07.03.11.03; NASA Order C-73506-N; NASA Order C-77005-T
Report No.(s): NASA/TM-2007-214920; E-16142; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034699

Recent interest in environmental/thermal barrier coatings (EBC/TBCs) has prompted research to develop life-prediction methodologies for the coating systems of advanced high-temperature ceramic matrix composites (CMCs). Heat-transfer analysis of EBC/TBCs for CMCs is an essential part of the effort. It helps establish the resulting thermal profile through the thickness of the CMC that is protected by the EBC/TBC system. This report documents the results of a one-dimensional analysis of an advanced high-temperature CMC system protected with an EBC/TBC system. The one-dimensional analysis

was used for tradeoff studies involving parametric variation of the conductivity; the thickness of the EBC/TBCs, bond coat, and CMC substrate; and the cooling requirements. The insight gained from the results will be used to configure a viable EBC/TBC system for CMC liners that meet the desired hot surface, cold surface, and substrate temperature requirements.
Author
Ceramic Matrix Composites; Coating; Heat Transfer; Life (Durability); Thermal Control Coatings; Elastic Properties

20070034700 NASA Glenn Research Center, Cleveland, OH, USA
Elevated Temperature Fatigue Endurance of Three Ceramic Matrix Composites
Kalluri, Sreeramesh; Verrilli, Michael J.; August 2007; 13 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 714-04-30; WBS 984754.02.07.03.11.03
Report No.(s): NASA/TM-2007-214922; E-16144; Copyright; Avail.: CASI: A03, Hardcopy

High-cycle fatigue endurance of three candidate materials for the acoustic liners of the Enabling Propulsion Materials Nozzle Program was investigated. The ceramic matrix composite materials investigated were N720/AS (Nextel 720, 3M Corporation), Sylramic S200 (Dow Corning), and UT 22. High-cycle fatigue tests were conducted in air at 910 C on as-machined specimens and on specimens subjected to tensile cyclic load excursions every 160 hr followed by thermal exposure at 910 C in a furnace up to total exposure times of 2066 and 4000 hr. All the fatigue tests were conducted in air at 100 Hz with a servohydraulic test machine. In the as-machined condition, among the three materials investigated only the Sylramic S200 exhibited a deterministic type of high-cycle fatigue behavior. Both the N720/AS and UT-22 exhibited significant scatter in the experimentally observed high-cycle fatigue lives. Among the thermally exposed specimens, N720/AS and Sylramic S200 materials exhibited a reduction in the high-cycle fatigue lives, particularly at the exposure time of 4000 hr.
Author
Ceramic Matrix Composites; Fatigue Tests; High Temperature; Fabrication; Endurance; Fatigue (Materials)

20070034702 NASA Glenn Research Center, Cleveland, OH, USA
Reinforced Carbon-Carbon Subcomponent Flat Plate Impact Testing for Space Shuttle Orbiter Return to Flight
Melis, Matthew E.; Brand, Jeremy H.; Pereira, J. Michael; Revilock, Duane M.; September 2007; 23 pp.; In English; 2006 National Space and Missile Materials Symposium (NSMMS), 26-30 Jun. 2006, Orlando, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 377816.06.03.02.04
Report No.(s): NASA/TM-2007-214384; E-15662; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034702

Following the tragedy of the Space Shuttle Columbia on February 1, 2003, a major effort commenced to develop a better understanding of debris impacts and their effect on the Space Shuttle subsystems. An initiative to develop and validate physics-based computer models to predict damage from such impacts was a fundamental component of this effort. To develop the models it was necessary to physically characterize Reinforced Carbon-Carbon (RCC) and various debris materials which could potentially shed on ascent and impact the Orbiter RCC leading edges. The validated models enabled the launch system community to use the impact analysis software LS DYNA to predict damage by potential and actual impact events on the Orbiter leading edge and nose cap thermal protection systems. Validation of the material models was done through a three-level approach: fundamental tests to obtain independent static and dynamic material model properties of materials of interest, sub-component impact tests to provide highly controlled impact test data for the correlation and validation of the models, and full-scale impact tests to establish the final level of confidence for the analysis methodology. This paper discusses the second level subcomponent test program in detail and its application to the LS DYNA model validation process. The level two testing consisted of over one hundred impact tests in the NASA Glenn Research Center Ballistic Impact Lab on 6 by 6 in. and 6 by 12 in. flat plates of RCC and evaluated three types of debris projectiles: BX 265 External Tank foam, ice, and PDL 1034 External Tank foam. These impact tests helped determine the level of damage generated in the RCC flat plates by each projectile. The information obtained from this testing validated the LS DYNA damage prediction models and provided a certain level of confidence to begin performing analysis for full-size RCC test articles for returning NASA to flight with STS 114 and beyond.
Author
Carbon-Carbon Composites; Flat Plates; Impact Tests; Reinforcing Materials; Columbia (Orbiter)

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20070034237 Air Force Research Lab., Edwards AFB, CA USA

Synthesis and Characterization of Silyldichloramines, Their Reactions with F- Ions, Stability of N2CI2 and NCI2(-), and Formation of NCI3 (Postprint)

Schneider, Stefan; Schroer, Thorsten; Gerkin, Michael; Haiges, Ralf; Christe, Karl O; Boatz, Jerry; Jan 2007; 11 pp.; In English

Report No.(s): AD-A469687; AFRL-PR-ED-JA-2006-237; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469687

Only two silyldichloramines, (C6H5)3SiNCl2 and (CH3)3SiNCl2, have been reported in the literature. The synthesis of the former was successfully repeated, and its structure was established by single crystal X-ray diffraction and vibrational spectroscopy. Attempts to prepare (CH3)3SiNCl2 were unsuccessful, however, a new trialkylsilyldichloramine, t-BuMe2Si-NCl2, was prepared and characterized by Raman and multinuclear NMR spectroscopy. The reaction of t-BuMe2SiNCl2 with (CH3)4NF in CHF3 solution at -78 deg C, followed by removal of all volatile products at -30 deg C, produced the expected t-BuMe2SiF by-product and a white solid consisting of NCl3 absorbed on Me4NCl. The NCl3 could be reversibly desorbed from the substrate and was identified as a neat liquid at room temperature by Raman spectroscopy. The observed final reaction products are consistent with the formation of an unstable N(CH3)4+NCl2(-) intermediate which decomposes to N(CH3)4+Cl(-) and NCl molecules which can dimerize to N2Cl2. Theoretical calculations confirm that NCl2(-) can readily lose Cl(-) and that N2Cl2 also possesses a low barrier towards loss of N2 to give chlorine atoms and, thus, can account for the formation of NCl3.

DTIC

Chlorine Compounds; Ions; Stability; X Ray Diffraction

20070034244 Air Force Research Lab., Edwards AFB, CA USA

Progress in Modeling Missile Fuel Venting and Plume Contrail Formation (Postprint)

Chenoweth, J D; Brinckman, K W; York, J J; Feldman, G; Dash, S M; Jan 2007; 14 pp.; In English

Report No.(s): AD-A469698; AFRL-PR-ED-TP-2006-454; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469698

In this paper, we discuss progress made in extending specialized missile plume codes to analyze more generalized problems entailing varied missile propulsive flow field phenomena. Problems of interest include those of fuel venting and plume contrail formation. To analyze such processes, gas/liquid modeling is being incorporated that includes primary and secondary breakup, and vaporization/condensation physics. This is being performed at an engineering level and overall progress in extending plume codes to analyze these processes will be described. Exemplary problems described include those of both gaseous and liquid fuel venting, application of unified secondary breakup and vaporization of a liquid fuel venting problem, and, contrail formation in a generic missile plume.

DTIC

Contrails; Flow Distribution; Kinetics; Missiles; Plumes; Progress; Vaporizing; Venting

20070034247 Air Force Research Lab., Edwards AFB, CA USA

Pentazole-Based Energetic Ionic Liquids: A Computational Study (Postprint)

Pimienta, Ian S; Elzey, Sherrie; Gordon, Mark S; Boatz, Jerry; Jan 9, 2007; 14 pp.; In English

Report No.(s): AD-A469704; AFRL-PR-ED-JA-2006-300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469704

The structures of protonated pentazole cations (RN5H(+)), oxygen-containing anions such as N(NO2)2(-), NO3(-), and ClO4(-), and the corresponding ion pairs are investigated by ab initio quantum chemistry calculations. The stability of the pentazole cation is explored by examining the decomposition pathways of several monosubstituted cations (RN5H(+)) to yield N2 and the corresponding azidinium cation. The heats of formation of these cations, which are based on isodesmic (bond type

conserving) reactions, are dependent on the nature of the substituents. The proton transfer reaction from the cation to the anion is investigated.
DTIC
Cations; Decomposition; Quantum Chemistry

20070034259 Illinois Univ., Urbana, IL USA
Multifunctional Polymers and Composites for Self-Healing Applications
White, Scott R; Moore, Jeffrey S; Sottos, Nancy R; Sep 30, 2006; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0179
Report No.(s): AD-A469720; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469720

Mechanical deformation can be used to activate specific reaction pathways in mechanochemical triggers designed to harness the energy in a polymer under stress. Since activation of these triggers occurs before chain scission, we feel that they will be useful for the development of self-toughening polymeric materials. Upon activation, the oQDM intermediates could react with pendant dienophiles to form new crosslinks. The formation of crosslinks would be directly coupled and tailored to the stress field in a failing polymer. We also feel, with slight modification, that mechanochemical triggers could be useful for the stress-induced formation of new chromophores. The newly formed chromophores could then signal that some critical load has been reached, or perhaps signal the presence of microcracks. We expect that the procedures reported here will be generally useful for the development of utilizing mechanical energy to activate specific chemical pathways, and help shift the major focus of mechanochemical studies from bond-breaking to bond-making transformations.
DTIC
Composite Materials; Epoxy Resins; Healing; Polymerization; Polymers

20070034266 Alabama Univ., Tuscaloosa, AL USA
Energetic Ionic Liquids: Fundamental Studies Relating Target Structures and Key Physical Properties
Rogers, Robin D; Katritzky, Alan R; Drab, David M; Smiglak, Marcin; May 25, 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0357
Report No.(s): AD-A469729; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469729

Synthesis, using existing, and developed procedures, as well as, investigation of physical and chemical properties is directed toward development of an understanding of the criteria needed to model and predict Ionic Liquid (IL) materials incorporating energetic and complementary properties. Using a matrix/systematic screening approach, a fundamental understanding of model compounds provides core information about key component interactions that will lead to the design of new energetic ILs.
DTIC
Targets; Thermodynamic Properties

20070034267 Wisconsin Univ., Madison, WI USA
Molecular Beam Studies of Reactions of Protic Gases with Bare and Surfactant-Coated Sulfuric Acid
Nathanson, Gilbert M; May 30, 2007; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0045
Report No.(s): AD-A469730; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469730

Gas-liquid scattering experiments were used to investigate the uptake of HCl and HBr, the evaporation of water, and the hydrolysis of N2O5 in sulfuric acid coated with the soluble surfactants n-butanol and n-hexanol under atmospheric conditions. The experiments show that HCl and HBr uptake is enhanced by butanol and hexanol films, water evaporation is unimpeded, and N2O5 hydrolysis is reduced by twofold. This reduction likely occurs because N2O5 is a large molecule whose transport is impeded by the butyl and hexyl chains covering the acid surface. In contrast, HCl and HBr uptake is enhanced because they are smaller molecules that penetrate through the alkyl chains and dissociate by protonating the OH groups of interfacial butanol and hexanol molecules. The hydrolysis of N2O5 is the most important heterogeneous reaction in the atmosphere

governing the depletion of ozone. The results suggest that this hydrolysis is overestimated in regions of the upper troposphere where small organic surfactants are present in high enough concentration to coat the surface of sulfuric acid aerosols.
DTIC
Chemical Reactions; Coatings; Gases; Molecular Beams; Sulfuric Acid; Surfactants

20070034268 North Carolina Univ., Chapel Hill, NC USA
The Growth and Characterization of Metastable Free Radical Nanoclusters
Baer, Tomas; Miller, Roger E; Jan 2007; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49550-04-1-0078; Proj-FA9550-04-1-0078
Report No.(s): AD-A469731; 5-36808; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469731

The ultimate objective of the research was to form and study a wide range of radical complexes and nanoclusters in helium nanodroplets. The unique conditions present in the helium nanodroplets has enabled the production of interesting new systems that have not been observed using more conventional methods. Infrared laser spectroscopy was the primary tool for carrying out these studies. Among the systems investigated were the halogen HF and HCN complexes and the methyl radical HP complex, which forms the transition state in the F + CH4 reaction. The methyl HCN complex was also investigated.
DTIC
Free Radicals; Infrared Spectroscopy; Liquid Helium; Metastable State; Nanoclusters

20070034273 Idaho Univ., Moscow, ID USA
Polyazidopyrimidines: High Energy Compounds and Precursors to Carbon Nanotubes (Postprint)
Ye, Chengfeng; Gao, Haixiang; Boatz, Jerry A; Drake, Gregory W; Twamley, Brendan; Shreeve, Jean'ne M; Jan 2006; 5 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0209; N00014-02-1-0600; Proj-2303
Report No.(s): AD-A469737; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469737

Organic polyazido substituted compounds are at the forefront of high energy research. Polyazido organic compounds have high relative heats of formation as one azido group adds about 87 kcal/mol of endothermicity to a hydrocarbon compound. In this family of compounds, 3,6-di(azido)-tetrazine (1), has the highest reported heat of formation ~ 1101 kJ mol-1 (6709 kJ kg-1). The compound 4,4',6,6'-tetra(azido)azo-1,3,5-triazine (2), has a heat of formation of 2171 (6164 kJ kg -1) (Fig. 1). Recently it was demonstrated that 1 and 2 were good precursors to nano carbon nitride materials. Thermal decomposition of 1 and 2 yields nitrogen-rich nanolayered, nanoclustered and nanodendritic carbon nitrides depending on the different heating processes.
DTIC
Azides (Inorganic); Azides (Organic); Carbon Nanotubes; Endothermic Reactions

20070034278 Connecticut Univ., Storrs, CT USA
Rheological Behavior of Entangled Polystyrene-Polyhedral Oligosilsesquioxane (POSS) Copolymer (Postprint)
Wu, Jian; Mather, Patrick T; Haddad, Timothy S; Kim, Gyeong-Man; Aug 24, 2006; 12 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A469743; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469743

We report on the linear viscoelastic properties of a family of entangled linear thermoplastic non-polar hybrid inorganic-organic polymers: random copolymers of polystyrene (PS) and styryl-based polyhedral oligosilsesquioxane (POSS), R7(Si8O12)(C6H4CH=CH2), with R = isobutyl (iBu). A series of styrene-styryl POSS random copolymers with 0, 6, 15, 30, 50 wt% iBuPOSS were investigated. WAXS and TEM demonstrate that the iBuPOSS disperses in the polymeric matrix at a molecular level. It is observed that the iBuPOSS plays a plasticizer-like effect, yielding a monotonic decrease of the glass transition temperature with increasing iBuPOSS content. Rheological measurements revealed that linear viscoelastic behavior of the copolymers is also profoundly influenced by the presence of iBuPOSS. The incorporation of iBuPOSS dramatically decreases the rubbery plateau modulus (oNG), suggesting a strong dilation effect of isobutyl-POSS on entanglement density. Additionally, the apparent flow activation energy, obtained by fitting the Vogel-Fulcher-Tamman-Hesse equation, monotonically increases with increasing iBuPOSS content, indicating a lower sensitivity of POSS copolymers to changes of temperature. We attribute observations of the microscopic topology of constituent polymer chains to be altered by iBuPOSS

comonomers that act as compact volumetric branches. Conversely, intermolecular interactions between iBuPOSS and PS segments do not play an essential role in determining the rheological behavior.
DTIC
Copolymers; Polystyrene; Rheology

20070034283 Georgia Inst. of Tech., Atlanta, GA USA
Nanojets: Electrification, Energetics, Dynamics, Stability and Breakup
Landman, Uzi; Dec 31, 2006; 65 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0093
Report No.(s): AD-A469752; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469752

Simulation methodologies, algorithms, and computer codes allowing molecular dynamics simulations of formation, propagation, and breakup processes of nanojets, generated either through the application of pressure or through the action of an electric field to liquids containing solvated charges, were developed. Particular emphasize was placed on simulations of electrically driven nanojets of liquid formamide solutions with dissolved NAI, and on investigations of the behavior and response of nanoscale drops of such solutions as well as of pure formamide, when placed in strong electric fields. The simulations, and coordinated electrospray experiments at the AFRL, Hanscom AFB, demonstrated a mixed charge emission regime exhibiting field-induced cluster ion evaporation and ejection of charged droplets. The simulation average mass-to-charge ratios and maximal surface fields of about 1V/nm agree with the experimental results and with electrohydrodynamic theory of cone-jets. The measured solvated ion distributions are also correctly reproduced by the simulations. Emission of charged particles is found in the simulations to occur predominantly from the tip of the nanojet, rather then from the neck between the Taylor cone and the nanojet. The MD simulations revealed novel field-induced structural ordering processes and electro-crystallization of pure formamide drops. The microscopic results obtained through the atomic-scale simulations were analyzed and compared to the predictions of a continuum formulation.
DTIC
Conducting Fluids; Electric Fields; Electrification; Pressure; Stability

20070034313 Army Research Lab., Aberdeen Proving Ground, MD USA
Decontamination of Chemical Agent Simulant by Nanometal Oxides
Zander, Nicole E; Rawlett, Adam M; Orlicki, Joshua A; Kowalski, Eileen; Jun 2007; 18 pp.; In English
Contract(s)/Grant(s): Proj-AH84
Report No.(s): AD-A469790; ARL-TR-4133; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469790

The ability of a U.S. Army vehicle or a piece of equipment to decontaminate itself in situ from the threat of chemical agents is highly desirable and may reduce the weight and logistical footprints associated with decontamination operations. This work explores the ability of several nanometal oxide powders (that could potentially be incorporated into U.S. Army coatings) to decontaminate 2-chloroethyl ethyl sulfide, a simulant for the blister agent sulfur mustard. Another mustard stimulant, 2-chloroethyl phenyl sulfide, and a simulant for the nerve agent GB, dimethyl methylphosphonate, were also examined.
DTIC
Decontamination; Oxides

20070034456 Army Research Lab., Adelphi, MD USA
Observation and Study of Dislocation Etch Pits in Molecular Beam Epitaxy Grown Gallium Nitride With the Use of Phosphoric Acid and Molten Potassium Hydroxide
Semendy, Fred; Lee, Unchul; Jun 2007; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469813; ARL-TR-4164; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Defects continue to challenge the functionality and reliability gallium nitride (GaN)-based devices. GaN grown on sapphire by molecular beam epitaxy was investigated by wet etching in hot phosphoric acid (H3PO4) and molten potassium hydroxide (KOH). Hexagonally shaped etch pits were formed on the etched sample surfaces. Etched samples were characterized with the use of atomic force microscopy (AFM) and scanning electron microscopy (SEM) and SEM cathode luminescence (SEM-CL). AFM images show dark spots indicating mixed dislocations. The densities of the mixed dislocations are almost ~3 x 108 cm 2. Observations were made about the three different types of etch pits distinguished as , , and . By comparing SEM and AFM, we made observations about a relationship between etch pits and dislocations. The origin of etch

pits is the mixed dislocation, and the combination of KOH etching and AFM is found to be a better approach for a two dimensional evaluation of mixed dislocations. Results showed that both H3PO4 and molten KOH are good wet etchants for GaN and the pits created by H3PO4 were smaller and numerous when compared to the pits created by molten KOH.
DTIC
Etching; Gallium Nitrides; Hydroxides; Molecular Beam Epitaxy; Phosphoric Acid; Potassium Compounds; Potassium Hydroxides; Scanning Electron Microscopy

20070034500 Colorado School of Mines, Golden, CO USA
Reaction and Transport Processes Controlling In Situ Chemical Oxidation of DNAPLs
Siegrist, Robert L; Crimi, Michelle; Munakata-Marr, Junko; Illangasekare, Tissa; Dugan, Pamela; Heiderscheidt, Jeff; Jackson, Shannon; Petri, Ben; Sahl, Jason; Seitz, Sarah; Nov 1, 2006; 235 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DACA72-02-C-0012; Proj-CU-1290
Report No.(s): AD-A469907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In situ chemical oxidation involves the introduction of chemical oxidants into the subsurface to destroy organic contaminants in soil and ground water, with the goal being to reduce the mass, mobility, and/or toxicity of contamination. The objective of this project was to quantify the pore/interfacial scale DNAPL reactions and porous media transport processes that govern the delivery of oxidant to a DNAPL-water interface and degradation of the DNAPL. In this project, an integrated set of tasks were carried out involving a comparative analysis focused on contrasting oxidant types (permanganate and catalyzed hydrogen peroxide) and oxidant application methods (low to high dose concentrations and delivery densities) to treat a mixture of tetrachloroethene (PCE) and trichloroethene (TCE) DNAPL present in mass levels and distributions under conditions representative of a range of subsurface environmental settings. The research also addressed the potential secondary effects of applications of ISCO, as well as the coupling of ISCO with pre- and post-ISCO treatment operations.
DTIC
Cleaning; Contamination; Ground Water; Liquids; Oxidation

20070034517 Air Force Research Lab., Eglin AFB, FL USA
Equation of State of Aluminum-Iron Oxide-Epoxy Composite
Jordan, Jennifer L; Foley, Jason R; Dick, Richard D; Ferranti, Louis; Thadhani, Naresh N; McDowell, David L; Austin, Ryan A; Benson, David J; Jul 2007; 11 pp.; In English
Contract(s)/Grant(s): F08630-03-C-0001; Proj-2502
Report No.(s): AD-A469941; AFRL-MN-EG-TP-2007-7406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on the measurements of the shock equation of state (Hugoniot) of an Al/Fe2O3/epoxy composite, prepared by epoxy cast curing of powder mixtures. Explosive loading, with Baratol, trinitrotoluene (TNT), and Octol, was used for performing experiments at higher pressures, in which case shock velocities were measured in the samples and aluminum, copper, or polymethyl methacrylate (PMMA) donor material, using piezoelectric pins. The explosive loading of the metal donors (aluminum and copper) will be discussed. Gas gun experiments provide complementary lower pressure data in which piezoelectric polyvinylidene fluoride (PVF) stress gauges were used to measure the input and propagated stress wave profiles in the sample and the corresponding shock propagation velocity. The results of the Hugoniot equation of state are compared with mesoscale finite-element simulations, which show good agreement.
DTIC
Aluminum; Aluminum Oxides; Composite Materials; Epoxy Compounds; Epoxy Resins; Equations of State; Iron Oxides

20070034522 Army Research Lab., Aberdeen Proving Ground, MD USA
Thermo-Responsive Films Based Upon Diels-Alder Chemistry and Block Copolymer Phase Separation
Costanzo, Philip J; Beyer, Frederick L; Demaree, J D; Jun 2007; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH42
Report No.(s): AD-A469946; ARL-TR-4127; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The surface properties of poly(ethylene glycol) (PEG) films have been modified using gold particles functionalized with block copolymer-based ligands of poly(styrene) (PS) and PEG. The ligands were synthesized using Diels-Alder chemistry to join the PS and PEG blocks into linear diblock copolymers, which were attached to gold particles with a thiol terminal functionality on the PS block. The block copolymer ligands compatibilized the Au particles by creating a PEG shell around the Au and PS core. The Diels-Alder linkage, however, is temperature sensitive, and by annealing the films at 90 C, the PEG

blocks of the ligand were separated from the PS-functionalized Au core. The Au particles were thus rendered immiscible in the PEG matrices and migrated to the film surfaces.
DTIC
Block Copolymers; Diels-Alder Reactions; Ligands; Solubility

20070034528 Army Research Lab., Aberdeen Proving Ground, MD USA
Nanocrystalline and Ultra-Fine Grained Tungsten for Kinetic Energy Penetrator and Warhead Liner Applications
Cho, Kyu; Kecskes, Laszlo; Dowding, Robert; Schuster, Brian; Wei, Qiuming; Valiev, Ruslan Z; Jun 2007; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469953; ARL-RP-180; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For the first time, we have demonstrated adiabatic shear localization in pure, ultra-fine grain (UFG) and nanocrystalline (NC) tungsten (W). Fabricated by severe plastic deformation (SPD), microstructural and mechanical property analyses of the W samples show that the combination of fine grain size, stored strain energy, ultra-high strength, little or no work hardening capacity leads to a unique flow softening behavior. It is further hypothesized that, while maintaining material ductility, grain refinement and redistribution of pre-existing impurities, segregated along grain boundaries (GBs), are equally critical for localized flow softening to occur. The UFG and SPD W results serve as minimum property benchmarks for shear localization to occur. In turn, these are used to define the experimental protocols and parameters for use in alternate fabrication procedures such as rapid consolidation of UFG or NC W powders. Preliminary results indicate that additional development of high-purity W nanopowders and appropriate grain-growth inhibitors will be required for this latter approach to successfully produce UFG and NC W microstructures.
DTIC
Kinetic Energy; Linings; Penetration; Powder Metallurgy; Tungsten; Warheads

20070034538 Georgia Inst. of Tech., Atlanta, GA USA
LES of Sooting Flames
El-Asrag, Hossam; Menon, Suresh; Dec 2006; 202 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0049
Report No.(s): AD-A469968; CCL-TR-2006-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Soot prediction in realistic systems is one of the most challenging problems in theoretical and applied combustion. Soot formation as a chemical process is very complicated and not fully understood up to the moment. The major difficulty stems from the chemical complexity of the soot formation processes as well as its strong coupling with the other thermochemical and fluid processes that occur simultaneously. Soot is a major byproduct of incomplete combustion, having a strong impact on the environment, as well as the combustion efficiency. Therefore, it needs to be predicted in realistic configurations in an accurate and yet computationally efficient way. In the current study, a new soot formation subgrid model is developed and reported here. The new model is designed to be used within the context of the Large Eddy Simulation (LES) framework, combined with Linear Eddy Mixing (LEM) as a subgrid combustion model. The final model can be applied equally to premixed and non-premixed flames over any required geometry and flow conditions in the free, the transition, and the continuum regimes. The soot dynamics is predicted using a Method of Moments approach with Lagrangian Interpolative Closure (MOMIC) for the fractional moments. Since, no prior knowledge of the particles distribution is required, the model is generally applicable. The effect of radiation is introduced as an optically thin model. As a validation the model is first applied to a non-premixed non-sooting flame, then a set of canonically premixed flames. Finally, the model is validated against a non-premixed jet sooting flame. Good results are predicted with reasonable accuracy.
DTIC
Flames; Soot

20070034545 Dayton Univ. Research Inst., OH USA
Nanocomposites Derived From a Low-Color Aromatic Polyimide (CP2) and Amine-Functionalized Vapor-Grown Carbon Nanofibers: In Situ Polymerization and Characterization (Preprint)
Wang, David H; Arlen, Michael J; Back, Jong-Beom; Vaia, Richard A; Tan, Loon-Seng; Jan 2007; 55 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4347
Report No.(s): AD-A469979; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Vapor-grown carbon nanofibers (VGCNF) were functionalized with amine-containing pendants via a Friedel-Crafts

acylation reaction with 4-(3-aminophenoxy)benzoic acid. The resulting H2N-VGCNF with ca. 5 atom% functionaliztion was in attendance during the polymerization of 2,2-bis(phtalic anhydride)-1,1,1,3,3,3-hexafluoroisopropane (6FDA) and 1,3-bis(3-aminophenoxy)benzene (APB) in N,N-dimethylacetamide (DMAc) to afford a series of polyimide (CP2)-based nanocomposite films, which contained 0.1 to 5.0 wt% of H2N-VGCNF. For comparison purposes, the pristine VGCNF (0.1-5.0 wt%) was also used in the in situ polymerization of 6FDA and ABP. These two series of CP2/VGCNF nanocomposite films were cast from the respective polyamic acid/VGCNF DMAC solutions, followed by thermal imidization at curing temperatures up to 250 ?C. The benefit and limitation of functionalized VGCNF on the length scale and the extent of CNF dispersion in a polyimide matrix were clear: (a) 0.1 wt% H2N-VGCNF film was visually transparent whereas similar (0.1 wt%) pristine VGCNF film showed the presence of large CNF aggregates throughout; (b) at 0.3 wt% H2N-VGCNF contents, the nanocomposite film had become translucent, and at 5 wt%, it was opaque. Since CP2 is very soluble in THF, the CP2-grafted VGCNF were simply separated from the free CP2 by solvent extraction. The molecular weights of the extracted CP2 were measured using gel-permeation chromatography (GPC). The effects of VGCNF on molecular weight (MW) and glass-transition (Tg) were discussed in terms of GPC and thermal analysis results, respectively. The dispersion of VGCNF in CP2 was evaluated using scanning electron microscopy (SEM). The tensile properties of the nanocomposite films were determined, showing up to 45% increase in modulus as the functionalized VGCNF content raised to 5 wt%.
DTIC
Amines; Carbon; Carbon Fibers; Characterization; Color; Composite Materials; Nanocomposites; Polyimides; Polymerization; Vapors

20070034553 Army Engineer Research and Development Center, Vicksburg, MS USA
Effect of Treatment pH on the End Products of the Alkaline Hydrolysis of TNT and RDX
Davis, Jeffrey L; Nestler, Catherine C; Felt, Deborah R; Larson, Steven L; Jun 2007; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469989; ERDC/EL-TR-07-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development of effective treatment options for munitions contaminants is essential for Department of Defense live fire range management and sustainability. The energetic compounds 2,4,6-trinitotoluene (TNT) and hexahydro-13,5-trinitro-1,3,5-triazine (RDX) have been identified in range soil. Alkaline hydrolysis, initiated through treatment with lime, has been shown to effectively destroy these compounds in solution and in well-mixed soil. This study was conducted to evaluate the effect of treatment pH on the end products of the alkaline hydrolysis of TNT and RDX. Titrations were performed at pH 10.5, 11.5 and 12.5 using unlabeled and universally labeled-14C-TNT or RDX. At the completion of the titration, reverse-phase high performance liquid chromatography established that there was no TNT or RDX present in the solutions except for the untreated control. TNT degraded rapidly at pH 12.5 and 11.5. At pH 10.5, the degradation was slow enough to observe many intermediate products, only some of which were identifiable under standard Method 8330 methods. RDX also degraded rapidly at pH 12.5 and 11.5. At pH 10.5, the reaction appeared to proceed by the established pathway, but at a much slower rate. Using gel permeation chromatography, we determined that the end products from the TNT and RDX alkaline hydrolysis were polar, small molecular weight compounds. Hydrolysis byproducts, including nitrate and formate, were determined using ion chromatography.
DTIC
Chemical Composition; Contaminants; Hydrolysis; Liquid Chromatography; pH; RDX; Titration

20070034761 Northwestern Univ., Evanston, IL USA
Temperature Evolution of the Gd Magnetization Profile in Strongly Coupled Gd/Fe Multilayers
CHoi, Y; Haskel, D; Camley, R E; Lee, D R; Lang, J C; Srajer, G; Jiang, J S; Bader, S D; Oct 27, 2004; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0174; W-31-109-ENG-38
Report No.(s): AD-A469824; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The temperature evolution of the magnetization depth profile in Gd layers of a strongly coupled fGds50 d/Fes15 dg15 multilayer is studied using x-ray resonant magnetic scattering (XRMS) and x-ray magnetic circular dichroism (XMCD) techniques. XRMS yields a spatially resolved, element-specific, magnetization depth profile, while XMCD spatially averages over this profile. The combined data inequivocally show the presence of an inhomogeneous magnetic profile within the Gd layers at all measured temperatures between 20 and 300 K. These inhomogeneous profiles, which feature enhanced magnetic ordering near the Gd/Fe interface, were refined using both a kinematic Born approximation and a recently developed distorted-wave Born approximation, both of which include the contribution of structural and magnetic interfacial roughness. Calculations of the static magnetic configuration within a mean-field approach that neglects interfacial roughness are in

agreement with the measured inhomogeneous profile and its temperature evolution. The results suggest that the enhanced Gd magnetization near the interface arises from its proximity to magnetically ordered Fe.
DTIC
Magnetization; Distortion; Kinematics

20070034872 Air Force Research Lab., Wright-Patterson AFB, OH USA
Thermo-Oxidative Behavior of High Temperature PMR-15 Resin and Composites (Postprint)
Tandon, G P; Pochiraju, K V; Schoeppner, G A; Feb 2007; 49 pp.; In English; International Conference on Recent Advances in Composite Materials (2nd), ICRACM-2007, 20 Feb. 2007, New Delhi, India; Original contains color illustrations
Contract(s)/Grant(s): FA8650-05-D-5052; Proj-4349
Report No.(s): AD-A469992; AFRL-ML-WP-2007-461; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The present study examines the thermo-oxidative behavior of high-temperature polymer matrix composite (HTPMC) materials. Thermo-oxidative aging in neat resin is simulated with a diffusion-reaction model in which temperature, oxygen concentration, and weight loss effects are considered. The thermo-oxidative behavior of the composite, on the other hand, is significantly different from that of the constituents as the composite microstructure, including the fiber/matrix interphase/interface, introduces anisotropy in the diffusion and oxidation behavior. Unit cell analyses are carried out using three-dimensional finite element analysis of repeated volume elements representing the fiber, matrix and interphase regions, and the resin oxidation model. Parametric studies illustrating the anisotropy in the oxidative region growth and the effect of fiber and interphase diffusivity on the oxidation layer growth are discussed. It is suggested that fiber-matrix debonding could provide additional diffusion paths to explain the extent of observed anisotropic oxidation growth.
DTIC
High Temperature; Oxidation; Resins; Thermoplasticity

20070034995 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Glove Contaminant Transfer Evaluation
Mucciacciaro, Anthony; July 17, 2007; 20 pp.; In English; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034995

This viewgraph presentation describes the process and evaluation of glove residue contamination when used with solvents. FTIR and GC/MS analysis is used to evaluate the glove residue.
CASI
Contamination; Gloves; Chemical Analysis; Residues

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METALS AND METALLIC MATERIALS

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

20070034307 California Univ., Irvine, CA USA
Theory of Collective Spin-Wave Modes of Interacting Ferromagnetic Spheres
Arias, Rodrigo; Mills, D L; Sep 29, 2004; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0174; CS0001028
Report No.(s): AD-A469784; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469784

We formulate the theory of the collective spin wave modes of arrays of spherical particles of ferromagnetic material, under the assumption that each sphere in the array is magnetized uniformly. In addition, the intersphere interactions have their origin in the magnetic fields generated by the precessing moments, appropriate to the case where there is no direct physical contact between the spheres. The formulation is a real space analysis, and thus can be applied in principle to disordered arrangements of spheres. While our formulation is quite general, and is directly applicable to the case where both exchange and dipolar interactions influence spin motions within an individual sphere, explicit calculations are presented for the case where exchange is absent. The numerical calculations we discuss explore the collective spin wave modes of square planar arrays of spheres, and consider the case where the spheres are magnetized both perpendicular and parallel to the plane.
DTIC
Ferromagnetic Materials; Magnons; Numerical Analysis; Spheres

20070034309 Colorado Univ., Colorado Springs, CO USA

Tunable Thermal Hysteresis in Magnetic Multilayers: Magnetic Superheating and Supercooling

Camley, R E; Lohstroh, W; Felcher, G P; Hosoito, N; Hashizume, H; Oct 22, 2004; 8 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0174

Report No.(s): AD-A469786; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469786

The phenomena of superheating and supercooling can lead to a thermal hysteresis curve where two states are stable over a range of temperatures. Here we present a simple magnetic multilayer system (Fe/Gd) that can be designed to show a thermal hysteresis curve. Calculations show that, with proper choice of parameters, the width, in temperature, of the hysteresis curve can be controlled by an external magnetic field and varies from 20 to 100K over a field range of 300 600 Oe. Polarized neutron reflectivity measurements confirm that such behavior is realized experimentally in multilayers of Fe/Gd.

DTIC

Gadolinium; Hysteresis; Iron; Supercooling; Superheating

20070034310 Chile Univ., Santiago, Chile

Theory of Spin Excitations and the Microwave Response of Cylindrical Ferromagnetic Nanowires

Arias, Rodrigo; Mills, D L; Mar 16, 2001; 12 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0174; CS0001028

Report No.(s): AD-A469787; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469787

We develop the theory of exchange/dipole spin wave excitations of ferromagnetic nanowires of cylindrical cross section, where the magnetization is parallel to the axis of the wire. In addition, we provide the theory of the microwave response of such structures, for the case where the nanowire is also a conductor. We present explicit calculations of both the mode structure of nanowires, and also their ferromagnetic resonance spectrum, with attention to recent experimental studies. We compare differences between the physical picture appropriate for the cylinder, with the well studied case of the ferromagnetic film.

DTIC

Cylindrical Bodies; Excitation; Ferromagnetic Materials; Ferromagnetic Resonance; Magnons; Microwaves; Nanowires; Thin Films

20070034463 Dayton Univ. Research Inst., OH USA

Dwell-Time Fatigue Crack Growth in Ni-Base Superalloys

Saxena, Ashok; Findley, Kip; Apr 2003; 55 pp.; In English

Contract(s)/Grant(s): F33615-98-C-5214; Proj-4347

Report No.(s): AD-A469823; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The state-of-the-art dwell-time fatigue crack growth models applicable to materials systems such as Waspaloy, Rene'95, Rene'88 and IN 100 were critically assessed. The review included models based on linear elastic fracture mechanics (LEFM) and those based on time dependent fracture mechanics (TDFM). The pertinent creep deformation and time and cycle dependent crack growth rate data on these materials were also collected to enable the evaluation of these models and for the establishment of their respective regimes of applicability and their limitations. The gaps in the available experimental and computational data for implementing the promising models were identified as part of the review. An experimental test plan and a plan for providing computational needs for addressing these shortcomings are proposed.

DTIC

Crack Propagation; Dwell; Fatigue (Materials); Heat Resistant Alloys; Nickel Alloys

20070034467 Army Research Lab., Aberdeen Proving Ground, MD USA

Strength-to-Weight Optimization of Titanium Pyramidal Core Sandwich Plates

Tice, Jason R; Doherty, Kevin J; Zupan, Marc; Jun 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ORISE-7263185; Proj-622105.AH84

Report No.(s): AD-A469829; ARL-RP-182; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future military vehicles demand increasingly mass-efficient structural armor systems to satisfy design requirements of increased mobility and survivability. In order to fully realize lightweight solutions, sandwich plates consisting of monolithic facesheets and a low-density cellular core are targeted as an integral ingredient in these armor systems, providing both structural strength and stiffness via through-the-thickness load-bearing potential. In this study, sandwich plates consisting of

thin facesheets and a periodic pyramidal core manufactured entirely from cold-rolled Grade 4 commercially-pure titanium (CP-1) are investigated. A plausible manufacturing route and its corresponding limitations are established, and analytical models for peak strength and effective stiffness for flatwise compression are presented. In addition, a strength-to-weight optimization technique is implemented, and model calibration experiments are conducted on the as-manufactured optimized plates. From these experiments, the model for peak strength was found to be a robust and accurate tool for depicting core performance. Although modeling effective stiffness was less successful, probable causes for reduced precision are presented. Also, the as-manufactured titanium plates are verified to be fully optimized from a strength-to-weight standpoint for flatwise compression.
DTIC
Metal Plates; Sandwich Structures; Titanium

20070034512 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Effect of Microstructure on Fretting Fatigue Behavior of Nickel Alloy IN-100
Saladin, Erik C; Mar 2007; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469926; AFIT/GMS/ENY/07-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis studied the effect of microstructure on the fretting fatigue behavior of IN-100. First, fretting and plain fatigue S-N curves were determined over a large range of applied stress at an identical R-ratio and for fretting tests, done with a constant contact load. It was found that fretting fatigue reduces the cycles to failure compared to plain fatigue. The half contact width was found for the specimens, the crack initiation angle was found to be 40 deg and the crack initiation location was at the trailing edge of contact for the fretting specimens. Computational work included finding the stress profile in the contact region using an analytical method and a finite element method. The analytical method computed half contact width and was found to be in good agreement with experimental half contact width. The stress profiles produced from each method were compared and found to be in good agreement. The stress profiles were used to find the Modified Shear Stress Range (MSSR) Parameter. The MSSR parameter produced results in good agreement with the experimental data for crack initiation location and fatigue life. This study found microstructure did not have an effect on the MSSR parameter for IN-100. This study also found MSSR data developed for titanium alloys did not adequately represent IN-100. The parameter also gave reasonable agreement with the experimental finding for crack initiation angle. A microstructural evaluation was done between the 7 micron grain sized material of this study and an oblong, 10 by 50 micron grained microstructure IN-100 from a previous study. The study found microstructure did have an effect on crack initiation and crack propagation, with the coarser grain structure performing better in fretting fatigue. The coarser grain structure allowed a longer initiation and crack propagation time.
DTIC
Fretting; Metal Fatigue; Microstructure; Nickel Alloys

20070034513 Army Research Lab., Aberdeen Proving Ground, MD USA
Ballistic Testing of Australian Bisalloy Steel for Armor Applications
Showalter, Dwight D; Gooch, William A; Burkins, Matt S; Thorn, Victoria; Cimpoeru, Stephen J; Barnett, Russell; Jun 2007; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L1622618AH80
Report No.(s): AD-A469930; ARL-RP-181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Research Laboratory (ARL) and Australian Defense Science and Technology Organization (DSTO) have ballistically baselined a range of armor steels (277-321HB to 477-534HB) manufactured by the Australian company, Bisalloy Steels. Plate was tested in thicknesses from 10 mm to 20 mm and ARL and DSTO ballistically tested the plates against 0.30 caliber and 0.50 caliber armor piercing projectiles, 0.50 caliber and 20 mm Fragment Simulating Projectiles (FSPs) and the 14.5 mm BS41. Ballistic performance was compared for armor steels over a range of hardnesses and toughnesses, and results compared with the minimum ballistic requirements of MIL-A-12560H and MIL-A-46100D.
DTIC
Armor; Australia; Ballistics; Hardness Tests; Steels

20070034563 Georgia Inst. of Tech., Atlanta, GA USA
Microstructure-Sensitive Notch Root Analysis for Ni-Base Superalloys (Preprint)
Tjiptowidjojo, Yustianto; Shenoy, Mahesh; Przybyla, Craig; McDowell, David; May 2007; 26 pp.; In English
Contract(s)/Grant(s): F33615-03-C-5229; Proj-3946
Report No.(s): AD-A470002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Macroscopic viscoplastic constitutive models for y-y Ni-base superalloys typically do not contain an explicit dependence

on the underlying microstructure. Microstructure dependent models are of interest since the sizes, volume fractions, and morphologies of primary, secondary, and tertiary precipitates can substantially affect the stress-strain response. The principle microstructural features that can significantly affect the stress-strain response of y-y Ni-base superalloys are the grain size and precipitate volume fraction and size distributions. An Artificial Neural Network (ANN) is used to correlate the material parameters in an internal state variable cyclic viscoplasticity model with these microstructure plasticity calculations performed on other microstructures within the range characterized experimentally. The trained model is applied to an example of component notch root analyses to explore the potential impact of microstructure-sensitive constitutive models in fatigue design of structures.
DTIC
Heat Resistant Alloys; Microstructure; Nickel Alloys; Notches; Sensitivity

20070034923 NASA Glenn Research Center, Cleveland, OH, USA
Development and Evaluation of TiAl Sheet Structures for Hypersonic Applications
Draper, S. L.; Krause, D.; Lerch, B.; Locci, I. E.; Doehnert, B.; Nigam, R.; Das, G.; Sickles, P.; Tabernig, B.; Reger, N.; Rissbacher, K.; October 2007; 28 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2006-214467/REV1; E-15759-1; Copyright; Avail.: CASI: A03, Hardcopy

A cooperative program between the National Aeronautics and Space Administration (NASA), the Austrian Space Agency (ASA), Pratt & Whitney, Engineering Evaluation and Design, and Plansee AG was undertaken to determine the feasibility of achieving significant weight reduction of hypersonic propulsion system structures through the utilization of TiAl. A trade study defined the weight reduction potential of TiAl technologies as 25 to 35 percent compared to the baseline Ni-base superalloy for a stiffener structure in an inlet, combustor, and nozzle section of a hypersonic scramjet engine (ref. 1). A scramjet engine inlet cowl flap was designed, along with a representative subelement, using design practices unique to TiAl. A sub-element was fabricated and tested to assess fabricability and structural performance and validate the design system. The TiAl alloy selected was Plansee's third generation alloy Gamma Met PX (Plansee AG), a high temperature, high strength gamma-TiAl alloy with high Nb content (refs. 2 and 3). Characterization of Gamma Met PX sheet, including tensile, creep, and fatigue testing was performed. Additionally, design-specific coupons were fabricated and tested in order to improve subelement test predictions. Based on the sheet characterization and results of the coupon tests, the subelement failure location and failure load were accurately predicted.
Author
Titanium Aluminides; Fatigue Tests; Creep Tests; Nickel Alloys; Tensile Creep; Structural Design; Weight Reduction; Supersonic Combustion Ramjet Engines; Engine Inlets; Flapping; High Strength Alloys; Heat Resistant Alloys

27
NONMETALLIC MATERIALS

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

20070034279 Wisconsin Univ., Madison, WI USA
Time Resolved Energy Transfer and Photodissociation of Vibrationally Excited Molecules
Crim, F F; Jun 2007; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0132
Report No.(s): AD-A469746; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469746

These experiments use ultrafast laser spectroscopy to study reaction and photodissociation dynamics in solution, probing both photodissociation and intramolecular energy transfer. They have observed the photodissociation dynamics of methylhypochlorite (CH3OCl) in different solvents by monitoring the disappearance of the Cl atom and have compared the flow of energy in vibrationally excited methyl iodide (CH3l) in solution and in the gas phase. This second experiment is one of the few direct comparisons of intramolecular vibrational energy flow in a solvated molecule with that in the same molecule isolated in a gas. Because of the importance of vibrational relaxation of molecules after photoisomerization, the other goal has been to probe the vibrational energy flow in both cis and trans-stilbene, a prototypical molecule for cis-trans isomerization.
DTIC
Energy Transfer; Isomerization; Molecules; Photodissociation

20070034453 Academy of Sciences of the Ukraine, Kiev, Ukraine

Highly Damping Hard Coatings for Protection of Titanium Blades

Movchan, Boris A; Ustinov, Anatolii I; Oct 1, 2005; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Adhesion; Ceramics; Damping; Hardness; Metals; Protection; Titanium; Titanium Alloys

20070034481 Naval Postgraduate School, Monterey, CA USA

Anchoring Distortions Coupled with Plane Couette & Poiseuille Flows of Nematic Polymers in Viscous Solvents: Morphology in Molecular Orientation, Stress & Flow

Zhou, Hong; Forest, M G; Mar 2006; 21 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0086; DMS-0308019

Report No.(s): AD-A469877; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The aim of this work is to model and simulate processing-induced heterogeneity in rigid, rod-like nematic polymers in viscous solvents. We employ a mesoscopic orientation tensor model due to Doi, Marrucci and Greco which extends the small molecule, liquid crystal theory of Leslie-Ericksen-Frank to nematic polymers. The morphology has various physical realizations, all coupled through the model equations: the orientational distribution of the ensemble of rods, anisotropic viscoelastic stresses, and flow feedback. Previous studies in plane Couette & Poiseuille flow (with the exception of(7)) have focused on the coupling between hydrodynamics and the orientational distribution of rigid rod polymers with identical anchoring conditions at solid boundaries; without flow, the equilibrium structure is homogeneous. Here we explore steady structures that emerge with mismatch anchoring conditions at the walls, which couple an equilibrium elastic distortion across the channel, short and long range elasticity potentials, and hydrodynamics. In plane Couette 'where moving plates drive the flow' and Poiseuille flow 'where a pressure gradient drives the flow', in the regime of weak flow and strong distortional elasticity, asymptotic analysis yields closed-form steady solutions and scaling laws with identical wall conditions. We focus simulations in this regime to expose the effects due to wall anchoring conflicts, and illustrate the induced morphology of the orientational distribution, stored viscoelastic stresses, and non-Newtonian flow. A remarkably simple diagnostic emerges in this physical parameter regime, in which salient morphology features are controlled by the amplitude and sign of the difference in plate anchoring angles of the director field at the two plates.

DTIC

Anchors (Fasteners); Couette Flow; Distortion; Hydrodynamics; Laminar Flow; Liquid Crystals; Mathematical Models; Molecular Flow; Morphology; Rods; Simulation

20070034546 Drexel Univ., Philadelphia, PA USA

High Performance Fatty Acid-Based Vinyl Ester Resin for Liquid Molding

Geng, Xing; La Scala, John J; Sands, James M; Palmese, Guiseppe R; Jul 2007; 16 pp.; In English

Contract(s)/Grant(s): DAAD19-02-2-0010

Report No.(s): AD-A469981; ARL-RP-184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Liquid resins used for molding composite structures are a significant source of volatile organic compounds (VOC) and hazardous air pollutant (HAP) emissions. One effective method of reducing styrene emissions from vinyl ester (VE) resins is to replace some or all of the styrene with fatty acid-based monomers. In our investigation, the styrene was reduced to 20-25 wt% compared to 40-60 wt% associated with commercial products. In addition, fatty acid-based monomers can bring about other benefits like higher toughness, lower exothermal heat and low volume shrinkage. One disadvantage of fatty acid-based VE resins, however, is the reduction in glass transition temperature (Tg) which limits their use in high temperature environments. Therefore, the specific focus of this work was to design high Tg fatty acid-based VE resins with low viscosities and high fracture properties. These high Tg resins were designed by blending fatty acid monomers with novolac vinyl esters. Various low viscosity formulations were established with Tgs as high as 147 degrees C. Moreover, approaches to further improve the fracture toughness of the resin were investigated. Vinyl terminated poly(butadiene-co-acrylonitrile) (VTBN) and epoxy terminated poly(butadiene-co-acrylonitrile) (ETBN) were used as modifiers to these fatty acid vinyl ester resins. Compared with commercial novolac VE resin, marked improvement in fracture toughness (167 J/m squared versus 56 J/m squared) was achieved.

DTIC

Casting; Esters; Fatty Acids; Plastics; Resins; Rubber; Toughness

20070034556 Universal Energy Systems, Inc., Dayton, OH USA
Effect of Al Addition on Glass Forming Stability of Ca-Mg-Zn-Cu Based Bulk Metallic Glasses (PREPRINT)
Senkov, O N; Scott, J M; Miracle, Daniel B; Apr 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-5233; Proj-2311
Report No.(s): AD-A469993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effect of Al addition on glass forming ability and glass stability of Ca-Mg-Zn, Ca-Mg-Cu, and Ca-Mg-Zn-Cu alloys was studied. The glassy alloys were produced by a copper mold casting method as wedge-shaped samples with thicknesses varying from 0.5 mm to 10 mm. Thermal properties, such as the glass transition, crystallization and melting temperatures, as well as heats of crystallization and melting, were determined for the produced glasses. Partial substitution of Zn and/or Cu with Al was found to generally reduce the glass forming ability; however, it improves the glass stability.
DTIC
Glass; Metallic Glasses; Stability

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*.

20070034240 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 806 (U.S. Geological Survey, TMGS Magnetometer/Towed Array)
Fling, Rick; McClung, Christina; Banta, Matthew; Karwatka, Michael; Burch, William; McDonnell, Patrick; May 2007; 51 pp.; In English
Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021
Report No.(s): AD-A469692; ATC-9409; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469692

This scoring record documents the efforts of the U.S. Geological Survey to detect and discriminate inert unexploded ordnance (UXO) utilizing the Yuma Proving Grounds (YPG) Standardized UXO Technology Demonstration Site Blind Grid. This Scoring Record was coordinated by Michael Karwatka and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Field Tests; Geological Surveys; Magnetometers; Ordnance; Scoring; Standardization

20070034241 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Open Field Scoring Record No. 808 (FEREX Fluxgate Gradient Magnetometer/Sling)
Fling, Rick; McClung, Christina; Banta, Matthew; Burch, William; Karwatka, Michael; McDonnell, Patrick; May 2007; 53 pp.; In English
Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021
Report No.(s): AD-A469693; ATC-9417; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469693

This scoring record documents the efforts of the Foerster Group to detect and discriminate inert unexploded ordnance (UXO) utilizing the Aberdeen Proving Ground (APG) Standardized UXO Technology Demonstration Site Open Field. This Scoring Record was coordinated by Michael Karwatka and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Gradients; Magnetic Fields; Magnetometers; Ordnance; Scoring; Standardization

20070034242 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 810 (FEREX Fluxgate Gradient Magnetometer/Sling)

Fling, Rick; McClung, Christina; Banta, Matthew; Burch, William; Karwatka, Michael; McDonnell, Patrick; May 2007; 49 pp.; In English

Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021

Report No.(s): AD-A469694; ATC-9418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469694

This scoring record documents the efforts of the Foerster Group to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. This Scoring Record was coordinated by Michael Karwatka and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Gradients; Magnetic Fields; Magnetometers; Ordnance; Scoring; Standardization

20070034264 Defense Threat Reduction Agency, Fort Belvoir, VA USA

Final Programmatic Environmental Impact Statement for Defense Threat Reduction Agency (DTRA) Activities on White Sands Missile Range, New Mexico

May 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469727; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469727

This Record of Decision (ROD) announces final Agency determinations and approvals prepared by the Defense Threat Reduction Agency (DTRA) in response to a proposal to increase DTRA testing activities at the White Sands Missile Range (WSMR), New Mexico. The proposed action (and preferred alternative) is comprised of nine activity-related categories: 1) collateral effects testing using simulant materials; 2) rock penetration testing; 3) hard target lethality and defeat testing; 4) advanced weapons lethality testing; 5) static high explosive (HE) testing for target lethality; 6) weapons effects testing using the Large Blast/Thermal Simulator (LB/TS); 7) antiterrorism testing; 8) development of weapon effects targets and test beds; and 9) improvements to the Permanent High Explosive Test Site (PHETS) Administrative Park. Two Environmental Assessments (EA) covering DTRA operations at WSMR were completed in early 2002. At that time, DTRA had no requirements for the use of simulants or taggants south of Mockingbird Gap and the limited number of simulants met the Agency requirements. It was recognized at that time if either situation changed, additional National Environmental Policy Act (NEPA) reviews would be required. In the fall of 2002, requests were made for the use of simulants at Capitol Peak and for the use of new simulants. Based on the number of simulants, the potential impact to the White Sands pup fish population and the overall scope, DTRA in conjunction with WSMR, determined a Programmatic Environmental Impact Statement (PEIS) rather than an EA was necessary to appropriately evaluate the proposed action.

DTIC

Environmental Surveys; Evaluation; Missile Ranges; System Effectiveness

20070034288 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA

Optimization and Development of a Human Scent Collection Method

Fletcher, Kendra S; Jun 4, 2007; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469758; USUHS-CI07-0052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469758

Canines have been used by law enforcement to detect human scent, narcotics, and explosives. Matching human scent using analytical instruments would add credibility to a canine's response. Traditionally, air passed through cotton pads has been used to collect scent at crime scenes. While this collection technique preserves forensic evidence and is adequate for canines, chemical analysis of scent samples may require better collection techniques. Optimization of the collection of 10 human scent compounds on cotton pads was performed by adjusting the collection flow rate and extraction time. Maximum recovery (1.8%) was achieved at a low flow rate (50 ft/min) and a short extraction time (54 secs), 7.6 cm from the analyte source. Alternative collection media were tested and revealed that use of solid-phase microextraction (SPME) collection

techniques increase the recovery (4.4%) of human scent compounds. Advanced collection techniques, such as SPME, will be needed for chemical analysis of human scent.
DTIC
Collection; Odors

20070034744 Army Defense Ammunition Center, McAlester, OK USA
Transportability Testing of the Marine Corps Light Weight Prime Mover (LWPM) TP-94-01 Transportability Testing Procedures
Barickman, Philip W; May 2007; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470024; DAC/VED-06-23; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Program Manager Motor Transport, Marine Corps Systems Command, to conduct transportability testing on the Light Weight Prime Mover (LWPM) manufactured by Lockheed Martin. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 'Transportability Testing Procedures.' The objective of the testing was to evaluate the Light Weight Prime Mover (LWPM) when transportability tested in accordance with TP-94-01, Revision 2, June 2004. The following observations resulted from the testing of LWPM: 1. The minimal distance between the outside of the pallet and the interior wall of the vehicle made it difficult to engage the strap hooks in the tie-downs. 2. Ratcheting of the straps was difficult due to the ratchet handles being located between the interior wall of the vehicle and the pallets. 3. There may not be adequate storage space on the vehicle for the straps. 4. Due to the limited space between the tie-down rings, a special pallet has to be built to hold the 155MM propelling charges. 5. The area of the deck of the vehicle directly behind the passenger side could potentially be used for storage and securement bar along the wall were added in this area. 6. Prior to the start of testing, both hinges on the tailgate failed. The damaged aluminum hinges were replaced with steel hinges. 7. Removal of the pallets in the forward area of the cargo bed difficult. Straps had to be wrapped around the pallets and then the pallets had to be slid to the rear of the bed to facilitate their removal by forklift. 8. No excessive movement or damage occurred to the payload, vehicle or tie-down rings as a result of testing. Throughout testing, tie-down rings on the LWPM performed adequately. No damage occurred to the tie-down rings or anchors. The LWPM, as currently designed, is adequate for the transport of ammunition.
DTIC
Combat; Performance Tests; Military Vehicles

20070034807 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Technical Standards Products Informing NASA Quality Practices
Oberhettinger, David; September 26, 2006; 6 pp.; In English; Quality Leadership Forum, 26-27 Sep. 2006, Los Angeles, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40316

This viewgraph presentation includes formal definitions of standards (external and internal), as well as discussions of the importance of standards to NASA, current technical standards issues, the NASA technical standards program, and provides technical standards resources.
CASI
Standards; NASA Programs; Specifications

20070034908 Air Force Research Lab., Wright-Patterson AFB, OH USA
Versatile Measurement Techniques to Validate Analytical Structural Mechanical Models
Banaszak, David; Mar 2007; 199 pp.; In English
Report No.(s): AD-A469782; AFRL-VA-WP-TR-2007-3042; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469782

The objective of this in-house work unit was to develop and improve structural measurement systems, facilities and techniques for the collection and analysis of static and dynamic loads data in an inexpensive, reliable and expeditious manner. The effort used state-of-the art instrumentation to collect and analyze data required to validly define the loads environment and provide the necessities for identification, prediction, prevention and control of vibration, static structural loads, dynamic flutter, acoustical loads and thermal stresses in areas of structural fatigue and damage. The Air Force needs common, versatile, advanced and inexpensive measurement systems to support numerous aerospace vehicles and aging aircraft. The approach includes environmental laboratory tests and flight tests of various types of flight data acquisition systems, sensors and

components to ensure compliance with accuracy, life, flight worthiness, maintenance, size performance, weight, reliability and safety requirements of loads data collection systems. Measurement systems should maximize on-board memory, and minimize size, weight and power requirements. This effort illustrates AFRL measurement needs in the laboratory and in the field. Conduct in-house studies of new vibration and static testing and analysis techniques. Studies included purchasing or developing in-house software and conducting experimental programs utilizing Design of Experiments (DOE) to check current and proposed measurement techniques. This report contains papers that document the resultant projects conducted to validate new instrumentation.
DTIC
Instruments; Mathematical Models; Measurement; Models; Structural Analysis

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*.

20070034155 NASA Dryden Flight Research Center, Edwards, CA, USA
High-Rate Wireless Airborne Network Demonstration (HiWAND) Flight Test Results
Franz, Russell; October 22, 2007; 12 pp.; In English; International Telemetering Conference 2007, 22-25 October 2007, Las Vegas, NF, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034155

An increasing number of flight research and airborne science experiments now contain network-ready systems that could benefit from a high-rate bidirectional air-to-ground network link. A prototype system, the High-Rate Wireless Airborne Network Demonstration, was developed from commercial off-the-shelf components while leveraging the existing telemetry infrastructure on the Western Aeronautical Test Range. This approach resulted in a cost-effective, long-range, line-of-sight network link over the S and the L frequency bands using both frequency modulation and shaped-offset quadrature phase-shift keying modulation. This paper discusses system configuration and the flight test results.
Author
Flight Tests; Wireless Communication; Communication Networks; Prototypes; Telemetry

20070034219 Army War Coll., Carlisle Barracks, PA USA
Global War on Terrorism: Executing War without Unity of Command
Torres, N J; Mar 9, 2007; 20 pp.; In English
Report No.(s): AD-A469641; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469641

The nature of the Global War on Terrorism (GWOT) has led the USA to execute war with all elements of the national security apparatus. Because the USA Government (USG) fights this war with the interagency, it has maintained a strategic leadership framework conducive to unified action. Unity of effort, a military principle normally held for Operations Other Than War, has become the lead concept for exercising national power against today's threat. Unfortunately, history has proven that this concept does not work in time of war; inherent prejudices and jurisdictional safeguarding within large institutions such as the USG hinder and sometimes fail to achieve national objectives. This project examines the characteristics of the GWOT, how the USG is currently organized to fight it, why it cannot succeed without change, and what additional measures are needed to correct the situation. The research reveals unity of effort without unity of command cannot achieve the decisive action required in war nor the efficiency and effectiveness demanded by the American people. Recommendations are made to establish an executor of the National Implementation Plan for the War on Terrorism, an individual that can be held accountable for the execution of the GWOT.
DTIC
Command and Control; Coordination; Leadership; United States; Warfare

20070034251 Royal Netherlands Army, The Hague, Netherlands

The NL C4ISR Architecture for Ground-Based Operations: Evolutionary Development of Network Enabled Capabilities

Blaas, Dirk J; Derksen, Theo; Dec 1, 2005; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469709; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469709

No abstract available

Command and Control; Communication Networks

20070034254 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands

Current and Future MIP Capabilities for Coalition Interoperability

van der Meijden, M G; Dec 1, 2005; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469714; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469714

No abstract available

Interoperability; Military Operations

20070034257 Defence Research and Development Canada, Valcartier, Quebec Canada

Information Engineering in Support of Multilateral Joint Operational Interoperability

Dorion, Eric; Boury-Brisset, Anne-Claire; Dec 1, 2005; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469717; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469717

No abstract available

Command and Control; Engineering; Information Systems; Interoperability; Military Operations

20070034258 Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

A Base Component for Network-Based Service-Oriented C4ISR Systems

Kaethner, Sylvia; Spielmann, Marc; Dec 1, 2005; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469718

No abstract available

Command and Control; Communication Networks; Information Systems

20070034448 Department of the Navy, Washington, DC USA

Remote Voice Detection System

Blackmon, Fletcher A, Inventor; Jun 25, 2007; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020292; No Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADD020292

A device and system to remotely detect vocalizations of speech. The skin located on the throat region of a speaking person or a reflective layer on the skin on the throat region vibrates in response to vocalizations of speech by the person. The vibrating skin or reflective layer is reflective of impinging radiation. A laser Doppler vibrometer transmits radiation onto the vibrating skin or the covering reflective layer and receives reflected radiation from the vibrating skin or reflective layer. The laser

Doppler vibrometer generates voltage output signals that are representative of the speech causing the vibrations. A target tracker directs the impinging radiation and detects the reflected radiation to pass between the throat region and the laser Doppler vibrometer and includes a processor that removes non-speech signal artifacts from the voltage output signals. An interconnected audio speaker reproduces the speech from the voltage output signals.
DTIC
Detection; Patent Applications; Remote Sensing; Speech Recognition; Voice Communication

20070034480 Army Research Lab., Aberdeen Proving Ground, MD USA
Simulated Frequency and Force Modulation Atomic Force Microscopy on Soft Samples
Crone, Joshua C; Solares, Santiago; Chung, Peter W; Jun 2007; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469876; ARL-TR-4166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report was generated as part of a Student Temporary Employment Program Internship from July 2006 through June 2007. The report presents basic didactic concepts and reviews recent progress in the scientific literature on atomic force microscopy (AFM). A new AFM technique is studied. The novel AFM approach is based on force and frequency modulation (FFM-AFM) that enables nondestructive AFM measurements of soft samples such as biological materials in solution. The vibrational properties of the AFM cantilever probe are examined to determine extermal conditions that the sample is likely to experience.
DTIC
Atomic Force Microscopy; Cantilever Beams; Frequency Modulation

20070034495 Naval Postgraduate School, Monterey, CA USA
Feasibility of a Dynamic Data Rate Satellite Link for Inmarsat
Boseman, John F; Jun 2007; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inmarsat is a predominantly commercial satellite system fitted on most USA Navy surface vessels including: frigates, cruisers, destroyers, amphibious ships and mine sweepers. It is primarily used for telephone, fax, email, web browsing, and the Global Command and Control System (GCCS). Inmarsat, however, has a very limited data rate. For ships fitted with the latest modem upgrade, Inmarsat provides a meager 128 kbps for support of its numerous functions. To improve upon Inmarsat's limited data rate, this thesis suggests a potential improvement to Inmarsat communications by integrating a dynamic data rate link that maintains the required probability of bit error without exceeding the allocated bandwidth. The results from this thesis show that link margin provisions from the static data rate design are able to support much greater data rates using advanced modulation and forward error correction techniques. The proposed adaptive dynamic link improves the link by measuring channel conditions to determine the fastest data rate for successful communications. When channel conditions are good, the adaptive dynamic link will communicate at a high data rate, and when channel conditions are poor, the dynamic link will communicate at a lower data rate to maintain a target probability of bit error ceiling.
DTIC
Inmarsat Satellites; Rates (Per Time); Satellite Communication

20070034529 Naval Postgraduate School, Monterey, CA USA
Enhanced Radio Frequency (RF) Collection With Distributed Wireless Sensor Networks
Batson, Mickey S; Jun 2007; 297 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469954; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this research, a novel approach for conducting signals intelligence from a distributed network of wireless nodes is developed. The primary objective of this research is enhancing signal collection in a specified target direction. Two conflicting priorities are addressed. One is the time required to determine the target direction and form the beams. The other is the energy consumption involved in developing these solutions. Two competing enhanced collection methodologies (ECM), ECM-1 and ECM-2, were developed and analyzed. ECM-1 uses a combination of time difference of arrival (TDOA) and adaptive beamforming. ECM-2 uses adaptive beamforming that performs a beamscan similar to phased-array radars. Additionally, two competing methods for forming the beams are developed. Method One uses data exclusively from the same elements. Method Two uses data from a new subset of sensors, for each iteration. Analytical expressions were derived for energy consumption and the time required to develop, to compare the competing methodologies. ECM-1 is shown to be far superior to ECM-2 in

both energy consumption and the time required to enhance signal collection, whereas Method Two is shown to be far superior to Method One in formation of the beams.
DTIC
Electronic Countermeasures; Radio Frequencies; Wireless Communication

20070034567 Naval Postgraduate School, Monterey, CA USA
Investigating Team Collaboration of the Fire Department of New York Using Transcripts from September 11, 2001
Garrity, Maura; Jun 2007; 195 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On September 11, 2001, more than one thousand people responded to aid in rescue efforts at the World Trade Center in New York City, mobilizing the largest rescue operation in the city's history. The collaborative teamwork demonstrated in this response is recorded in the radio transcripts between responding units and the Manhattan Dispatcher. The goal of this thesis is to use these transcripts to provide a real world example to validate the Structural Model of Team Collaboration, sponsored by the Office of Naval Research. This model focuses on individual cognitive processes during collaboration with the goal of understanding how individuals work together towards making a decision. This thesis also investigates the effects of loss of situational awareness and adherence to standard operating procedure as an indicator of efficient radio communication. Efficient radio communication expedites the process of moving the team towards their ultimate goal; on September 11, 2001, that goal was to rescue the thousands of civilians trapped in the Twin Towers. This thesis uses the Structural Model of Team Collaboration to help the Fire Department of New York understand how it works together as a team, and offer suggested improvements as necessary.
DTIC
Fires; Models; Telecommunication

20070034768 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Design of a Wideband Radio Telescope
Imbriale, William A.; Weinreb, Sander; Mani, Handi; March 3, 2007; 12 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 1586, Version 3; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40344

A wideband Radio Telescope is being designed for use in the Goldstone Apple Valley Radio Telescope program. It uses an existing 34-meter antenna retrofitted with a tertiary offset mirror placed at the apex of the main reflector. It can be rotated to use two feeds that cover the 1.2 to 14 GHz band. The feed for 4.0 to 14.0 GHz is a cryogenically cooled commercially available open boundary quadridge horn from ETS-Lindgren. Coverage from 1.2 to 4.0 GHz is provided by an un-cooled scaled version of the same feed. The performance is greater than 40% over most of the band and greater than 55%from 6 to 13.5 GHz.
Author
Radio Telescopes; Broadband; Reflectors; Mirrors; Microwave Frequencies

20070034770 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Piezoelectric Polymers Actuators for Precise Shape Control of Large Scale Space Antennas
Chen, Qin; Natale, Don; Neese, Bret; Ren, Kailiang; Lin, Minren; Zhang, Q. M.; Pattom, Matthew; Wang, K. W.; Fang, Houfei; Im, Eastwood; March 18, 2007; 10 pp.; In English; SPIE Smart Structures and Materials and Nondestruvtive Evaluation and Health Monitoring, 18-22 Mar. 2007, San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40349

Extremely large, lightweight, in-space deployable active and passive microwave antennas are demanded by future space missions. This paper investigates the development of PVDF based piezopolymer actuators for controlling the surface accuracy of a membrane reflector. Uniaxially stretched PVDF films were poled using an electrodeless method which yielded high quality poled piezofilms required for this application. To further improve the piezoperformance of piezopolymers, several PVDF based copolymers were examined. It was found that one of them exhibits nearly three times improvement in the in-plane piezoresponse compared with PVDF and P(VDF-TrFE) piezopolymers. Preliminary experimental results indicate that

these flexible actuators are very promising in controlling precisely the shape of the space reflectors.
Author
Piezoelectric Actuators; Piezoelectricity; Copolymers; Shape Control; Microwave Antennas; Shapes

20070034840 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cloudsat Radar Instrument Design and Development Status
Im, Eastwood; Durden, Stephen L.; Li, Fuk K.; Wu, Chialin; Haddad, Ziad S.; Geoscience and Remote Sensing Symposium, 2001. IGARSS International; July 8, 2001; Volume 2, pp. 691-693; In English; 23rd IEEE International Geoscience and Remote Sensing Symposium (IGARSS), 9-13 Jul. 2001, Sydney, Australia; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40394; http://dx.doi.org/10.1109/IGARSS.2001.976604

The Cloud Profiling Radar is the key science instrument for the CloudSat Mission to acquire a global data set of vertical atmospheric cloud structure and its variability. CPR is a 94 GHz nadir-looking radar that measures the power backscattered by clouds as a function of distance from the radar. This sensor is expected to provide cloud measurements at a 500-m vertical resolution and a 1.5-km horizontal resolution. CPR will operate in a short pulse mode and will yield measurements at a minimum detectable sensitivity of -28 dBZ.
Author
Cloud Physics; Vertical Distribution; CloudSat

20070034841 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Interference from the Robledo DSN Transmitters to Central Madrid IMT-2000/UMTS System through Terrain Diffraction at S-Band
Ho, Christian M.; Sue, Miles K.; Peng, Ted K.; Smith, Ernest K.; January 9, 2002; 22 pp.; In English; National Radio Science Meeting, 9-12 Jan. 2002, Boulder, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40395

This study evaluates the possible interference from DSN Robledo 70-m transmitter with Madrid IMT-2000/UMTS wireless users in Spain as both systems will share the same frequency band. Using the effective earth radius, the 50 km terrain profile between Robledo and Madrid is modified and reconstructed. The diffraction propagation losses due to mountain peaks are calculated for the receivers in Madrid urban area. The mountains along the path are simplified into a rounded knife-edge and a rounded obstacle. The results show that for a near surface receiver (1.5 m above the ground) in Madrid, interference signal powers received are less than -135 dBm, which is far below the -109 dBm, the IMT-2000 wireless phone threshold. When a receiver is located at about 40 m above the ground (e.g., the top of Clock Tower of Cibeles Palace), diffraction will generate interference power less than -115 dBm. We find that our calculation results are basically consistent with those from the Longley-Rice model, while the latter has smaller loss because of the low resolution terrain profile used. As a comparison, we also find that the measurements of interference powers of -121.2 dBm at the top of Clock tower is in the range of the estimation. We conclude that the interference through the diffraction mechanism will not cause any problem to IMT-2000/UMTS users at near the surface of Madrid urban area.
Author
Transmitters; Diffraction Propagation; Ultrahigh Frequencies; Terrain; Superhigh Frequencies

20070034853 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Next Generation Millimeter-Wave Radar for Safe Planetary Landing
Pollard, Brian D.; Sadowy, Gregory; March 5, 2005; 7 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40448

Safe, precise landing on planetary bodies requires knowledge of altitude and velocity, and may require active detection and avoidance of hazardous terrain. Radar offers a superior solution to both problems due to its ability to operate at any time of day, through dust and engine plumes, and ability to detect velocity coherently. While previous efforts have focused on providing near term solutions to the safe landing problem, we are designing radar velocimeters and radar imagers for missions beyond the next decade. In this paper we identify the fundamental issues within each approach, at arrive at strawman sensor designs at a center frequency at or around 160 GHz (Gband). We find that a G-band radar velocimeter design is capable of sub-10 cm/s accuracy, and a G-band imager is capable of sub-0.5 degree resolution over a 28 degree field of view. From those

designs, we arrive at the key technology requirements for the development of power and low noise amplifiers, signal distribution methods, and antenna arrays that enable the construction of these next generation sensors.
Author
Millimeter Waves; Antenna Arrays; Power Amplifiers; Planetary Landing; Velocity Measurement

20070034854 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Challenge of Active Optical Sensing from Extreme Orbits
Spiers, Gary D.; November 8, 2004; 9 pp.; In English; SPIE 4th International Asia-Pacific Environmental Remote Sensing Symposium, 8-12 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40449

A review of the history and current state of atmospheric sensing lidar from Earth orbit was conducted and it was found that space based earth remote sensing is still in its infancy with only one limited success extended duration autonomous mission to date. An analysis of the basic requirements for some candidate geo-synchronous lidar concepts was completed and it was concluded that significant basic work is required in all areas of lidar development.
Author
Atmospheric Sounding; Remote Sensing; Earth Orbits; Optical Radar; Geosynchronous Orbits

20070034907 German Armed Forces, Germany
Modern C4I Systems: BURDEN OR BENEFIT?
Bertholee, Rob; Dec 1, 2005; 18 pp.; In English; Meeting on Coalition C4ISR Architectures and Information Exchange Capabilities (Les architectures C4ISR et les capacites d'echange d'information en coalition), 27-28 Sept. 2004, The Hague, Netherlands; Original contains color illustrations
Report No.(s): AD-A469792; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469792

No abstract available
Command and Control; Intelligence

20070034963 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Real-Time Point Positioning Performance Evaluation of Single-Frequency Receivers Using NASA's Global Differential GPS System
Muellerschoen, Ronald J.; Iijima, Byron; Meyer, Robert; Bar-Sever, Yoaz; Accad, Elie; September 23, 2004; 9 pp.; In English; Ion GNSS 2004, 20-23 Sep. 2004, Long Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40494

This paper evaluates the performance of a single-frequency receiver using the 1-Hz differential corrections as provided by NASA's global differential GPS system. While the dual-frequency user has the ability to eliminate the ionosphere error by taking a linear combination of observables, the single-frequency user must remove or calibrate this error by other means. To remove the ionosphere error we take advantage of the fact that the magnitude of the group delay in range observable and the carrier phase advance have the same magnitude but are opposite in sign. A way to calibrate this error is to use a real-time database of grid points computed by JPL's RTI (Real-Time Ionosphere) software. In both cases we evaluate the positional accuracy of a kinematic carrier phase based point positioning method on a global extent.
Author
Global Positioning System; Real Time Operation; Receivers; Performance Tests; Computational Grids; Positioning; Frequencies; Data Bases; Calibrating

20070034971 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A 94 GHz RF Electronics Subsystem for the CloudSat Cloud Profiling Radar
LaBelle, Remi C.; Girard, Ralph; Arbery, Graham; October 29, 2003; 4 pp.; In English; The Institute of Electrical and Electronics Engineers (IEEE) European Microwave Conference, 6-10 Oct. 2003, Munich, Germany; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40462

The CloudSat spacecraft, scheduled for launch in 2004, will carry the 94 GHz Cloud Profiling Radar (CPR) instrument.

The design, assembly and test of the flight Radio Frequency Electronics Subsystem (RFES) for this instrument has been completed and is presented here. The RFES consists of an Upconverter (which includes an Exciter and two Drive Amplifiers (DA's)), a Receiver, and a Transmitter Calibrator assembly. Some key performance parameters of the RFES are as follows: dual 100 mW pulse-modulated drive outputs at 94 GHz, overall Receiver noise figure < 5.0 dB, a highly stable W-band noise source to provide knowledge accuracy of Receiver gain of < 0.4 dB over the 2 year mission life, and a W-band peak power detector to monitor the transmitter output power to within 0.5 dB over life. Some recent monolithic microwave integrated circuit (MMIC) designs were utilized which implement the DA's in 0.1 micron GaAs high electron-mobility transistor (HEMT) technology and the Receiver low-noise amplifier (LNA) in 0.1 micron InP HEMT technology.
Author
Radio Frequencies; CloudSat; Noise Generators; Receivers; Transmitters; Calibrating; Up-Converters

20070035002 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Acquisition, Tracking, and Pointing Using Earth Thermal Images for Deep Space Optical Communications
Ortiz, Gerry G.; Lee, Shinhak; October 26, 2003; 2 pp.; In English; 16th Annual Meeting of the Institute of Electrical and Electronics Engineers (IEEE) Lasers and Electro-Optics Society (LEOS), 26-30 Oct. 2003, Tucson, AZ, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40469

The feasibility of using long wavelength Earth thermal (infrared) images for telescope tracking/pointing application. for both Deep Space Free- pace Optical Communications has been investigated and is reported her. The advantage of this technology rests on using full Earth images in this band, which yield more accurate estimates of geometric centroids than that of Earth images in the visible band. Another major advantage is that these images are nearly independent of Earth phase angle. The results of the study show that at a Mars range, with currently available sensors, a noise equivalent angle of 10 to 150 nanoradians and a bias error of better than 80 nanoradians can be obtained. This enables precise pointing of the optical communications beam for high data rate links.
Author
Infrared Imagery; Optical Communication; Target Acquisition; Space Communication; Deep Space

20070035038 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RadSTAR L-Band Imaging Scatterometer: Performance Assessment
Rincon, Rafael; Hildebrand, Peter; Hilliard, Larry; [2007]; 2 pp.; In English; International Geoscience and Remote Sensing Symposium (IGARSS), 23-27 Jul. 2007, Barcelona, Spain; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070035038

RadSTAR is an instrument development program aimed at combining a radiometer and a scatterometer system into a highly compact configuration that uses a single, electronically scanned antenna to provide co-located and simultaneous measurements of emission and backscatter for airborne and spaceborne applications [I]. The program was designed to map soil moisture and ocean salinity, both important components of the water cycle, and to map sea ice density and thickness, an important factor in ocean-atmosphere heat exchange in Polar Regions. The accuracy in estimation of these and a number of other Earth science parameters can be greatly enhanced by providing the co-aligned radar/radiometer microwave measurements. For instance, radiometer estimates of soil moisture from soil emission are affected by emission from vegetation, and from the roughness of the surface. Complementary measurements using the scatterometer can be used to evaluate the vegetation and surface roughness effects. Hence, the combined observations can provide an improved estimate. As with soil moisture, the ocean salinity is a function of the microwave emission from the sea surface temperature (SST) and sea roughness. There, the addition of radar backscatter measurements of sea roughness enables the correction of the emissivity and provide more accurate estimates of ocean salinity. Similar arguments can be made for other important Earth science parameters. This paper discusses the RadSTAR program, the radar system design, calibration, and digital beamforming techniques, and presents preliminary analysis of the data collected during the test flights. The data sets obtained during the flights and during the radar calibration in the anechoic chamber are also employed to asses the performance of the radar. The paper also discusses the Digital Beamforming Synthetic Aperture Radar (DBSAR) processor, a real-time processor recently developed for the LIS instrument which enables beam synthesis, fine resolutions, and large swaths.
Author
Imaging Techniques; Scatterometers; Radiometers; Radar Measurement; Backscattering; Emissivity; Microwave Emission; Surface Roughness Effects; Soil Moisture

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*.

20070034154 Lockheed Martin Space Systems Co., Sunnyvale, CA, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Hubble Space Telescope Battery Capacity Update

Hollandsworth, Roger; Armantrout, Jon; Rao, Gopalakrishna M.; April 23, 2007; 28 pp.; In English; 2007 Space Power Workshop, 23-26 April 2007, Los Angeles, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): N AS5-5000; NAS8-32697; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034154

Orbital battery performance for the Hubble Space Telescope is discussed and battery life is predicted which supports decision to replace orbital batteries by 2009-2010 timeframe. Ground characterization testing of cells from the replacement battery build is discussed, with comparison of data from battery capacity characterization with cell studies of Cycle Life and 60% Stress Test at the Naval Weapons Surface Center (NWSC)-Crane, and cell Cycle Life testing at the Marshal Space Flight Center (MSFC). The contents of this presentation includes an update to the performance of the on-orbit batteries, as well as a discussion of the HST Service Mission 4 (SM4) batteries manufactured in 1996 and activated in 2000, and a second set of SM4 backup replacement batteries which began manufacture Jan 11, 2007, with delivery scheduled for July 2008.

Author

Hubble Space Telescope; Electric Batteries; Manufacturing; Life (Durability); Capacity; Onboard Equipment

20070034160 NASA Langley Research Center, Hampton, VA, USA

Wire Crimp Termination Verification Using Ultrasonic Inspection

Perey, Daniel F.; Cramer, K. Elliott; Yost, William T.; October 22, 2007; 12 pp.; In English; SAE Aerospace Electrical Interconnect System Symposium (AEISS), 22-26 October 2007, Savannah, GA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): FAA DTFACT-06-X-00003; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034160

The development of a new ultrasonic measurement technique to quantitatively assess wire crimp terminations is discussed. The amplitude change of a compressional ultrasonic wave propagating through the junction of a crimp termination and wire is shown to correlate with the results of a destructive pull test, which is a standard for assessing crimp wire junction quality. Various crimp junction pathologies such as undercrimping, missing wire strands, incomplete wire insertion, partial insulation removal, and incorrect wire gauge are ultrasonically tested, and their results are correlated with pull tests. Results show that the nondestructive ultrasonic measurement technique consistently (as evidenced with destructive testing) predicts good crimps when ultrasonic transmission is above a certain threshold amplitude level. A physics-based model, solved by finite element analysis, describes the compressional ultrasonic wave propagation through the junction during the crimping process. This model is in agreement within 6% of the ultrasonic measurements. A prototype instrument for applying this technique while wire crimps are installed is also presented. The instrument is based on a two-jaw type crimp tool suitable for butt-splice type connections. Finally, an approach for application to multipin indenter type crimps will be discussed.

Author

Compression Waves; Inspection; Ultrasonic Radiation; Folding; Stopping; Junctions; Electric Wire

20070034163 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; 15 pp.; In English; Applied Superconductivity Conference, Seattle, Washington, August 28 - September 1, 2006, 28 Aug. - 1 Sep. 2006, Seattle, WA, USA; Original contains color and black and white illustrations

Report No.(s): ASC 2006--1; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40252

This viewgraph presentation describes the fabrication of large area superconducting Niobium Nitride nanowire single photon detectors. The topics include: 1) Introduction and Motivation; 2) Operation of SNSPD Detectors; 3) NbTiN Deposition; 4) Fabrication Details; 5) Backside Coupled SNSPD; 6) Measurement Apparatus; 7) Electrical Response of a

15x15 micrometer SNSPD to 1064nm radiation; 8) Detector Efficiency vs Bias Current; 9) Interarrival Time Plot; 10) Detector Linearity; and 11) Conclusion.
CASI
Fabrication; Nanowires; Niobium; Nitrides; Photons; Superconductivity; Characterization; Detectors

20070034280 California Univ., San Diego, La Jolla, CA USA
Resonant Quantum Device Technologies
Fainman, Y; Sham, L J; Tu, C W; Mar 23, 2007; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0285; Proj-2304
Report No.(s): AD-A469747; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469747

From 2005-2006 success was made in incorporating the nanocrystal into Polymethl methacrylate (PMMA) matrix. The sensitivity of this composite to electron beams makes it attractive in the fabrication of photonic devices. From 2004-2005, numerical simulations were made for experimentally plausible system parameters for the network sending a single photon wavepacket and for entanglement between two nodes. The team continued optimizing the properties of the quantum dot composites and succeeded to make the nanocomposites in both PMMA and SU-8 hosts with high level of uniformity. A near field optical characterization tool for nanophotonic devices was developed. A study was started on excitation of ultrashort pulse surface plasmon polariton (SPP) fields as well as an investigation of ultrafast electrodynamics of the ultrashort SPP wavepackets. From 2003-2004 the team completed a theoretical study on nonlinear phase shift in the system with a quantum dot embedded in a two-sided cavity from the weak-coupling regime to the strong coupling regime. Additionally, the team developed an approach to manufacture photonic crystal-based on a two-step process consisting of holographic lithography patterning to define the photonic crystal lattice followed by optical direct-write of the functional elements.
DTIC
Nanotechnology; Photonics

20070034281 Michigan Technological Univ., Houghton, MI USA
A Vaporizing Liquid-Metal Anode for High-Power Hall Thrusters
King, Lyon B; Massey, Dean R; Kieckhafer, Alex W; Makela, Jason M; Jun 14, 2007; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0027
Report No.(s): AD-A469748; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469748

This report summarizes major findings from a three-year effort to develop and characterize a 2-kW bismuth Hall thruster. The device utilizes a set of segmented anodes, wherein discharge current can be shifted to control the temperature of a bismuth evaporator. Thruster performance on Xe is reported to establish a baseline attributable to segmented anode geometry separate from propellant species. Results are presented on bismuth, confirming the ability to maintain a self-sustaining metal-vapor plasma discharge using only waste heat from the thruster. Thermal failure of stainless-steel porous propellant diffusers is documented along with a fabrication strategy to construct diffusers using porous molybdenum. Results are presented for current and voltage behavior of a LaB6 cathode operating on bismuth vapors.
DTIC
Anodes; Hall Thrusters; Liquid Metals; Vaporizing

20070034316 Army Research Lab., Adelphi, MD USA
A Comparison of Light-Emitting Diode Power Supply Circuits
Harrison, Arthur; Jul 2007; 14 pp.; In English
Report No.(s): AD-A469794; ARL-TN-284; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469794

In applications where LEDs use a large proportion of power and cell life is an important consideration, a power-conserving technique utilizing a switched circuit offers a considerable improvement in cell life. Two circuits, one utilizing a conventional method of resistive current limiting, and the other utilizing a switching method, were constructed and evaluated. The switching method yielded a 39% improvement in the duration of LED illumination.
DTIC
Light Emitting Diodes; Power Supply Circuits; Supplying

20070034319 Rutgers - The State Univ., Piscataway, NJ USA

Advanced Metals and Ceramics for Armor and Anti-Armor Applications. High-Fidelity Design and Processing of Advanced Armor Ceramics

Niesz, D E; McCauley, J W; Jun 2007; 124 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0004; Proj-BH64

Report No.(s): AD-A469804; ARL-CR-594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469804

This is the final summary report of a 5-year (2001 2005) collaborative research program on advanced metals and ceramics for armor and anti-armor applications carried out in the U.S. Army Research Laboratory Material Center of Excellence at Rutgers and Johns Hopkins Universities under a cooperative-agreement contractual relationship. The focus of this center is on high-fidelity design and processing of advanced armor ceramics. The overarching goal has been to develop an improved understanding of selected key areas of the materials and processing science of ceramic armor materials. The areas investigated were selected jointly by the participating organizations with significant input from the ceramic armor community through a ceramic armor working group (CAWG) that included over 20 industrial organizations. They were selected as the most relevant, unclassified basic-research areas for improving the scientific understanding of the materials and processing science critical to the ballistic performance of ceramic armor materials. Length scales from the atomic to the macro were included in the investigation.

DTIC

Armor; Ceramics; Metals; Nanotechnology

20070034446 Department of the Navy, Washington, DC USA

Open Yaggi Antenna Array

Joseypenko, Michael J, Inventor; Jul 24, 2006; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020290; No Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADD020290

An open Yaggi antenna array is disclosed wherein the reflector element and parasitic director elements of the antenna array are opened in line with the feed point of the driven element so that the reflector and director elements do not cause a shunting effect on the driven element of the antenna.

DTIC

Antenna Arrays; Patent Applications

20070034461 Air Force Air Education and Training Command, Cary, NC USA

A New Sensor Based Upon a Rotating-Coil Electromagnetic Induction Concept

McDonald, Jim; Dec 2006; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469819; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research described in this report was conducted in support of SERDP SEED Broad Agency Announcement (BAA) dated November 7, 2003, Statement of Need UXSEED-05-01, which specifically called for development of new UXO sensors at the proof-of-concept level that will allow development of new or improved discrimination techniques for distinguishing intact ordnance from metallic scrap items. Modern UXO geophysical surveys are normally conducted under GPS control using arrays of magnetometers and/or EMI sensors. Typical vehicular towed arrays produce high density maps of 200,000 2,000,000 data points per acre when using EMI and magnetometer sensor arrays. Target analyses typically involve fitting of perceived magnetic anomalies to dipole signature models. To improve the ability to distinguish intact UXO from metallic scrap, statistical analysis approaches often are applied to the output parameters of the physics-based target-fitting algorithms to improve the classification ability. Although we can approach the 100% detection of UXO threats on fairly uncomplicated ranges, clearing the ranges still requires digging 5-25 non-UXO targets to recover each intact UXO. We have recently concluded that, using currently available magnetic and EMI sensors, little or no further performance gain is likely to be achieved using only the physics-based fitting parameters to make decisions about ordnance classification. Frequency-domain EMI sensors such as the GEM-3(TM) from Geophex Ltd. can operate at frequencies as low as 30 Hz. However, the signal-to-noise ratio of measurements at frequencies below 100 Hz is significantly degraded.

DTIC

Ammunition; Detectors; Magnetic Induction; Rotation

20070034482 Naval Research Lab., Washington, DC USA

The NRL Long-Wavelength Test Array

Stewart, K P; Hicks, B C; Crane, P C; Ray, P S; Gross, C; Polisensky, E; Cohen, A; Kassim, N E; Weiler, K W; Jun 22, 2007; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469880; NRL/FR/7210-07-10150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The NRL Long-Wavelength Test Array (NLTA) was constructed to develop and test active baluns and electrically short dipoles for possible use as the primary wideband receiving elements for an emerging suite of large HF/VHF arrays including the Low Frequency Array (LOFAR) and the Long-Wavelength Array (LWA). Several dipoles of various designs and dimensions have been built and tested. Their useful range is when the dipoles arms are between approximately 1/8 and one wavelength long and the feedpoint is less that one half wavelength above ground. The NLTA, operating as an interferometer, has observed fringes from the brightest celestial sources in the frequency range from 10 to 50 MHz. The antenna temperatures vary from about 10% to 100% of the average brightness temperature of the Galactic background. With these parameters, it is relatively easy to make the amplifier noise levels low enough so that final system temperature is dominated by the Galactic background.

DTIC

Antenna Arrays; Antenna Components; Test Stands

20070034485 Naval Research Lab., Washington, DC USA

Analysis of an Optical Channelization Technique for Microwave Applications

Rogge, Matthew S; Urick, Vincent J; Bucholtz, Frank; Jun 27, 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469886; NRL/MR/5652-07-9061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Increasing electrical bandwidth combined with improved optical filtering allow for a new class of optical channelizers for use in radiofrequency, microwave, and millimeter-wave applications. After a brief review of existing channelization technology, an optical channelizer that uses optical local oscillators and optical filters is analyzed. Linearity and other limitations of the scheme show a strong dependence on the linearity of the optical modulator. The optical modulator is explored in both the optical domain and in the electrical domain. For the channelizer, it is shown that consideration must be given to nonlinearities in the optical field itself.

DTIC

Broadband; Electro-Optics; Light Modulators; Linearity; Microwaves; Modulators; Optical Filters; Oscillators

20070034486 Naval Research Lab., Washington, DC USA

Radiometric Characterization of a New Photovoltaic Cell Unit for Powering Modulating Retroreflectors

Zhang, Xiaolei; Murphy, James; Gilbreath, G C; Jun 19, 2007; 18 pp.; In English

Contract(s)/Grant(s): Proj-72-6388

Report No.(s): AD-A469887; NRL/FR/7210-07-10149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe the experimental procedures and results of a detailed radiometric characterization of a new photovoltaic (PV) wafer unit intended for powering the Multiple Quantum Well (MQW) Modulating Retroreflector (MRR) using natural sunlight and/or system laser light as energy input, to enable autonomous operation of free-space optical data link using the MQW-MRR. Our initial measurements show that the PV wafer unit has an average power conversion efficiency of 7% to 8% over the entire visible-to-IR wavelength range from 200 nm to 3500 nm, and a conversion efficiency around 40% at the 1550 nm laser frequency. Comparisons of the different methods for radiometric characterization of the PV wafer unit are also given.

DTIC

Energy Conversion; Modulation; Photovoltaic Cells; Radiometers; Retroreflectors; Solar Cells

20070034561 California Univ., San Diego, La Jolla, CA USA

Wideband Electroabsorption Modulator for Analog Applications

Yu, P K; Shubin, I; Xie, X B; Chang, W S; May 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0055; Proj-WEMD

Report No.(s): AD-A469999; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There were two main technical objectives of this program with respect to the investigation of the high speed waveguide electroabsorption (EA) modulator, namely: (1) Design and fabrication of a waveguide modulator with a widened optical

waveguide for easy packaging and lower insertion loss, and (2) interfacing with Infotonics for their fiber packaging effort of the modulator. In addition, an examination of the limits to Radio Frequency (RF) link gain, noise figure and spurious free dynamic range (SFDR) of the EA modulator was accomplished. This program produced the following accomplishments: 1) Finished a design for the modulator with large optical waveguide to improve the coupling in materials structure of either bulk InGaAsP or multiple quantum wells. The design has been fabricated at UCSD and repeated at a commercial foundry. 2) Examined the limits of RF link gain, noise figure and SFDR of EA modulators.
DTIC
Analog Data; Broadband; Electromagnetic Absorption; Lasers; Light Modulation; Modulators; Optical Waveguides; Photoabsorption; Systems Engineering

20070034755 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Designing High Speed Printed Circuit Boards Using DxDesigner and Expedition
Navarro, Robert; March 13, 2007; 9 pp.; In English; 2007 Mentor Graphics International User Conference, 13 Mar. 2007, San Jose, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40338

Mentor's DxDesigner and Expedition schematic capture and printed circuit board tools were chosen to implement a custom high speed signal processing board containing many high pin count Field Programmable Gate Arrays and many high speed serial connections with data rates over 2 Gigasamples/sec. The methodology used to place the parts and route the board involved the interaction of both the DxDesigner and Expedition tools. The basic design philosophy was to specify as much as possible through design constraints at the schematic level. This paper will explore implementing that philosophy in both tools to facilitate part placement and trace routing.
Author
Design Analysis; Circuit Boards; Field-Programmable Gate Arrays; Printed Circuits; Signal Processing; Data Processing

20070034766 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Reconfigurable Patch-Slot Reflectarray Elements using RF MEMS Switches: A Subreflector Wavefront Controller
Rajagopalan, Harish; Rahmat-Samii, Yahya; Imbriale, William A.; June 10, 2007; 4 pp.; In English; IEEE AP-S International Conference, 10-15 Jun. 2007, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40341

The purpose of this paper is to investigate potential reflectarray elements by taking into consideration the eventual implementation of MEMS technology for this particular application and detailed characterization of one of the potential element designs.
Author
Antenna Arrays; Reflector Antennas; Subreflectors; Microelectromechanical Systems; Controllers

20070034793 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA; Paris VI Univ., France
A High Efficiency Multiple-Anode 260-340 GHz Frequency Tripler
Maestrini, Alain; Tripon-Canseliet, Charlotte; Ward, John S.; Gill, John J.; Mehdi, Imran; May 10, 2006; 4 pp.; In English; 17th International Symposium on Space Terahertz Technology, 10-12 May 2006, Paris, France; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40325

We report on the fabrication at the Jet Propulsion Laboratory of a fixed-tuned split-block waveguide balanced frequency tripler working in the 260-340 GHz band. This tripler will be the first stage of a x3x3x3 multiplier chain to 2.7 THz (the last stages of which are being fabricated at JPL) and is therefore optimized for high power operation. The multiplier features six GaAs Schottky planar diodes in a balanced configuration integrated on a GaAs membrane. Special attention was put on splitting the input power as evenly as possible among the diodes in order to ensure that no diode is overdriven. Preliminary RF tests indicate that the multiplier covers the expected bandwidth and that the efficiency is in the range 1.5-7.5 % with 100 mW of input power.
Author
Frequencies; Multipliers; Radio Frequencies; Bandwidth; Anodes; Schottky Diodes

20070034810 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Compact Low-loss Magic-T using Microstrip-Slotline Transitions

U-yen, Kongpop; Wollack, Edward J.; Moseley, Samuel H.; Papapolymerou, John; Laskar, Joy; June 3, 2007; 4 pp.; In English; International Microwave Symposium 2007, 3-8 Jun. 2007, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The design of a compact low-loss magic-T is proposed. The planar magic-T incorporates the compact microstrip-slotline tee junction and small microstrip-slotline transition area to reduce slotline radiation. The experimental results show that the magic-T produces broadband in-phase and out-of-phase power combiner/divider responses, has an average in-band insertion loss of 0.3 dB and small in-band phase and amplitude imbalance of less than plus or minus 1.6 deg. and plus or minus 0.3 dB, respectively.

Author

Magic Tees; Microstrip Transmission Lines; Electrical Engineering; Circuits; Fabrication; Mathematical Models; Ports (Openings)

20070034824 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Functional Recovery of Analog Circuits at Extreme Temperatures

Zebulum, Ricardo S.; Stoica, Adrian; Keymeulen, Didier; Ramesham, Rajeshuni; Neff, Joseph; Katkoori, Srinivas; November 2, 2006; 7 pp.; In English; Identifier Data: Artificial Neural Networks In Engineering (ANNIE), 5-8 Nov. 2006, St. Louis. MO; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40355

This paper describes a new reconfigurable analog array (RAA) architecture and integrated circuit (IC) used to map analog circuits that can adapt to extreme temperatures under programmable control. Algorithm-driven adaptation takes place on the RAA IC. The algorithms are implemented in a separate Field Programmable Gate Array (FPGA) IC, co-located with the RAA in the extreme temperature environment. The experiments demonstrate circuit adaptation over a wide temperature range, from extremely low temperature of -180 C to high 120 C.

Author

Analog Circuits; Integrated Circuits; Algorithms; Field-Programmable Gate Arrays

20070034839 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Characterization of Transducers and Resonators under High Drive Levels

Sherrit, Stewart; Bao, X.; Sigel, D. A.; Gradziel, M. J.; Askins, S. A.; Dolgin, B. P.; Bar-Cohen, Y.; October 7, 2001; 4 pp.; In English; IEEE International Ultrasonics Symposium, 7-10 Oct. 2001, Atlanta, GA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40392; http://dx.doi.org/10.1109/ULTSYM.2001.991910

In many applications, piezoelectric transducers are driven at AC voltage levels well beyond the level for which the material was nominally characterized. In this paper we describe an experimental setup that allows for the determination of the main transducer or resonator properties under large AC drive. A sinusoidal voltage from a waveform generator is amplified and applied across the transducer/resonator in series with a known high power resistor. The amplitude of applied voltage and the amplitude and the relative phase of the current through the resistor are monitored on a digital scope. The frequency of the applied signal is swept through resonance and the voltage/current signals are recorded. After corrections for the series resistance and parasitic elements the technique allows for the determination of the complex impedance spectra of the sample as a function of frequency. In addition, access to the current signal allows for the direct investigation of non-linear effects through the application of Fourier transform techniques on the current signal. Our results indicate that care is required when interpreting impedance data at high drive level due to the frequency dependence of the dissipated power. Although the transducer/resonator at a single frequency and after many cycles may reach thermal equilibrium, the spectra as a whole cannot be considered an isothermal measurement due to the temperature change with frequency. Methods to correct for this effect will be discussed. Results determined from resonators of both soft and hard PZT and a ultrasonic horn transducer are presented.

Author

Piezoelectric Transducers; Resonators; Alternating Current; Fourier Transformation; Electric Potential; Thermodynamic Equilibrium; Voltage Generators; Impedance

20070034957 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Statistical Approach to Characterizing the Reliability of Systems Utilizing HBT Devices

Chen, Yuan; Wang, Qing; Kayali, Sammy; October 24, 2004; 5 pp.; In English; 19th Annual Workshop on Compound Semiconductor Reliability, 24 Oct. 2004, Monterey, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40489

This paper presents a statistical approach to characterizing the reliability of systems with HBT devices. The proposed approach utilizes the statistical reliability information of the HBT individual devices, along with the analysis on the critical paths of the system, to provide more accurate and more comprehensive reliability information about the HBT systems compared to the conventional worst-case method.

Author

Statistical Tests; Reliability; Heterojunction Devices; Critical Path Method; Statistical Analysis; Bipolar Transistors; Semiconductor Devices

20070034959 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Electrochemically Grown Single Nanowire Sensors

Yun, Minhee; Lee, Choonsup; Vasquez, Richard P.; Penner, Reginald; Bangar, Mangesh; Mulchandani, Ashok; Myung, Nosang V.; October 24, 2004; 7 pp.; In English; SPIE Optic East, 25-28 Oct. 2004, Philadelphia, PA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40491

We report a fabrication technique that is potentially capable of producing arrays of individually addressable nanowire sensors with controlled dimensions, positions, alignments, and chemical compositions. The concept has been demonstrated with electrodeposition of palladium wires with 75 nm to 350 nm widths. We have also fabricated single and double conducting polymer nanowires (polyaniline and polypyrrole) with 100nm and 200nm widths using electrochemical direct growth. Using single Pd nanowires, we have also demonstrated hydrogen sensing. It is envisioned that these are the first steps towards nanowire sensor arrays capable of simultaneously detecting multiple chemical species.

Author

Nanowires; Conducting Polymers; Fabrication; Pyrroles; Chemical Composition

20070034967 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Multi-Anode Frequency Triplers at Sub-Millimeter Wavelengths

Maestrini, Alain; Tripon-Canseliet, Charlotte; Ward, John S.; Javadi, Hamid; Gill, John; Chattopadhyay, Goutam; Schlecht, Erich; Mehdi, Imran; May 2, 2005; 3 pp.; In English; 16th International Symposium on Space Terahertz Technology, 2-4 May 2005, Goteborg, Sweden; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40497

We report on the design methodology of fix-tuned split-block waveguide balanced frequency triplers working at 300,600 and 900 GHz. They feature four to six GaAs Schottky planar diodes in a balanced configuration. A 6-anode 300 GHz tripler, a 6-anode 560 GHz tripler and a 4-anode 900 GHz tripler will be fabricated with JPL membrane technology in order to minimize dielectric loading and ensure accurate thickness of the substrate. A 4-anode 600 GHz tripler was fabricated with JPL substrateless technology that delivers 0.8-1.6mW in the 540-640 GHz band at room temperature. When cooled to l2OK this tripler delivers 2-4mW from 540 to 640 GHz.

Author

Frequencies; Submillimeter Waves; Frequency Multipliers; Schottky Diodes; Oscillators; Dielectrics

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FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20070034220 Air Force Research Lab., Edwards AFB, CA USA

Atomization of Wall-Bounded Two-Phase Flows (Preprint)

Lightfoot, Malissa D; Nov 7, 2006; 64 pp.; In English

Report No.(s): AD-A469642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469642

The current understanding of droplet generation processes from liquid films is reviewed. Films are defined as liquids with

one free and one wall-bound surface. In many of the systems where films occur, atomization is an undesirable side-effect of the two-phase flow. The motivation for this study, however, is a process where atomization from the film is the goal--an injector used in a rocket combustion chamber. Because atomization is often unwanted in film configurations, few studies focus on the mechanisms that cause atomization in this set-up. The large body of literature on the atomization of jets and sheets is, therefore, utilized in this review. Similarities and differences between the geometries are discussed when applicable. Generally, the atomization is considered to involve two steps: the creation of a disturbance on the film surface and the breakdown of this disturbance into droplets. Prompt Atomization, where atomization occurs directly at a nozzle exit, is also briefly discussed. Several atomization mechanisms are identified from the literature. Theoretical descriptions are given where available, but, due to limitations in the current understanding and the complexity of the atomization process, these are somewhat incomplete. Consequently, important nondimensional groupings and a selection of empirical correlations are also given to aid in the understanding of film atomization.
DTIC
Atomizing; Two Phase Flow; Wall Flow

20070034265 Texas A&M Univ., College Station, TX USA
Active Control of Jet Engine Inlet Flows
Rediniotis, Othon; Bowersox, Rodney; Kirk, Aaron; Kumar, Abhinav; Tichenor, Nathan; Mar 31, 2007; 184 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0166
Report No.(s): AD-A469728; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469728

Serpentine or S-shaped engine inlet geometries are conducive to the emergence of significant secondary flow structures, leading to high pressure loss and flow distortion. Poor pressure recovery results in reduced overall engine performance and decreased fuel efficiency, while distortion at the engine face plane causes instabilities in the compressor dynamics that lower engine surge and stall limits. Using various methods such as computational fluid dynamics (CFD), flow visualization tests, particle image velocimetry (PIV), pressure probe and wall static tap experiments at various locations, the development and evolution of the secondary flow structures were observed. With this information, flow control devices were designed and constructed to control and suppress secondary flows and eliminate the associated pressure loss and flow non-uniformities that are detrimental to engine performance. The results of this effort are presented using a variety of industry standard performance descriptors that allow quantification of the gains achieved by flow control. Additionally, the PIV data will be used for future CFD code validation and modeling.
DTIC
Active Control; Engine Inlets; Flow; Inlet Flow; Jet Control; Jet Engines

20070034275 California Univ., Santa Barbara, CA USA
Surface/Fluid Interactions in Micro and Nano-Channels
Meinhart, Carl D; May 15, 2007; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9950-04-1-0106
Report No.(s): AD-A469739; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469739

This research project investigates the dynamics of surface/fluid interactions that occur in micro- and nano-channels. For example, micron-resolution particle image velocimetry (micro-PIV) results suggest that a hydrophilic fluid flowing over a solid hydrophobic surface in micro- and nano-channels can create slip flow whereby the no-slip boundary condition may not be valid. The slip flow may be a result of a low-viscosity nanoscale gaseous layer forming between the fluid and the microchannel surface. The microscale allows for free-surfaces to be controlled by surface tension. The free-surface fluidic architecture can be combined with Surface-Enhanced Raman Spectroscopy (SERS) to allow the real-time profiling of atmospheric species and detection of airborne agents. The system has been used to detect 4-aminobenzenethiol, a chemical species similar in size and structure to trinitrotoluene (TNT).
DTIC
Microchannels; Surface Reactions

20070034282 Massachusetts Univ., Amherst, MA USA
An Oriented-Eddy Collision Model for Turbulence Prediction
Perot, Blair; Jun 15, 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-04-1-0267
Report No.(s): AD-A469751; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469751

This report describes the development of an entirely new approach to modeling turbulence, that has far less empiricism and contains more physics, but costs far less than large eddy simulation.
DTIC
Collisions; Computational Fluid Dynamics; Mathematical Models; Turbulence; Turbulent Flow; Vortices

20070034487 North Carolina Univ., Chapel Hill, NC USA
On Weak Plane Couette and Poiseuille Flows of Rigid Rod and Platelet Ensembles
Cui, Zhenlu; Forest, M G; Wang, Qi; Zhou, Hong; Jan 2006; 35 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0086; F49620-03-1-0098
Report No.(s): AD-A469889; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Films and molds of nematic polymer materials are notorious for heterogeneity in the orientational distribution of the rigid rod or platelet macromolecules. Predictive tools for structure length scales generated by shear-dominated processing are vitally important: both during processing because of flow feedback phenomena such as shear thinning or thickening, and postprocessing since gradients in the rod or platelet ensemble translate to nonuniform composite properties and to residual stresses in the material. These issues motivate our analysis of two prototypes for planar shear processing: drag-driven Couette and pressure-driven Poiseuille flows. Hydrodynamic theories for high aspect ratio rod and platelet macromolecules in viscous solvents are well developed, which we apply in this paper to model the coupling between short-range excluded volume interactions, anisotropic distortional elasticity 'unequal elasticity constants', wall anchoring conditions, and hydrodynamics. The goal of this paper is to generalize scaling properties of steady flow molecular structures in slow Couette flows with equal elasticity constants [M. G. Forest et al., J. Rheol., 48 '2004', pp. 175-192] in several ways: to contrast isotropic and anisotropic elasticity; to compare Couette versus Poiseuille flow; and to consider dynamics and stability of these steady states within the asymptotic model equations.
DTIC
Couette Flow; Laminar Flow; Platelets; Rods

20070034499 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
CFD Investigation of Effect of Depth to Diameter Ratio on Dimple Flow Dynamics
Etter, Robert B; Jun 2007; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469906; AFIT/GAE/ENY/07-J07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study aimed to further the understanding of laminar flow through a dimple with the goal of mitigating flow separation. Dimples of various depth to diameter ratios (0.05, 0.15) were examined for three different dimple diameters and chordwise locations, corresponding to diameter based (ReD) and chordwise location based (Rex) Reynolds number combinations of ReD 20500\Rex 5000, ReD 20500 Rex 77000, and ReD 9000 Rex 21000. For the last combination, a dimple of depth to diameter ratio of 0.25 was also examined. The dimples were placed in a flat plate located in a diverging channel causing an adverse pressure gradient encouraging flow separation near the dimple location. The flow was modeled in the commercial CFD solver Fluent. Results indicate that dimple depth to diameter ratio has a significant effect on the structure of dimple flow. The shallowest dimples showed little change to the overall flow in the channel. Deeper dimples contained dynamic vortical flow structures with behavior varying between each dimple studied. This dynamic vortex activity was observed to be linked with variances in downstream flow. The 0.15 depth to diameter ratio dimples showed behavior very similar to 0.10 ratio dimples investigated elsewhere. The 0.25 dimple show flow different in nature than 0.15 dimples for the same ReD and Rex; the differences were not as stark as those between 0.05 and 0.15 dimples. In light of this and other studies, dimple flow behavior is found to depend on a combination of parameters that eludes direct quantitative parameterization. However, the conclusion is drawn that the most effective dimple will be just deep enough to develop dynamic vortical activity and vortex shedding.
DTIC
Boundary Layer Separation; Computational Fluid Dynamics; Depth; Fluid Dynamics; Laminar Flow; Separated Flow

20070034701 NASA Dryden Flight Research Center, Edwards, CA, USA

Wind-Tunnel Results of the B-52B with the X-43A Stack

Davis, Mark C.; Sim, Alexander G.; Rhode, Matthew; Johnson, Kevin D., Sr.; Journal of Spacecraft and Rockets 2007; August 2007; ISSN 0022-4650; Volume 44, No. 4, pp. 871-877; In English; 24th AIAA Applied Aerodynamics Conference (Paper 3850), 5-8 Jun. 2006, San Francisco, CA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034701; http://dx.doi.org/10.2514/1.27191

A low-speed wind-tunnel test was performed with a 3%-scale model of a booster rocket mated to an X-43A research vehicle, a combination referred to as the Hyper-X launch vehicle. The test was conducted both in freestream air and in the presence of a partial model of the B-52B airplane. The objectives of the test were to obtain force and moment data to generate structural loads affecting the pylon of the B-52B airplane and to determine the aerodynamic influence of the B-52B on the Hyper-X launch vehicle for evaluating launch separation characteristics. The windtunnel test was conducted at a low-speed wind tunnel in Hampton, Virginia. All moments and forces reported are based either on the aerodynamic influence of the B-52B airplane or are for the Hyper-X launch vehicle in freestream air. Overall, the test showed that the B-52B airplane imparts a strong downwash onto the Hyper-X launch vehicle, reducing the net lift of the Hyper-X launch vehicle. Pitching and rolling moments are also imparted onto the booster and are a strong function of the launch-drop angle of attack.

Author

Wind Tunnel Tests; X-43 Vehicle; B-52 Aircraft; Low Speed Wind Tunnels; Scale Models; Booster Rocket Engines

20070034826 NASA Langley Research Center, Hampton, VA, USA

Subscale Ship Airwake Studies Using Novel Vortex Flow Devices with Smoke, Laser-Vapor-Screen and Particle Image Velocimetry

Lamar, John E.; Landman, Drew; Swift, Russell S.; Parikh, Paresh C.; [2007]; 42 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Ships produce vortices and air-wakes while either underway or stationary in a wind. These flow fields can be detrimental to the conduction of air operations in that they can adversely impact the air vehicles and flight crews. There are potential solutions to these problems for both frigates/destroyers and carriers through the use of novel vortex flow or flow control devices. This appendix highlights several devices which may have application and points out that traditional wind-tunnel testing using smoke, laser-vapor screen, and Particle Image Velocimetry can be useful in sorting out the effectiveness of different devices.

Author

Vortices; Turbulent Wakes; Flow Visualization; Ships; Flow Distribution; Flow Measurement; Wind Tunnel Tests

20070034831 Centre National de la Recherche Scientifique, Poitiers, France; NASA Langley Research Center, Hampton, VA, USA

Current Trends in Modeling Research for Turbulent Aerodynamic Flows

Gatski, Thomas B.; Rumsey, Christopher L.; Manceau, Remi; [2007]; 31 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The engineering tools of choice for the computation of practical engineering flows have begun to migrate from those based on the traditional Reynolds-averaged Navier-Stokes approach to methodologies capable, in theory if not in practice, of accurately predicting some instantaneous scales of motion in the flow. The migration has largely been driven by both the success of Reynolds-averaged methods over a wide variety of flows as well as the inherent limitations of the method itself. Practitioners, emboldened by their ability to predict a wide-variety of statistically steady, equilibrium turbulent flows, have now turned their attention to flow control and non-equilibrium flows, that is, separation control. This review gives some current priorities in traditional Reynolds-averaged modeling research as well as some methodologies being applied to a new class of turbulent flow control problems.

Author

Turbulent Flow; Large Eddy Simulation; Navier-Stokes Equation; Computational Fluid Dynamics; Turbulence Models; Direct Numerical Simulation

20070034837 NASA Glenn Research Center, Cleveland, OH, USA

Offset Stream Technology Test-Summary of Results

Brown, Clifford A.; Bridges, James E.; Henderson, Brenda; October 2007; 29 pp.; In English; 13th AIAA/CEAS Aeroacoustics Conference, 21-23 May 2007, Rome, Italy; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.02

Report No.(s): NASA/TM-2007-214992; AIAA Paper-2007-3664; E-16156; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034837

Statistical jet noise prediction codes that accurately predict spectral directivity for both cold and hot jets are highly sought both in industry and academia. Their formulation, whether based upon manipulations of the Navier-Stokes equations or upon heuristic arguments, require substantial experimental observation of jet turbulence statistics. Unfortunately, the statistics of most interest involve the space-time correlation of flow quantities, especially velocity. Until the last 10 years, all turbulence statistics were made with single-point probes, such as hotwires or laser Doppler anemometry. Particle image velocimetry (PIV) brought many new insights with its ability to measure velocity fields over large regions of jets simultaneously; however, it could not measure velocity at rates higher than a few fields per second, making it unsuitable for obtaining temporal spectra and correlations. The development of time-resolved PIV, herein called TR-PIV, has removed this limitation, enabling measurement of velocity fields at high resolution in both space and time. In this paper, ground-breaking results from the application of TR-PIV to single-flow hot jets are used to explore the impact of heat on turbulent statistics of interest to jet noise models. First, a brief summary of validation studies is reported, undertaken to show that the new technique produces the same trusted results as hotwire at cold, low-speed jets. Second, velocity spectra from cold and hot jets are compared to see the effect of heat on the spectra. It is seen that heated jets possess 10 percent more turbulence intensity compared to the unheated jets with the same velocity. The spectral shapes, when normalized using Strouhal scaling, are insensitive to temperature if the stream-wise location is normalized relative to the potential core length. Similarly, second order velocity correlations, of interest in modeling of jet noise sources, are also insensitive to temperature as well.

Author

Jet Aircraft Noise; Aeroacoustics; Particle Image Velocimetry; Technology Utilization; Computational Fluid Dynamics

20070034862 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Scalar Dissipation Modeling for Passive and Active Scalars: a priori Study Using Direct Numerical Simulation

Selle, L. C.; Bellan, Josette; August 6, 2006; 12 pp.; In English; Combustion Institute International Symposium on Combustion, Heidelberg, 6-11 Aug. 2006, Heidelberg, Germany; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40438

Transitional databases from Direct Numerical Simulation (DNS) of three-dimensional mixing layers for single-phase flows and two-phase flows with evaporation are analyzed and used to examine the typical hypothesis that the scalar dissipation Probability Distribution Function (PDF) may be modeled as a Gaussian. The databases encompass a single-component fuel and four multicomponent fuels, two initial Reynolds numbers (Re), two mass loadings for two-phase flows and two free-stream gas temperatures. Using the DNS calculated moments of the scalar-dissipation PDF, it is shown, consistent with existing experimental information on single-phase flows, that the Gaussian is a modest approximation of the DNS-extracted PDF, particularly poor in the range of the high scalar-dissipation values, which are significant for turbulent reaction rate modeling in non-premixed flows using flamelet models. With the same DNS calculated moments of the scalar-dissipation PDF and making a change of variables, a model of this PDF is proposed in the form of the (beta)-PDF which is shown to approximate much better the DNS-extracted PDF, particularly in the regime of the high scalar-dissipation values. Several types of statistical measures are calculated over the ensemble of the fourteen databases. For each statistical measure, the proposed (beta)-PDF model is shown to be much superior to the Gaussian in approximating the DNS-extracted PDF. Additionally, the agreement between the DNS-extracted PDF and the (beta)-PDF even improves when the comparison is performed for higher initial Re layers, whereas the comparison with the Gaussian is independent of the initial Re values. For two-phase flows, the comparison between the DNS-extracted PDF and the (beta)-PDF also improves with increasing free-stream gas temperature and mass loading. The higher fidelity approximation of the DNS-extracted PDF by the (beta)-PDF with increasing Re, gas temperature and mass loading bodes well for turbulent reaction rate modeling.

Author

Direct Numerical Simulation; Data Bases; Distribution Functions; Probability Theory; Two Phase Flow; Mass Flow; Evaporation

20070034926 NASA Glenn Research Center, Cleveland, OH, USA

Development of Techniques to Investigate Sonoluminescence as a Source of Energy Harvesting

Wrbanek, John D.; Fralick, Gustave C.; Wrbanek, Susan Y.; October 2007; 24 pp.; In English; 43rd Joint Propulsion Conference, 8-11 Jul. 2007, Cincinnati, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.03.02

Report No.(s): NASA/TM-2007-214982; AIAA Paper-2007-5596; E-16164; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034926

Instrumentation techniques are being developed at NASA Glenn Research Center to measure optical, radiation, and thermal properties of the phenomena of sonoluminescence, the light generated using acoustic cavitation. Initial efforts have been directed to the generation of the effect and the imaging of the glow in water and solvents. Several images have been produced of the effect showing the location within containers, without the additions of light enhancers to the liquid. Evidence of high energy generation in the modification of thin films from sonoluminescence in heavy water was seen that was not seen in light water. Bright, localized sonoluminescence was generated using glycerin for possible applications to energy harvesting. Issues to be resolved for an energy harvesting concept will be addressed.

Author

Sonoluminescence; Thermodynamic Properties; Temperature Effects; Cavitation Flow; Solvents; Optical Properties; Radiation Spectra

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INSTRUMENTATION AND PHOTOGRAPHY

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

20070034152 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The QUaD (QUEST at DASI) Experiment

Hinderks, James; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA

Contract(s)/Grant(s): NNH06CC03B; No Copyright; Avail.: Other Sources; Abstract Only

The QUaD (QUEST at DASI) experiment is a millimeter-wave polarimeter designed to probe the cosmic microwave background (CMB) polarization over a multipole range of 100 to 2500. QUaD observes the CMB with an array of 3 1 polarization-sensitive bolometers split between two frequency bands centered at 100 and 150-GHz. The telescope is a 2.6 m on-axis Cassegrain design with beam sizes of 6.3' and 4.2' at the two respective observing frequencies. QUaD was commissioned at the South Pole in the Austral summer of 2004/2005. It has since completed two full seasons of observations with a third season underway. I will report on the status of QUaD observations and analysis. QUaD is a collaboration between institutions in the US, the UK and Ireland and is funded by the NSF, PPARC and Enterprise Ireland.

Author

Cosmic Microwave Background Radiation; Polarimeters; Probes; Telescopes

20070034205 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Four Years of Absolutely Calibrated Hyperspectral Data from the Atmospheric Infrared Sounder (AIRS) on the Eos Aqua

Aumann, Hartmut H.; Broberg, Steve; Elliott, Denis; Gregorich, Dave; July 24, 2006; 37 pp.; In English; AGU Western Pacific Geophysics Meeting (WPGM). Satellite Instrument Calibration: The Challenges of Global Climate Change and Numerical Weather Prediction, 24-27 Jul. 2006, Beijing, China; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40284

This viewgraph presentation reviews four years of absolute calibration of hyperspectral data from the AIRS instrument located on the EOS AQUA spacecraft. The following topics are discussed: 1) A quick overview of AIRS; 2) What absolute calibration accuracy and stability are required for climate applications?; 3) Validating of radiance accuracy and stability: Results from four years of AIRS data; and 4) Conclusions.

CASI

Aqua Spacecraft; Calibrating; Infrared Instruments; Airborne Integrated Reconnaissance System

20070034222 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wessling, Germany
Hyperspectral Sensors for Military Applications
Richter, R; Oct 1, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469649; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469649
No abstract available
Detection; Imagery; Military Technology; Remote Sensors; Target Acquisition

20070034449 Department of the Navy, Washington, DC USA
Point Source Localization Sonar System and Method
Bernecky, W R, Inventor; Jun 25, 2007; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-D020294; No Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADD020294
A matched-field based sonar system and method of use that supports real-time, three-dimensional acoustic source localization using a mobile, horizontal- array. The system receives and processes acoustic array, non-acoustic array, and own-ship navigational data in the matched-field process (MFP) Driven by own-ship and array status, a global bathymetry database and an acoustic environmental model are used to generate replicas for the MFP. If a three-dimensional tracker is assigned, then the tracker will steer the search region to maintain contact on the target of interest. Displays are provided to the user including tracker displays (which provide tracker information), MFP ambiguity surface displays (which support contact localization) and non-acoustic and navigational displays. A control interface allows a user to control the search region in bearing, range, depth, and frequency; assign the three-dimensional tracker function; and control display processing.
DTIC
Patent Applications; Point Sources; Position (Location); Sonar

20070034459 Army Research Lab., Adelphi, MD USA
Classification of Polar Stratospheric Clouds Using LIDAR Measurements From the SAGE III Ozone Loss and Validation Experiment
Felton, Jr , Melvin A; Kovacs, Thomas A; Omar, Ali H; Hostetler, Chris A; Jun 2007; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469817; ARL-TR-4154; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Backscatter LIDAR measurements from the stratospheric aerosol and gas experiment (SAGE) III ozone loss and validation experiment (SOLVE) have been used to identify classes of polar stratospheric clouds (PSCs) and their corresponding characteristics. Volume backscatter at 532 nm (Beta532) and 1064 nm (Beta1064), scattering ratio at 532 nm (R532) and 1064 nm (R1064), aerosol depolarization (delta(a)), and color ratio (Beta532/Beta1064), and temperature (T) were used to categorize PSCs via principal component analysis (PCA) and Cluster Analysis (CA). The clusters found in this study are consistent with previous studies of PSCs of types Ia (R532 < 1.5 and delta(a) > 0.1), Ia-enhanced (R532 > 1.4 and delta(a) > 0.1), Ib (R532 > 2 and delta(a) < 0.025), and II (532 > 7 and delta(a) > 0.1). In addition, a cluster predominantly found on the outside edges of clouds, which does not fit the definition of these PSCs, which has low R532 and delta(a) values, was found. The clustering analysis of PSC data provides an objective and automated method for the production of image plots that show a two-dimensional distribution of the PSC particle types. Such capabilities will be useful for analyzing large data sets such as will be produced by space-borne LIDARS (laser identification and ranging system).
DTIC
Classifications; Ice Clouds; Losses; Optical Radar; Ozone; Polar Meteorology; Radar Measurement; Stratosphere

20070034473 Dillon Consulting Limited, Cambridge, Ontario Canada
Determining the Properties and Capabilities of an Existing Experimental Large Loop EM61 Underwater UXO Detector
Dec 2006; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-MM-1385
Report No.(s): AD-A469854; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In response to UXSON-04-03, Dillon Consulting Ltd (DCL) investigated the response of a prototype Large Loop EM61 Marine System. The system was originally conceived in 2002 for a marine UXO survey of Wright's Cove near Halifax, Nova Scotia, to detect accumulations of metal on or below the sea floor at depths of 1 to 15 meters of water. The survey presented

new challenges in that the water depths required that sensors be deployed at significant depths, but at the same time contact with the seabed was to be minimized. Dillon Consulting Limited, with assistance from Geonics Limited, modified a high power Geonics EM61-MK2 System by adding a large primary loop transmitter floating on a barge and a submerged receiver mounted on a planing board that was towed beneath the transmitter. The entire system can be purchased for well under $100K (rented for much less) and does not require a special boat for deployment. The specific purpose of this research is to determine if the system response of this equipment can be understood and if necessary improved sufficiently to be used for detailed mapping and demonstration phases. The technology targets the near shore environments of critical concern to SERDP, addressing both very shallow (<15 feet, 5 m) and shallow (16-60 feet, 5-20m) water depths. It provides a novel engineering-based technique and platform that overcomes access limitations for locating UXO present in underwater locations. The project also explores the variations of EM response in underwater environments that must be resolved as a necessary precursor to efforts in improving detection and discrimination in underwater UXO-contaminated areas.
DTIC
Ammunition; Detectors

20070034526 Johns Hopkins Univ., Laurel, MD USA
Three-Dimensional Steerable Magnetic Field (3DSMF)Sensor System for Classification of Buried Metal Targets
Nelson, Carl V; Mendat, Deborah P; Huynh, Toan B; Ramac-Thomas, Liane C; Beaty, James D; Craig, Joseph N; Jul 2006; 77 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DACA72-02-C-0030; Proj-MM-1314
Report No.(s): AD-A469950; JHU-NSTD-05-693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Johns Hopkins University/Applied Physics Laboratory (JHU/APL) has developed a novel approach to metal target classification via an advanced Three-Dimensional Steerable Magnetic Field (3DSMF) Sensor System. The 3DSMF is a time-domain (TD) electromagnetic induction (EMI) sensor configured with a three-axis magnetic field generator and three receivers that measures the multiple components of buried unexploded ordnance (UXO) magnetic polarizability tensors (MPT). This final report summarizes work completed throughout the project. The results from the current year show promise of confirming the 3DSMF identification concept when using libraries of target time decay constants. The spatial orientation of targets was determined at different depths using library constants which had been derived from calibration measurements made with that target at a single depth. There is also evidence that the orientation of a target can be determined even if the target is off-center of the antenna. Further data collection and analysis would characterize the effectiveness of the 3DSMF Sensor System in discriminating between different targets.
DTIC
Classifications; Magnetic Fields; Ordnance; Targets

20070034527 Sky Research, Ashland, OR USA
A Unified Approach to UXO Discrimination Using the Method of Auxiliary Sources
Pasion, Leonard R; Song, Lin-Ping; Lhomme, Nicolas; Shubitidze, Fridon; Oldenburg, Douglas W; Oct 12, 2006; 103 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-MM-1446; Proj-X-1446
Report No.(s): AD-A469952; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research described in this report was conducted in support of Strategic Environmental Research and Development Program (SERDP) SEED Broad Agency Announcement (BAA), Statement of Need UXSEED-05-02, Innovative Approaches to Unexploded Ordnance (UXO) Cleanup. A SERDP SEED research and development project UX-1446 entitled A Unified Approach to UXO Discrimination Using the Method of Auxiliary Sources was proposed in response to the above BAA. The main emphasis of this research was to explore the fundamental characteristics of the Surface Magnetic Charge (SMC) and Standard Excitation Approach (SEA) methods when applied to UXO discrimination problems. Both methods were derived from the Method of Auxiliary Sources (MAS), and thus represent the secondary magnetic fields from a compact metallic target with a surface of magnetic charge. The SEA and SMC are relatively new modeling techniques for UXO discrimination. Therefore, we investigated some fundamental, as well as practical, characteristics of the forward model. These include the accuracy with which the methods can model sensor data, the speed to carry out the forward modeling, and the type of discrimination algorithms amenable to each of the forward modeling methods. For the SEA, we wanted to determine the ease with which the sources can be derived for a particular target. For the SMC, we wanted to determine if the surface magnetic charge distribution is a good discriminant, and, if so, what algorithm is required to obtain a stable estimate of the magnetic charge.
DTIC
Ammunition; Ordnance

20070034812 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The GLAST Guest Investigator Program
Band, David L., et al.; [2007]; 2 pp.; In English
Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: A01, Hardcopy

We provide an overview of the GLAST Guest Investigator (GI) program, which will support basic research relevant to the GLAST mission in yearly cycles beginning approximately two months after launch. Current details about the GLAST GI program will always be posted on the GLAST Science Support Center (GSSC) website: http://glast.gsfc.nasa.gov/ssc/.
Author
Gamma Ray Telescopes; Spaceborne Telescopes; General Overviews; NASA Programs

20070034816 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fabry-Perot Based Radiometers for Precise Measurement of Greenhouse Gases
Heaps, William S.; Wilson, Emily L.; Georgieva, Elena; June 25, 2007; 1 pp.; In English; Fourth International Workshop on Greenhouse Gas Measurements from Space, 25-27 Jun. 2007, Paris, France; Copyright; Avail.: Other Sources; Abstract Only

Differential radiometers based upon the Fabry-Perot interferometer have been developed and demonstrated that exhibit very great sensitivity to changes in the atmospheric column of carbon dioxide, oxygen, and water vapor. These instruments employ a solid Fabry-Perot etalon that is tuned to the proper wavelength by changing the temperature. By choosing the thickness of the etalon its multiple pass bands can be made to align with regularly space absorption features of the molecule under investigation. Use of multiple absorption features improves the optical throughput of the instrument and improves the stability of the instrument response with respect to environmental changes. Efforts are underway at Goddard to extend this technique to the carbon 13 isotope of carbon dioxide and to methane. These instruments are intrinsically rugged and can be made rather small and inexpensively. They therefore hold promise for widespread use in ground based networks for calibration of satellite instruments such as OCO and GOSAT. Results will be presented for ground based and airborne operations for these systems. The effects of atmospheric scattering, pointing errors, pressure broadening and temperature effects will be discussed with regard to achieving precision better than .5% required for validation of carbon dioxide column measured from space. Designs permitting the extension of the technique to an even larger number of atmospheric species will be discussed along with theoretical analysis of potential system performance.
Author
Fabry-Perot Interferometers; Greenhouse Effect; Radiometers; Precision

20070034821 Optimal Synthesis, Inc., Palo Alto, CA, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
Control of Formation-Flying Multi-Element Space Interferometers with Direct Interferometer-Output Feedback
Lu, Hui-Ling; Cheng, Victor H. L.; Lyon, Richard G.; Carpenter, Kenneth G.; September 24, 2007; 15 pp.; In English; 20th International Symposium on Space Flight Dynamics, 24-28 Sep. 2007, Annapolis, MD, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The long-baseline space interferometer concept involving formation flying of multiple spacecrafts holds great promise as future space missions for high-resolution imagery. A major challenge of obtaining high-quality interferometric synthesized images from long-baseline space interferometers is to accurately control these spacecraft and their optics payloads in the specified configuration. Our research focuses on the determination of the optical errors to achieve fine control of long-baseline space interferometers without resorting to additional sensing equipment. We present a suite of estimation tools that can effectively extract from the raw interferometric image relative x/y, piston translational and tip/tilt deviations at the exit pupil aperture. The use of these error estimates in achieving control of the interferometer elements is demonstrated using simulated as well as laboratory-collected interferometric stellar images.
Author
Feedback; Formation Flying; Interferometers; Mathematical Models; Stellar Atmospheres; Imagery

20070034910 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Science with Constellation-X, Choice of Instrumentation
Hornscheimeier, Ann; White, Nicholas; Tananbaum, Harvey; Garcia, Michael; Bookbinder, Jay; Petre, Robert; Cottam, Jean; June 14, 2007; 1 pp.; In English; 40 Years of X-Ray Astronomy, 14-15 June 2007, State College, PA, USA; Copyright; Avail.: Other Sources; Abstract Only

The Constellation X-ray Observatory is one of the two Beyond Einstein Great Observatories and will provide a 100-fold

increase in collecting area in high spectral resolving power X-ray instruments over the Chandra and XMM-Newton gratings instruments. The mission has four main science objectives which drive the requirements for the mission. This contribution to the Garmire celebration conference describes these four science areas: Black Holes, Dark Energy, Missing Baryons, and the Neutron Star Equation of State as well as the requirements flow-down that give rise to the choice of instrumentation and implementation for Constellation-X. As we show, each of these science areas place complementary constraints on mission performance parameters such as collecting area, spectral resolving power, timing resolution, and field of view. The mission's capabilities will enable a great breadth of science, and its resources will be open to the community through its General Observer program.
Author
Constellation-X; Instrument Packages; Aerospace Sciences; Space Missions; X Ray Astronomy

20070034943 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Space Infrared Interferometric Telescope (SPIRIT)
Rinehart, Stephen; June 25, 2007; 1 pp.; In English; Extreme Solar Systems, 25-29 June 1007, Santorini, Greece; No Copyright; Avail.: Other Sources; Abstract Only

The Space Infrared Interferometric Telescope (SPIRIT) is a candidate NASA Origins Probe Mission. SPIRIT is a two-telescope Michelson interferometer covering wavelengths from 25-400 microns, providing simultaneously high spectral resolution and high angular resolution. With comparable sensitivity to Spitzer, but two orders of magnitude improvement in angular resolution, SPIRIT will enable us to address a wide array of compelling scientific questions, including how planetary systems form in disks and how new planets interact with the disk. Further, SPIRIT will lay the technological groundwork for an array of future interferometry missions with ambitious scientific goals, including the Terrestrial Planet Finder Interferometer / Darwin, and the Submillimeter Probe of the Evolution of Cosmic Structure.
Author
Infrared Telescopes; Michelson Interferometers; Spaceborne Telescopes; Space Probes

20070034979 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Development of Microshutters for the Near Infrared Spectrograph on the James Webb Space Telescope
Silverberg, Robert F.; Moseley, S.; Arendt, R. G.; Franz, D.; Jhabvala, M.; Kletetschka, G.; Kutyrev, A.; Li, M. J.; Rapchun, D.; Snodgrass, S.; Sohl, D.; Sparr, L.; May 27, 2007; 1 pp.; In English; American Astronomical Society Meeting, 27-31 May 2007, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

One of the James Webb Space Telescope's (JWST) primary science goals is to characterize the epoch of galaxy formation in the universe and observe the first galaxies and clusters of galaxies. This goal requires multi-band imaging and spectroscopic data in the near infrared portion of the spectrum for large numbers of very faint galaxies. Because such objects are sparse on the sky at the JWST resolution, a multi-object spectrograph is necessary to efficiently carry out the required observations. We have developed a fully programmable microshutter array that will be used as the field selector for the Near Infrared Spectrograph (NIRSpec) on JWST. This device allows slits to be opened at the locations of selected galaxies in the field of view while blocking other unwanted light from the sky background and bright sources. In practice, greater than 100 objects within the field of view will be observed simultaneously. In this paper, we describe the microshutter arrays, their development, fabrication, testing, and progress toward delivery of flight qualified devices to the NIRSpec instrument team in 2008.
Author
James Webb Space Telescope; Near Infrared Radiation; Spectrographs; Galactic Clusters; Fabrication

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LASERS AND MASERS

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

20070034248 Photonic Associates, Santa Fe, NM USA
Laser Space Propulsion Overview (Postprint)
Phipps, Claude; Luke, James; Helgeson, Wesley; Sep 2006; 12 pp.; In English
Contract(s)/Grant(s): FA9300-04-C-0030
Report No.(s): AD-A469705; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469705

In this paper, we review the history of laser space propulsion from its earliest theoretical conceptions to modern practical

applications. Applications begin with the 'Lightcraft' flights of Myrabo and include practical thrusters for satellites now completing development as well as proposals for space debris removal and direct launch of payloads into orbit. We consider laser space propulsion in the most general sense, in which laser radiation is used to propel a vehicle in space. In this sense, the topic includes early proposals for pure photon propulsion, laser ablation propulsion, as well as propulsion using lasers to detonate a gas, expel a liquid, heat and expel a gas, or even to propagate power to a remote conventional electric thruster.
DTIC

Laser Propulsion; Launching; Propulsion System Configurations; Propulsion System Performance

20070034253 Omni Sciences, Inc., Ann Arbor, MI USA

Mid-Infrared Fiber Laser Based on Super-Continuum

Freeman, Michael J; Jan 31, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W31P4Q-05-C-0159; ARPA ORDER-S039-39

Report No.(s): AD-A469712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469712

The overall goal of the Phase I Supplement was to improve the performance of the bench-top, mid-infrared fiber laser system that had been developed under the Phase I program. The program succeeded in demonstrating an all-fiber integrated Mid-InfraRed Fiber Laser (MIRFIL), see Figure 1, with no optical bench, such that bulk optics are no longer required. More specifically, the all-fiber integrated MIRFIL breadboard generates super-continuum (SC) with 1.2W time-averaged power extending to -3.4 microns in 60m of ZBLAN fiber. The long wavelength edge of the SC is limited by the bend-induced loss of the particular ZBLAN fiber used in the experiments. The power levels and repetition have been optimized to generate high time-averaged power along with the broadest spectrum supported by the fiber. In addition, the results from the all-fiber integrated MIRFIL are compared with results obtained using the same ZBLAN fiber in a bulk-optical, tabletop, set-up in Prof. Almantas Galvaunaskas's lab, and the results lay almost directly on top of each other. In order to broaden the spectrum out to -4.6 microns, new ZBLAN fibers with less bend-induced loss will be required, and we are working with fiber makers to fabricate this fiber while maintaining a high damage threshold. One of the first tasks was to implement and characterize the first stage pre-amplifier. The pulse repetition rate in the pre-amplifier can be varied from 20kHz to 500kHz, and the power is scaled up by increasing the repetition rate.
DTIC

Continuums; Fiber Lasers; Infrared Radiation; Lasers

20070034509 Naval Postgraduate School, Monterey, CA USA

Integrating the FEL on an All-Electric Ship

Allen, III, Charles A; Jun 2007; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469922; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis examines the feasibility of placing the free electron laser (FEL) on the all-electric ship. The power required by the FEL and the tolerance of the FEL to vibrations is determined using computer simulations. Methods of reducing the vibrations using vibration isolation and active alignment are described. The simulations show that the all-electric ship will provide more than enough power to operate the FEL. The results also indicate that there must be methods to reduce the effect of ship vibrations in order for the FEL to reach the desired output power of one to three megawatts. The thesis also describes the physical dimensions of the FEL as well as its weight and cost, and compares these figures to other ship systems. Overall the simulations and the research show that it is reasonable that a highpowered FEL can be developed for use as a weapon on the all-electric ship. While developing such a weapon will be an engineering challenge the capability to do so has been demonstrated.
DTIC

Free Electron Lasers; Ships; Vibration Isolators

20070034550 Photonic Associates, Santa Fe, NM USA

Laser-Powered Thrusters for High Efficiency Variable Specific Impulse Missions (Preprint)

Phipps, C R; Luke, J R; Helgeson, W D; Apr 10, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9300-04-C-0030; Proj-BMSB

Report No.(s): AD-A469986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our objective is to develop an engine with high efficiency, and specific impulse which can be varied over more than an order of magnitude to match the requirements of efficient spacecraft propulsion in the constant momentum propulsion regime.

Laser ablation propulsion uniquely offers an almost arbitrarily large range of exhaust velocity, since it depends only on incident laser intensity. We have shown that thrust efficiency remains good over the specific impulse range 150 to 3,200 seconds. Considering a laser ablation propulsion device as an electric thruster, use of energetic ablation fuels can give thrust electrical efficiency greater than unity at the bottom of this Isp range. In our laser plasma thrusters (LPT's), we have demonstrated specific impulse which can be varied over a factor-of-15, from 200 to 3000 seconds to match the velocity profile in a mission. The corresponding thrust efficiency varies from 165% to 40%. The micro-LPT product has a 0.1 - 10 mN thrust range. After reviewing the science basis and performance of the existing devices, we describe the unique capabilities predicted for the LPT technology when it is scaled to the 1N thrust level. This scaling permits taking full advantage of the technology's inherent advantages in thrust/power ratio (up to 1.35N/kW), thrust efficiency and thrust density (5,000 to 350,000N/m2). However, the most important capability of the 'macro-LPT' design is variable Isp for optimally-efficient, constant-momentum flights. Claims made for the macro-LPT are based on measured performance of our millisecond and nanosecond-pulse LPT devices, and the anticipated performance of a revolutionary liquid ablation fuel.
DTIC
Electric Propulsion; High Impulse; Laser Applications; Lasers; Specific Impulse

20070034552 Air Force Research Lab., Rome, NY USA
Photonic Modulation Using Bi-Directional Diamond Shaped Ring Lasers at 1550 NM
Bussjager, Rebecca; Erdmann, Reinhard; Kovanis, Vasilios; McKeon, Brian; Apr 2007; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-SEMI
Report No.(s): AD-A469988; AFRL-SN-RS-TR-2007-123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Research Laboratory/Sensors Directorate (AFRL/SNDP) Binoptics Corp, and Infotonics Technology Center worked collaboratively to characterize and eventually package diode-based, diamond-shaped cavity, ring lasers that operate at 1550 nm. The laser modes propagate bi-directionally; however, uniaxial propagation was induced by optical injection from a tunable diode laser. The four-port laser ring offers use as an indirect modulator, directional router, and optical logic devices. Each optical output retains the encoding with either positive or negative logic, which can be used for conventional digital signal processing or routing. Secondly, the two counter-propagating laser modes provide a direct means for realizing the Sagnac effect, which has been well established in gyro technology with gas and fiber lasers. The ring lasers described here offer an ultra compact geometry for potential laser gyro and inertial sensor applications. These devices are scaleable and monolithically integrable with many semi-conductor based components including optical amplifiers, photodiodes, and electro-absorption modulators (EAMs).
DTIC
Diamonds; Modulation; Ring Lasers

20070034811 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Progress in Laser Risk Reduction for 1 micron lasers at GSFC
Heaps, William S.; April 9, 2007; 8 pp.; In English; Defense and Security 2007, 9-13 Apr. 2007, Orlando, FL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034811

In recent years, lasers have proven themselves to be invaluable to a variety of remote sensing applications. LIDAR techniques have been used to measure atmospheric aerosols and a variety of trace species, profile winds, and develop high resolution topographical maps. Often it would be of great advantage to make these measurements from an orbiting satellite. Unfortunately, the space environment is a challenging one for the high power lasers that would enable many LIDAR missions. Optical mounts must maintain precision alignment during and after launch. Outgassing materials in the vacuum of space lead to contamination of laser optics. Electronic components and optical materials must survive the space environment, including a vacuum atmosphere, thermal cycling, and radiation exposure. Laser designs must be lightweight, compact, and energy efficient. Many LIDAR applications require frequency conversion systems that have never been designed or tested for use in space. For the last six years the National Aeronautical and Space Administration (NASA) has undertaken a program specifically directed at addressing the durability and long term reliability issues that face space-borne lasers. The effort is shared between NASA Goddard Space Flight Center in Greenbelt, Maryland, and NASA Langley Research Center in Hampton, Virginia. This paper is an overview of the issues facing space-borne lasers and the efforts that Goddard has been pursuing to address them.
Author
Remote Sensing; Risk; Spaceborne Lasers; High Power Lasers; General Overviews

20070034819 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Application of the Hilbert-Huang Transform to the Search for Gravitational Waves

Camp, Jordan B.; Cannizzo, John K.; Numata, Kenji; [2007]; 5 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

We present the application of a novel method of time-series analysis, the Hilbert-Huang Transform, to the search for gravitational waves. This algorithm is adaptive and does not impose a basis set on the data, and thus the time-frequency decomposition it provides is not limited by time-frequency uncertainty spreading. Because of its high time-frequency resolution it has important applications to both signal detection and instrumental characterization. Applications to the data analysis of the ground and space based gravitational wave detectors, LIGO and LISA, are described.

Author

Algorithms; Gravitational Waves; Hilbert Transformation; Data Processing; Time Series Analysis

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MECHANICAL ENGINEERING

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

20070034728 NASA Glenn Research Center, Cleveland, OH, USA

RDS-21 Face-Gear Surface Durability Tests

Lewicki, David G.; Heath, Gregory F.; Filler, Robert R.; Slaughter, Stephen C.; Fetty, Jason; September 2007; 16 pp.; In English; American Helicoptr Society 63rd Annual Forum, 1-3 May 2007, Virginia Beach, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01

Report No.(s): NASA/TM-2007-214970; ARL-TR-4089; E-16123; Copyright; Avail.: CASI: A03, Hardcopy

Experimental fatigue tests were performed to determine the surface durability life of a face gear in mesh with a tapered spur involute pinion. Twenty-four sets of gears were tested at three load levels: 7200, 8185, and 9075 lb-in face gear torque, and 2190 to 3280 rpm face gear speed. The gears were carburized and ground, shot-peened and vibro-honed, and made from VIM-VAR Pyrowear 53 steel per AMS 6308. The tests produced 17 gear tooth spalling failures and 7 suspensions. For all the failed sets, spalling occurred on at least one tooth of all the pinions. In some cases, the spalling initiated a crack in the pinion teeth which progressed to tooth fracture. Also, spalling occurred on some face gear teeth. The AGMA endurance allowable stress for a tapered spur involute pinion in mesh with a face gear was determined to be 275 ksi for the material tested. For the application of a tapered spur involute pinion in mesh with a face gear, proper face gear shim controlled the desired gear tooth contact pattern while proper pinion shim was an effective way of adjusting backlash without severely affecting the contact pattern.

Author

Durability; Fatigue Tests; Gear Teeth; Rotary Wing Aircraft; Mechanical Engineering; Spiral Bevel Gears

20070034894 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Effects of Gravity on Start-up of a Miniature Loop Heat Pipe with Multiple Evaporators and Multiple Condensers

Ku, Jentung; Nagano, Hosei; July 09, 2007; 8 pp.; In English; 37th International Conference on Environmental Systems, 9-12 July 2007, Chicago, IL, USA; Original contains black and white illustrations

Report No.(s): 07ICES-325; Copyright; Avail.: Other Sources

This paper describes an experimental study on the effect of gravity on the start-up of a miniature loop heat pipe (MLHP) with two evaporators and two condensers. Each evaporator has an outer diameter of 9 mm and has its own integral compensation chamber (CC). The MLHP was placed under five configurations where the relative elevation and tilt among the loop components were varied. The four well-known initial conditions between the evaporator and CC prior to the LHP start-up were created in this experimental study through combinations of: 1) the test configuration; 2) the method of preconditioning

the loop prior to start-up, and 3) the heat load distribution among the evaporators. A total of 165 start-ups were conducted under the five test configurations. All of these start-ups were successful. However, the effect of gravity on start-up transients was clearly seen under otherwise the same heat load distribution and sink temperatures. An analytical model was used to simulate the MLHP transient behaviors, and the model predictions agreed very well with the experimental results.
Author
Evaporators; Gravitational Effects; Heat Pipes; Miniaturization; Condensers (Liquefiers); Starting; Mechanical Engineering

20070034927 NASA Glenn Research Center, Cleveland, OH, USA
Fracture Strength of Single-Crystal Silicon Carbide Microspecimens at Room and Elevated Temperature
Nemeth, Noel N.; Sharpe, William N., Jr.; Beheim, Glenn M.; Evans, Laura J.; Jadaan, Osama M.; October 2007; 27 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.19.05
Report No.(s): NASA/TM-2007-214990; E-16167; Copyright; Avail.: CASI: A03, Hardcopy

Three shapes of tensile specimens were tested--curved with a very low stress concentration factor and straight with either a circular hole or an elliptical hole. The nominal thickness was 125 micron with a net section 100 micron wide; the overall length of these microspecimens was 3.1 mm. They were fabricated by an improved version of deep reactive ion etching, which produced specimens with smooth sidewalls and cross-sections having a slightly trapezoidal shape that was exaggerated inside the holes. The novel test setup used a vertical load train extending into a resistance furnace. The specimens had wedge-shaped ends which fit into ceramic grips. The fixed grip was mounted on a ceramic post, and the movable grip was connected to a load cell and actuator outside the furnace with a ceramic-encased nichrome wire. The same arrangement was used for tests at 24 and at 1000 C. The strengths of the curved specimens for two batches of material (made with slightly different processes) were 0.66+/-0.12 GPa and 0.45+/-0.20 GPa respectively at 24 C with identical values at 1000 C. The fracture strengths of the circular-hole and elliptical-hole specimens (computed from the stress concentration factors and measured loads at failure) were approximately 1.2 GPa with slight decreases at the higher temperature. Fractographic examinations showed failures initiating on the surface--primarily at corners. Weibull predictions of fracture strengths for the hole specimens based on the properties of the curved specimens were reasonably effective for the circular holes, but not for the elliptical holes.
Author
Ceramics; Silicon Carbides; Holes (Mechanics); Stress Concentration; Fracture Strength; Fabrication

20070035023 NASA Johnson Space Center, Houston, TX, USA
Developing Carbon Nanotube Standards at NASA
Nikolaev, Pasha; Arepalli, Sivaram; Sosa, Edward; Gorelik, Olga; Yowell, Leonard; September 26, 2007; 1 pp.; In English; Third NASA-NIST Workshop on Nanotube, 26-28 Sep. 2007, Gaithersburg, MD, USA
Contract(s)/Grant(s): NNJ05HI05C; No Copyright; Avail.: Other Sources; Abstract Only

Single wall carbon nanotubes (SWCNTs) are currently being produced and processed by several methods. Many researchers are continuously modifying existing methods and developing new methods to incorporate carbon nanotubes into other materials and utilize the phenomenal properties of SWCNTs. These applications require availability of SWCNTs with known properties and there is a need to characterize these materials in a consistent manner. In order to monitor such progress, it is critical to establish a means by which to define the quality of SWCNT material and develop characterization standards to evaluate of nanotube quality across the board. Such characterization standards should be applicable to as-produced materials as well as processed SWCNT materials. In order to address this issue, NASA Johnson Space Center has developed a protocol for purity and dispersion characterization of SWCNTs. The NASA JSC group is currently working with NIST, ANSI and ISO to establish purity and dispersion standards for SWCNT material. A practice guide for nanotube characterization is being developed in cooperation with NIST. Furthermore, work is in progress to incorporate additional characterization methods for electrical, mechanical, thermal, optical and other properties of SWCNTs.
Author
Carbon Nanotubes; Purity; Standards; Dispersions

38
QUALITY ASSURANCE AND RELIABILITY

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

20070034983 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Thin-Film Sensors Monitor Defects
Flinn, Edward D.; Aerospace America; April 2007; ISSN 0740-722X; Volume 45, No. 4, pp. 22-23; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

As aircraft reach or exceed their design lifetimes, the USAF is turning to advanced nondestructive evaluation methods to determine whether the vehicles are fit for continued duty. One important instrument in conducting nondestructive evaluation, or NDE, testing is the magnetostrictive sensor (MsS). A flexible thin-film deposition process that will enable the fabrication of thin magnetostrictive sensors has been developed. These sensors can efficiently detect and monitor defects in aircraft without the need for costly teardowns or unnecessary inspections. This project was aimed at developing a magnetostrictive multilayer thin-film sensor that could be deposited onto a part and used at high temperatures with wireless communication. The technology was tested to 500 F, but extending this capability to 1,000-1.200 F is being examined
Derived from text
Nondestructive Tests; Thin Films; Magnetoresistivity; High Temperature Tests; Measuring Instruments

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*.

20070034213 Army War Coll., Carlisle Barracks, PA USA
Reconstruction under Adversity, Rebuilding Iraq -- Lessons for the Future
Miles, Steven R; Mar 15, 2007; 28 pp.; In English
Report No.(s): AD-A469612; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469612

In Iraq, the infrastructure reconstruction remains the lynch pin component to building long-term Iraqi stability and progress. To that end, the USA pledged over 20 billion dollars to improve basic essential services and rebuild Iraq's dilapidated infrastructure (oil, water, electricity, sewer, health, education, etc.). The unexpected strength and success of the insurgency derailed many of the post-conflict objectives, creating a strategy dilemma. Which comes first, security or reconstruction? Reconstruction is pivotal to winning the hearts and minds of the local people. However, infrastructure reconstruction requires a sustained permissive environment for noncombatant local contractors to execute the re-building effort. The traditional linear sequential approach of reconstruction after hostilities appears to be a luxury of the past. This 'new kind of war' demands a new approach. This study examines eight critical lessons that the USA should implement to improve its ability to conduct successful reconstruction operations in the future. These key lessons focus on strategic command and control, unity of effort, program pace and scope, security, local dynamics, cultural dynamics, outsourcing, and fixing federal contracting rules. Only if phase IV operations are as successful as combat operations, will the peace be a 'good one.'
DTIC
Construction; Iraq; Management Planning; Security

20070034565 Library of Congress, Washington, DC USA
Iraq: Reconstruction Assistance
Tarnoff, Curt; Jun 25, 2007; 39 pp.; In English
Report No.(s): AD-A470009; CRS-RL31833; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A large-scale assistance program has been undertaken by the USA in Iraq since mid-2003. To date, nearly $42 billion has been appropriated for Iraq reconstruction. On February 5, 2007, the Administration presented an FY2007 Supplemental request for Iraq reconstruction of about $6.6 billion, a regular FY2008 request of $391.8 million, and an Emergency FY2008

request of $3.5 billion. The FY2007 Supplemental (H.R. 2206, P.L. 110-28), signed into law on May 25, 2007, provides a total of $6.3 billion in Iraq reconstruction assistance, $316 million less than the Administration request. Of this amount, about $1.6 billion appropriated to the Economic Support Fund (ESF) account is subject to a presidential certification of Iraqi progress in 18 benchmarks. On June 21, 2007, the House approved H.R. 2764, the FY2008 State/Foreign Operations regular appropriations bill, rejecting requested regular FY2008 funding for Iraq. On June 28, 2004, the entity implementing assistance programs, the Coalition Provisional Authority (CPA), dissolved, and sovereignty was returned to Iraq. U.N. Security Council Resolution 1546 of June 8, 2004, returned control of assets held in the Development Fund for Iraq to the government of Iraq. U.S. economic assistance is now provided through the U.S. embassy while security aid is chiefly managed by the Pentagon. Many reconstruction efforts on the ground are completed or ongoing, but security concerns have slowed progress. Reconstruction programs include the training and equipping of Iraqi security forces; construction of road, sanitation, electric power, oil production, and other infrastructure; and a range of programs to offer expert advice to the Iraqi government, establish business centers, provide school books and vaccinations, finance village development projects, and promote civil society, etc. This report will be updated as events warrant.

DTIC

Construction; Federal Budgets; Iraq; Structural Engineering; United States

20070034829 National Inst. of Aerospace, Hampton, VA, USA; NASA Langley Research Center, Hampton, VA, USA

Dynamic Snap-Through of Thermally Buckled Structures by a Reduced Order Method

Przekop, Adam; Rizzi, Stephen A.; [2007]; 20 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS-23-794-40-4A; Copyright; Avail.: CASI: A03, Hardcopy

The goal of this investigation is to further develop nonlinear modal numerical simulation methods for application to geometrically nonlinear response of structures exposed to combined high intensity random pressure fluctuations and thermal loadings. The study is conducted on a flat aluminum beam, which permits a comparison of results obtained by a reduced-order analysis with those obtained from a numerically intensive simulation in physical degrees-of-freedom. A uniformly distributed thermal loading is first applied to investigate the dynamic instability associated with thermal buckling. A uniformly distributed random loading is added to investigate the combined thermal-acoustic response. In the latter case, three types of response characteristics are considered, namely: (i) small amplitude vibration around one of the two stable buckling equilibrium positions, (ii) intermittent snap-through response between the two equilibrium positions, and (iii) persistent snap-through response between the two equilibrium positions. For the reduced-order analysis, four categories of modal basis functions are identified including those having symmetric transverse, anti-symmetric transverse, symmetric in-plane, and anti-symmetric in-plane displacements. The effect of basis selection on the quality of results is investigated for the dynamic thermal buckling and combined thermal-acoustic response. It is found that despite symmetric geometry, loading, and boundary conditions, the anti-symmetric transverse and symmetric in-plane modes must be included in the basis as they participate in the snap-through behavior.

Author

Dynamic Structural Analysis; Applications Programs (Computers); Thermal Buckling; Thermal Stresses; Beams (Supports); Dynamic Stability; Thermoacoustic Effects; Dynamic Response; Finite Element Method

20070035048 NASA Dryden Flight Research Center, Edwards, CA, USA

Extended Aging Theories for Predictions of Safe Operational Life of Critical Airborne Structural Components

Ko, William L.; Chen, Tony; May 2006; 60 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): RTOP 24-104-08-01

Report No.(s): NASA/TP-2006-213676; H-2624; No Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070035048

The previously developed Ko closed-form aging theory has been reformulated into a more compact mathematical form for easier application. A new equivalent loading theory and empirical loading theories have also been developed and incorporated into the revised Ko aging theory for the prediction of a safe operational life of airborne failure-critical structural components. The new set of aging and loading theories were applied to predict the safe number of flights for the B-52B aircraft to carry a launch vehicle, the structural life of critical components consumed by load excursion to proof load value, and the

ground-sitting life of B-52B pylon failure-critical structural components. A special life prediction method was developed for the preflight predictions of operational life of failure-critical structural components of the B-52H pylon system, for which no flight data are available.
Author
Loads (Forces); Critical Loading; Structural Design; Service Life; Prediction Analysis Techniques; B-52 Aircraft; Failure

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*.

20070034777 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
TES Level 1 Algorithms: Interferogram Processing, Geolocation, Radiometric, and Spectral Calibration
Worden, Helen; Beer, Reinhard; Bowman, Kevin W.; Fisher, Brendan; Luo, Mingzhao; Rider, David; Sarkissian, Edwin; Tremblay, Denis; Zong, Jia; IEEE Transactions on Geoscience and Remote Sensing; May 5, 2006; ISSN 0196-2892; Volume 44, No. 5, pp. 1288-1296; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40301; http://dx.doi.org/10.1109/TGRS.2005.863717

The Tropospheric Emission Spectrometer (TES) on the Earth Observing System (EOS) Aura satellite measures the infrared radiance emitted by the Earth's surface and atmosphere using Fourier transform spectrometry. The measured interferograms are converted into geolocated, calibrated radiance spectra by the L1 (Level 1) processing, and are the inputs to L2 (Level 2) retrievals of atmospheric parameters, such as vertical profiles of trace gas abundance. We describe the algorithmic components of TES Level 1 processing, giving examples of the intermediate results and diagnostics that are necessary for creating TES L1 products. An assessment of noise-equivalent spectral radiance levels and current systematic errors is provided. As an initial validation of our spectral radiances, TES data are compared to the Atmospheric Infrared Sounder (AIRS) (on EOS Aqua), after accounting for spectral resolution differences by applying the AIRS spectral response function to the TES spectra. For the TES L1 nadir data products currently available, the agreement with AIRS is 1 K or better.
Author
Earth Observing System (EOS); Meteorological Parameters; Radiometers; Trace Contaminants; Calibrating; Spectral Emission; Interferometry; Fourier Transformation

20070034855 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
QuakeSim and the Solid Earth Research Virtual Observatory
Donnellan, Andrea; Rundle, John; Fox, Geoffrey; McLeod, Dennis; Grant, Lisa; Tullis, Terry; Pierce, Marlon; Parker, Jay; Lyzenga, Greg; July 9, 2004; 8 pp.; In English; 4th International Asia Pacific Economic Cooperation (APEC) Cooperation for Earthquake Simulation (ACES) Workshop, 9-14 Jul. 2004, Beijing, China; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40451

We are developing simulation and analysis tools in order to develop a solid Earth science framework for understanding and studying active tectonic and earthquake processes. The goal of QuakeSim and its extension, the Solid Earth Research Virtual Observatory (SERVO), is to study the physics of earthquakes using state-of-the-art modeling, data manipulation, and pattern recognition technologies. We are developing clearly defined accessible data formats and code protocols as inputs to simulations, which are adapted to high-performance computers. The solid Earth system is extremely complex and nonlinear resulting in computationally intensive problems with millions of unknowns. With these tools it will be possible to construct the more complex models and simulations necessary to develop hazard assessment systems critical for reducing future losses from major earthquakes. We are using Web (Grid) service technology to demonstrate the assimilation of multiple distributed data sources (a typical data grid problem) into a major parallel high-performance computing earthquake forecasting code. Such a linkage of Geoinformatics with Geocomplexity demonstrates the value of the Solid Earth Research Virtual Observatory (SERVO) Grid concept, and advances Grid technology by building the first real-time large-scale data assimilation grid.
Author
Earth Sciences; Real Time Operation; Earthquakes; Tectonics; Pattern Recognition; Computerized Simulation

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*.

20070034151 Chiba Univ., Chiba, Japan; NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thin Sea-Ice Thickness as Inferred from Passive Microwave and In Situ Observations
Naoki, Kazuhiro; Ukita, Jinro; Nishio, Fumihiko; Nakayama, Masashige; Comiso, Josefino C.; Gasiewski, Al; [2007]; 29 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Since microwave radiometric signals from sea-ice strongly reflect physical conditions of a layer near the ice surface, a relationship of brightness temperature with thickness is possible especially during the early stages of ice growth. Sea ice is most saline during formation stage and as the salinity decreases with time while at the same time the thickness of the sea ice increases, a corresponding change in the dielectric properties and hence the brightness temperature may occur. This study examines the extent to which the relationships of thickness with brightness temperature (and with emissivity) hold for thin sea-ice, approximately less than 0.2 -0.3 m, using near concurrent measurements of sea-ice thickness in the Sea of Okhotsk from a ship and passive microwave brightness temperature data from an over-flying aircraft. The results show that the brightness temperature and emissivity increase with ice thickness for the frequency range of 10-37 GHz. The relationship is more pronounced at lower frequencies and at the horizontal polarization. We also established an empirical relationship between ice thickness and salinity in the layer near the ice surface from a field experiment, which qualitatively support the idea that changes in the near-surface brine characteristics contribute to the observed thickness-brightness temperature/ emissivity relationship. Our results suggest that for thin ice, passive microwave radiometric signals contain, ice thickness information which can be utilized in polar process studies.
Author
Microwave Radiometers; Sea Ice; Thickness; Mathematical Models; Remote Sensing

20070034161 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Contribution of Chlorophyll Fluorescence to the Apparent Reflectance of Vegetation
Campbell, P. K. Entcheva; Middleton, E. M.; Kim, M. S.; March 2007; 30 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

Current strategies for monitoring the physiologic status of terrestrial vegetation rely on remote sensing reflectance (R) measurements, which provide estimates of relative vegetation vigor based primarily on chlorophyll content. Vegetation chlorophyll fluorescence (CF) offers a non-destructive alternative and a more direct approach for diagnosis of vegetation stress before a significant reduction in chlorophyll content has occurred. Thus, monitoring of vegetation vigor based on CF may allow earlier stress detection and more accurate carbon sequestration estimates, than is possible using R data alone. However, the observed apparent vegetation reflectance (Ra) in reality includes contributions from both the reflected and fluoresced radiation. The aim of this study is to determine the relative R and CF fractions contributing to Ra from the vegetation in the red to near-infrared region of the spectrum. The practical objectives of the study are to: 1) evaluate the relationship between CF and R at the foliar level for corn, soybean, maple; and 2) for corn, determine if the relationship established for healthy (optimal N) vegetation changes under N defiiency. To obtain generally applicable results, experimental measurements were conducted on unrelated crop and tree species (maple, soybean and corn), under controlled conditions and a gradient of inorganic N fertilization levels. Optical R spectra and actively induced CF emissions were obtained on the same foliar samples, in conjunction with measurements of photosynthetic function, pigment levels, and C and N content. The common spectral trends or similarities were examined. On average, 10-20% of apparent R at 685 nm was actually due to CF. The spectral trends in steady and maximum F varied significantly, with Fs (especially red) showing higher ability for species and treatment separation. The relative contribution of ChF to R varied significantly among species, with maple emitting much higher F amounts, as compared to corn and soybean. Fs individual red and far-red bands and their ratio exhibited consistent species separations. For corn, the relative CF fraction increased in concert with the nutrient stress levels from <2% for non-stressed foliage to >7% for severely nutrient deficient plants. F685s provided optimal treatment separation. This study confirms the trends in F685sE740s associated with N deficiency and vegetation stress, established usmg single narrow band excitation.
Author
Chlorophylls; Fluorescence; Reflectance; Remote Sensing; Vegetation; Plant Stress; Crop Vigor

20070034226 Army War Coll., Carlisle Barracks, PA USA
Minerals Strategic Impact on Regional Stability in Africa
Hansen, Lee E; Mar 30, 2007; 22 pp.; In English
Report No.(s): AD-A469659; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469659

Africa is seemingly in perpetual conflict. Seven of the 16 current United Nations peacekeeping operations are taking place in Africa. There are three broad classifications of conflict in Africa: civil conflicts, insurgencies, and wars that began when the African nations received their independence from colonial powers. Some form of financing must be available to sustain a conflict beyond its initial stages. National treasure, loans, foreign assistance, captured enemy assets, or natural resources are just a few financing sources that have in the past extended conflicts beyond their initial stages. Africa is a continent that is rich in natural resources. This paper will open the door to understanding the question of minerals strategic impact on regional stability in Africa; specifically, whether or not minerals (e.g., gold, diamonds, and columbite-tantalite) are funding warlords and their conflicts. This paper will focus on the mineral-rich region of the eastern Democratic Republic of Congo (formerly Zaire) and three of its neighboring countries: Rwanda, Uganda, and Burundi.
DTIC
Africa; Burundi; Democratic Republic of Congo; Exploitation; Finance; Gold; Minerals; Rwanda; Stability; Uganda; Warfare

20070034227 Army War Coll., Carlisle Barracks, PA USA
US Oil Dependency -- The New Weapon of Mass Disruption
Czarnik, Joseph E; Mar 22, 2007; 18 pp.; In English
Report No.(s): AD-A469668; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469668

America's economy, American's very way of life, has become dependent on foreign oil. America can reverse its oil dependency over generations, but in terms of days, weeks, or even months, the nation is perilously dependent on the free flow of oil and the energy oil produces. It is reasonable to suggest that America should have a plan to deal with a man-made (9/11) or natural (Katrina) disruption to America's oil needs. Hurricane Katrina suggests that America does not have an emergency energy plan to deal with short-term energy disruption. This paper's focus is America's need for a plan to deal with short-term energy disruption, a proposed plan, and how that plan could be used as a Flexible Deterrent Option.
DTIC
Disasters; Oils; Petroleum Products; United States; Vulnerability

20070034800 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Recent Theoretical Advances in Analysis of AIRS/AMSU Sounding Data
Susskind, Joel; [2007]; 1 pp.; In English; Proceedings, SPIE, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIII, 9-13 Apr. 2007, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

AIRS was launched on EOS Aqua on May 4,2002, together with AMSU-A and HSB, to form a next generation polar orbiting infrared and microwave atmospheric sounding system. This paper describes the AIRS Science Team Version 5.0 retrieval algorithm. Starting in early 2007, the Goddard DAAC will use this algorithm to analyze near real time AIRS/AMSU observations. These products are then made available to the scientific community for research purposes. The products include twice daily measurements of the Earth's three dimensional global temperature, water vapor, and ozone distribution as well as cloud cover. In addition, accurate twice daily measurements of the earth's land and ocean temperatures are derived and reported. Scientists use this important set of observations for two major applications. They provide important information for climate studies of global and regional variability and trends of different aspects of the earth's atmosphere. They also provide information for researchers to improve the skill of weather forecasting. A very important new product of the AIRS Version 5 algorithm is accurate case-by-case error estimates of the retrieved products. This heightens their utility for use in both weather and climate applications. These error estimates are also used directly for quality control of the retrieved products. Version 5 also allows for accurate quality controlled AIRS only retrievals, called 'Version 5 AO retrievals' which can be used as a backup methodology if AMSU fails. Examples of the accuracy of error estimates and quality controlled retrieval products of the AIRS/AMSU Version 5 and Version 5 AO algorithms are given, and shown to be significantly better than the previously used Version 4 algorithm. Assimilation of Version 5 retrievals are also shown to significantly improve forecast skill, especially when the case-by-case error estimates are utilized in the data assimilation process.
Author
Earth Observing System (EOS); Algorithms; Atmospheric Sounding; Aqua Spacecraft; Advanced Microwave Sounding Unit; Infrared Radiation; Data Acquisition

20070034808 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Surveillance and Control of Malaria Transmission Using Remotely Sensed Meteorological and Environmental Parameters

Kiang, R.; Adimi, F.; Nigro, J.; [2007]; 4 pp.; In English; 32nd International Symposium on Remote Sensing of Environment, 25-29 Jun. 2007, San Jose, Costa Rica; Copyright; Avail.: CASI: A01, Hardcopy

Meteorological and environmental parameters important to malaria transmission include temperature, relative humidity, precipitation, and vegetation conditions. These parameters can most conveniently be obtained using remote sensing. Selected provinces and districts in Thailand and Indonesia are used to illustrate how remotely sensed meteorological and environmental parameters may enhance the capabilities for malaria surveillance and control. Hindcastings based on these environmental parameters have shown good agreement to epidemiological records.

Author

Epidemiology; Meteorological Parameters; Remote Sensing; Surveillance; Parasitic Diseases

20070034809 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Generating a Long-Term Land Data Record from the AVHRR and MODIS Instruments

Pedelty, Jeffrey; Devadiga, Sadashiva; Masuoka, Edward; Brown, Molly; Pinzon, Jorge; Tucker, Compton; Vermote, Eric; Prince, Stephen; Nagol, Jyotheshwar; Justice, Christopher; Roy, David; Ju, Junchang; Schaaf, Crystal; Liu, Jicheng; Privette, Jeffrey; Pincheiro, Ana; July 23, 2007; 1 pp.; In English; International Geoscience and Remote Sensing Symposium (IGARSS) '07, 23-27 Jul. 2007, Barcelona, Spain; Copyright; Avail.: Other Sources; Abstract Only

The goal of NASA's Land Long Term Iiata Record (LTDR) project is to produce a consistent long term data set from the AVHRR and MODIS instruments for land climate studies. The project will create daily surface reflectance and normalized difference vegetation index (NDVI) products at a resolution of 0.05 deg., which is identical to the Climate Modeling Grid (CMG) used for MODIS products from EOS Terra and Aqua. Higher order products such as burned area, land surface temperature, albedo, bidirectional reflectance distribution function (BRDF) correction, leaf area index (LAI), and fraction of photosyntheticalIy active radiation absorbed by vegetation (fPAR), will be created. The LTDR project will reprocess Global Area Coverage (GAC) data from AVHRR sensors onboard NOAA satellites by applying the preprocessing improvements identified in the AVHRR Pathfinder Il project and atmospheric and BRDF corrections used in MODIS processing. The preprocessing improvements include radiometric in-flight vicarious calibration for the visible and near infrared channels and inverse navigation to relate an Earth location to each sensor instantaneous field of view (IFOV). Atmospheric corrections for Rayleigh scattering, ozone, and water vapor are undertaken, with aerosol correction being implemented. The LTDR also produces a surface reflectance product for channel 3 (3.75 micrometers). Quality assessment (QA) is an integral part of the LTDR production system, which is monitoring temporal trands in the AVHRR products using time-series approaches developed for MODIS land product quality assessment. The land surface reflectance products have been evaluated at AERONET sites. The AVHRR data record from LTDR is also being compared to products from the PAL (Pathfinder AVHRR Land) and GIMMS (Global Inventory Modeling and Mapping Studies) systems to assess the relative merits of this reprocessing vis-a-vis these existing data products. The LTDR products and associated information can be found at http://ltdr.nascom.nasa.gov/ltdr/ltdr.html.

Author

Advanced Very High Resolution Radiometer; MODIS (Radiometry); Land; Earth Sciences; Climate Models; Data Products

20070034814 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Initial Verification of GEOS-4 Aerosols Using CALIPSO and MODIS: Scene Classification

Welton, Ellsworth J.; Colarco, Peter R.; Hlavka, Dennis; Levy, Robert C.; Vaughan, Mark A.; daSilva, Arlindo; October 22, 2007; 1 pp.; In English; A-train Symposium in Lille, 22-25 Oct. 2007, Lille, France; No Copyright; Avail.: Other Sources; Abstract Only

A-train sensors such as MODIS and MISR provide column aerosol properties, and in the process a means of estimating aerosol type (e.g. smoke vs. dust). Correct classification of aerosol type is important because retrievals are often dependent upon selection of the right aerosol model. In addition, aerosol scene classification helps place the retrieved products in context for comparisons and analysis with aerosol transport models. The recent addition of CALIPSO to the A-train now provides a means of classifying aerosol distribution with altitude. CALIPSO level 1 products include profiles of attenuated backscatter at 532 and 1064 nm, and depolarization at 532 nm. Backscatter intensity, wavelength ratio, and depolarization provide information on the vertical profile of aerosol concentration, size, and shape. Thus similar estimates of aerosol type using MODIS or MISR are possible with CALIPSO, and the combination of data from all sensors provides a means of 3D aerosol scene classification. The NASA Goddard Earth Observing System general circulation model and data assimilation system

(GEOS-4) provides global 3D aerosol mass for sulfate, sea salt, dust, and black and organic carbon. A GEOS-4 aerosol scene classification algorithm has been developed to provide estimates of aerosol mixtures along the flight track for NASA's Geoscience Laser Altimeter System (GLAS) satellite lidar. GLAS launched in 2003 and did not have the benefit of depolarization measurements or other sensors from the A-train. Aerosol typing from GLAS data alone was not possible, and the GEOS-4 aerosol classifier has been used to identify aerosol type and improve the retrieval of GLAS products. Here we compare 3D aerosol scene classification using CALIPSO and MODIS with the GEOS-4 aerosol classifier. Dust, smoke, and pollution examples will be discussed in the context of providing an initial verification of the 3D GEOS-4 aerosol products. Prior model verification has only been attempted with surface mass comparisons and column optical depth from AERONET and MODIS.

Author

Earth Observing System (EOS); Atmospheric General Circulation Models; Aerosols; Satellite Observation; CALIPSO (Pathfinder Satellite); GEOSAT Satellites; MODIS (Radiometry)

20070034815 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Science Archives in the 21st Century: A NASA LAMBDA Report

Butterworth, P.; Greason, M.; April 26, 2007; 1 pp.; In English; Poster presentation: Science Archives in the 21st Century, 25-26 Apr. 2007, College Park, MD, USA

Contract(s)/Grant(s): NNG06EB68C; No Copyright; Avail.: Other Sources; Abstract Only

Lambda is a thematic data center that focuses on serving the cosmic microwave background (CMB) research community. LAMBDA is an active archive for NASA's Cosmic Background Explorer (COBE) and Wilkinson Microwave Anisotropy Probe (WMAP) mission data sets. In addition, LAMBDA provides analysis software, on-line tools, relevant ancillary data and important web links. LAMBDA also tries to preserve the most important ground-based and suborbital CMB data sets. CMB data is unlike other astrophysical data, consisting of intrinsically diffuse surface brightness photometry with a signal contrast of the order 1 part in 100,000 relative to the uniform background. Because of the extremely faint signal levels, the signal-to-noise ratio is relatively low and detailed instrument-specific knowledge of the data is essential. While the number of data sets being produced is not especially large, those data sets are becoming large and complex. That tendency will increase when the many polarization experiments currently being deployed begin producing data. The LAMBDA experience supports many aspects of the NASA data archive model developed informally over the last ten years-that small focused data centers are often more effective than larger more ambitious collections, for example; that data centers are usually best run by active scientists; that it can be particularly advantageous if those scientists are leaders in the use of the archived data sets; etc. LAMBDA has done some things so well that they might provide lessons for other archives. A lot of effort has been devoted to developing a simple and consistent interface to data sets, for example; and serving all the documentation required via simple 'more' pages and longer explanatory supplements. Many of the problems faced by LAMBDA will also not surprise anyone trying to manage other space science data. These range from persuading mission scientists to provide their data as quickly as possible, to dealing with a high volume of nuisance (spam) messages. Because so many data center problems and solutions are common across individual data centers and disciplines it would be very valuable to establish some new systems of communication - such as informal email lists for administrators and developers. But resources are very limited, so new timeconsuming and inefficient mechanisms - like too-frequent and too-structured meetingsshould be avoided. Although there are great advantages to being small, agile and independent, there are also some areas where science data centers within and without NASA could be better coordinated - for the assignment of persistent identifiers; to encourage the early adoption of useful standards and technologies; etc. Some super-structure to facilitate such coordination might be beneficial as long as it doesn't begin to control the other work of the archives, and become a 'methodology police'. In this respect the CCSDS 'Reference Model for an Open Archive Information System' is a little worrying. It may be that the closer a data center gets to following such a detailed prescription, the less effective it will become. It is much better to have an informal coordination process than a bureaucratic straight-jacket.

Author

Thematic Mapping; Cosmic Microwave Background Radiation; Microwave Anisotropy Probe; Data Acquisition; Cosmic Background Explorer Satellite

20070034838 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Second Generation Multi-Angle Imaging SpectroRadiometer (MISR-2)

Bothwell, Graham; Diner, David J.; Pagano, Thomas S.; Duval, Valerie G.; Beregovski, Yuri; Hovland, Larry E.; Preston, Daniel J.; August 28, 2001; 6 pp.; In English; Earth Science Technology Conference, 28-30 Aug. 2001, College Park, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40391

The Multi-angle Imaging SpectroRadiometer (MISR) has been in Earth orbit since December 1999 on NASA's Terra spacecraft. This instrument provides new ways of looking at the Earth's atmosphere, clouds, and surface for the purpose of understanding the Earth's ecology, environment, and climate. To facilitate the potential future continuation of MISR's multi-angle observations, a study was undertaken in 1999 and 2000 under the Instrument Incubator Program (IIP) of NASA Code Y's Earth Science Technology Office (ESTO) to investigate and demonstrate the feasibility of a successor to MISR that will have greatly reduced size and mass. The kernel of the program was the design, construction, and testing of a highly miniaturized camera, one of the nine that would probably be used on a future space borne MISR-like instrument. This demonstrated that the size and mass reduction of the optical system and camera electronics are possible and that filters can be assembled to meet the miniaturized packaging requirements. An innovative, reflective optics design was used, enabling the wavelength range to be extended into the shortwave infrared. This was the smallest all-reflective camera ever produced by the contractor. A study was undertaken to determine the feasibility of implementing nine (multi-angle) cameras within a single structure. This resulted in several possible configurations. It would also be possible to incorporate one of the cameras into an airborne instrument.

Author

MISR (Radiometry); Terra Spacecraft; Airborne Equipment; Cameras; Earth Sciences; Earth Orbits

20070034848 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Semiconductor Reference Oscillator Development for Coherent Detection Optical Remote Sensing Applications

Tratt, David M.; Mansour, Kamjou; Menzies, Robert T.; Qiu, Yueming; Forouhar, Siamak; Maker, Paul D.; Muller, Richard E.; August 28, 2001; 5 pp.; In English; NASA Earth Science Technology Conference, 28-30 Aug. 2001, College Park, MD, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40402

The NASA Earth Science Enterprise Advanced Technology Initiatives Program is supporting a program for the development of semiconductor laser reference oscillators for application to coherent optical remote sensing from Earth orbit. Local oscillators provide the frequency reference required for active spaceborne optical remote sensing concepts that involve heterodyne (coherent) detection. Two recent examples of such schemes are Doppler wind lidar and tropospheric carbon dioxide measurement by laser absorption spectrometry, both of which are being proposed at a wavelength of 2.05 microns. Frequency-agile local oscillator technology is important to such applications because of the need to compensate for large platform-induced Doppler components that would otherwise interfere with data interpretation. Development of frequency-agile local oscillator approaches has heretofore utilized the same laser material as the transmitter laser (Tm,Ho:YLF in the case of the 2.05-micron wavelength mentioned above). However, a semiconductor laser-based frequency-agile local oscillator offers considerable scope for reduced mechanical complexity and improved frequency agility over equivalent crystal laser devices, while their potentially faster tuning capability suggest the potential for greater scanning versatility. The program we report on here is specifically tasked with the development of prototype novel architecture semiconductor lasers with the power, tunability, and spectral characteristics required for coherent Doppler lidar. The baseline approach for this work is the distributed feedback (DFB) laser, in which gratings are etched into the semiconductor waveguide structures along the entire length of the laser cavity. However, typical DFB lasers at the wavelength of interest have linewidths that exhibit unacceptable growth when driven at the high currents and powers that are required for the Doppler lidar application. Suppression of this behavior by means of corrugation pitch-modulation (using a detuned central section to prevent intensity peaking in the center of the cavity) is currently under investigation to achieve the required performance goals.

Author

Semiconductor Lasers; Earth Sciences; Remote Sensing; Oscillators; Earth Orbits; Doppler Radar; Wind Measurement; Absorption Spectroscopy

20070034891 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Partitioning Evapotranspiration in Semiarid Grassland and Shrubland Ecosystems Using Diurnal Surface Temperature Variation

Moran, M. Susan; Scott, Russell L.; Keefer, Timothy O.; Paige, Ginger B.; Emmerich, William E.; Cosh, Michael H.; O'Neill, Peggy E.; [2007]; 30 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The encroachment of woody plants in grasslands across the Western U.S. will affect soil water availability by altering the contributions of evaporation (E) and transpiration (T) to total evapotranspiration (ET). To study this phenomenon, a network of flux stations is in place to measure ET in grass- and shrub-dominated ecosystems throughout the Western U.S. A method is described and tested here to partition the daily measurements of ET into E and T based on diurnal surface temperature variations of the soil and standard energy balance theory. The difference between the mid-afternoon and pre-dawn soil surface temperature, termed Apparent Thermal Inertia (I(sub A)), was used to identify days when E was negligible, and thus, ET=T. For other days, a three-step procedure based on energy balance equations was used to estimate Qe contributions of daily E and T to total daily ET. The method was tested at Walnut Gulch Experimental Watershed in southeast Arizona based on Bowen ratio estimates of ET and continuous measurements of surface temperature with an infrared thermometer (IRT) from 2004-2005, and a second dataset of Bowen ratio, IRT and stem-flow gage measurements in 2003. Results showed that reasonable estimates of daily T were obtained for a multi-year period with ease of operation and minimal cost. With known season-long daily T, E and ET, it is possible to determine the soil water availability associated with grass- and shrub-dominated sites and better understand the hydrologic impact of regional woody plant encroachment.

Author

Thermal Emission; Grasslands; Evapotranspiration; Ecosystems; Arid Lands; Soils; Surface Temperature; Grasses

20070034915 Science Applications International Corp., USA

Forecasting Plant Productivity and Health Using Diffuse-to-Global Irradiance Ratios Extracted from the OMI Aerosol Product

Knowlton, Kelly; Andrews, Jane C.; Ryan, Robert E.; April 2007; 5 pp.; In English

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0132; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034915

Atmospheric aerosols are a major contributor to diffuse irradiance. This Candidate Solution suggests using the OMI (Ozone Monitoring Instrument) aerosol product as input into a radiative transfer model, which would calculate the ratio of diffuse to global irradiance at the Earth s surface. This ratio can significantly influence the rate of photosynthesis in plants; increasing the ratio of diffuse to global irradiance can accelerate photosynthesis, resulting in greater plant productivity. Accurate values of this ratio could be useful in predicting crop productivity, thereby improving forecasts of regional food resources. However, disagreements exist between diffuse-to-global irradiance values measured by different satellites and ground sensors. OMI, with its unique combination of spectral bands, high resolution, and daily global coverage, may be able to provide more accurate aerosol measurements than other comparable sensors.

Author

Aerosols; Forecasting; Photosynthesis; Radiative Transfer; Farm Crops; Health; Ozone; Irradiance; Productivity

20070034946 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Prototype of NASA's Global Precipitation Measurement Mission Ground Validation System

Schwaller, M. R.; Morris, K. R.; Petersen, W. A.; May 07, 2007; 4 pp.; In English; NASA Precipitation Measurement Science Team Meeting, 7-10 May 2007, Atlanta, GA, USA; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20070034946

NASA is developing a Ground Validation System (GVS) as one of its contributions to the Global Precipitation Mission (GPM). The GPM GVS provides an independent means for evaluation, diagnosis, and ultimately improvement of GPM spaceborne measurements and precipitation products. NASA's GPM GVS consists of three elements: field campaigns/physical validation, direct network validation, and modeling and simulation. The GVS prototype of direct network validation compares Tropical Rainfall Measuring Mission (TRMM) satellite-borne radar data to similar measurements from the U.S. national network of operational weather radars. A prototype field campaign has also been conducted; modeling and simulation prototypes are under consideration.

Author

Precipitation Measurement; Prototypes; Earth Sciences; Satellite-Borne Radar

20070034964 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Performance Expectations for Future Moderate Resolution Visible and Infrared Space Instruments Based on AIRS and MODIS In-Flight Experience

Pagano, Thomas S.; Broberg, Steven E.; Aumann, Hartmut H.; Baron, Richard L.; November 8, 2004; 8 pp.; In English; SPIE Remote Sensing of the Environment, 8 Nov. 2004, Honolulu, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40495

Lessons learned from the Atmospheric Infrared Sounder (AIRS) and the Moderate Resolution Imaging Spectroradiometer (MODIS) projects highlight areas where further technology development is needed to address future land, ocean and atmospheric measurement needs. Although not established as requirements at this time, it is anticipated that scientists will expect improvements in the areas of spatial, spectral, radiometric, polarimetric, temporal and calibration performance for future sensors. This paper addresses each of these performance areas and provides lessons learned from MODIS and AIRS. We also present expectations in performance of the system based on information from NASA Instrument Incubator Program and industry reports. Tradeoffs are presented vs orbit altitude (LEO, ME0 and GEO) and provide a 'systems' perspective to future measurement concepts.

Author

Infrared Instruments; MODIS (Radiometry); Imaging Spectrometers; Polarimetry; Low Earth Orbits; Calibrating

20070035027 NASA Langley Research Center, Hampton, VA, USA

Summer Dust Aerosols Detected from CALIPSO Observations over the Tibetan Plateau

Huang, Jianping; Minnis, Patrick; Yi, Yuhong; Tang, Qiang; Wang, Xin; Hu, Yongxiang; Liu, Zhaoyan; Ayers, Kirk; Trepte, Charles; Winker, David; [2007]; 19 pp.; In English; Original contains color illustrations

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Summertime Tibetan dust aerosol plumes are detected from the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite. CALIPSO reveals that dust storms occur 4 times more frequently than previously found from Tibetan surface observations because few surface sites were available over remote northwestern Tibet. The Tibetan dust aerosol is characterized by column-averaged depolarization and color ratios around 21% and 0.83, respectively. The dust layers appear most frequently around 4-7 km above mean sea level. The depolarization ratio for about 90% of the dust particles is less than 10% at low altitudes (3-5 km), while only about 50% of the particles have a greater depolarization ratio at higher altitudes (7-10 km) suggesting a separation of larger irregular particles from smaller, near spherical ones during transport. The 4-day back trajectory analyses show that these plumes probably originate from the nearby Taklimakan desert surface and accumulate over the northern slopes of the Tibetan Plateau. These dust outbreaks can affect the radiation balance of the atmosphere of Tibet because they both absorb and reflect solar radiation.

Author

Aerosols; Dust Storms; Plateaus; Summer; Tibet; CALIPSO (Pathfinder Satellite); Satellite Observation; Clouds (Meteorology); Remote Sensing

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*.

20070034230 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Diffusion of Innovation: Factors Promoting Interest in Solar Photovoltaic Generation Systems Within Air Force Installations

Diaz, Jr, Daniel; Mar 2007; 169 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469672; AFIT/GEM/ENV/07-M3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469672

The purpose of this research was to identify factors which promote interest in solar photovoltaic generation systems for facility use within the USA Air Force. The construct model was developed based on past literature on Diffusion of Innovation Theory. The model comprised of measures defined as motivation, knowledge, experience, and familiarity as well as contextual

variables. These measures were then used to determine whether any significant association existed between the measures and the overall dependent variable, interest. A phone interview was conducted on Air Force energy managers located within the continental U.S. The methods of correlation and regression analysis were used to evaluate the objectives and hypotheses identified. Results indicate that there is a positive, significant relationship between the motivation to seek new energy technologies for reducing load demands and interest in solar photovoltaic generation systems. The significant factors promoting interest were identified as knowledge, the amount of solar irradiance a base receives, the peak electrical demand loads of a base, and the population size of a base.
DTIC
Diffusion; Diffusion Theory; Electric Generators; Electric Power Plants; Military Air Facilities; Photovoltaic Cells; Photovoltaic Conversion; Solar Generators

20070034745 Oregon State Univ., Corvallis, OR USA
Microscale Power Generation Based on Radiolytic Processes (Preprint)
Peterson, Richard B; Paul, Brian K; Palmer, Todd; Wu, Qiao; Jost, William; Tseng, Chih-Heng T; Tiwari, Santosh; Patello, Gertrude; Buck, Edgar C; Holladay, Jamelyn D; Dec 2006; 6 pp.; In English
Contract(s)/Grant(s): FA8651-04-1-0005
Report No.(s): AD-A469985; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Oregon State University, Battelle Pacific Northwest Division, and Case Western Reserve University have been investigating nuclear-to-electric power generation utilizing a technique based on closed cycle fuel cell operation. The approach being developed is to first use the decay energy of a radioisotope to generate H2 and O2 from water, then to utilize these species in a fuel cell to generate electricity. This method can regenerate its own reactants and operate continuously as a closed system for as long as the primary source of power, namely the radioisotope, is active. With micro engineering and fabrication techniques available today, a miniaturized integrated package of 1 cm3 in size and producing power in the 10 mW range appears feasible in a mature design. For this project, a unique fuel cell capable of utilizing mixed reactants at room temperature has been developed. Efficiency of this early fuel cell design falls in the range between 15 and 20%. Measured power output from a test cell approached 0.45 mW for several hours with a radiation leakage rate estimated at 490 mrem/yr.
DTIC
Radioisotope Batteries; Energy Conversion; Nuclear Electric Power Generation

20070034746 Massachusetts Inst. of Tech., Cambridge, MA USA
Microchemical Systems for Fuel Processing and Conversion to Electrical Power
Jensen, Klavs F; Mar 15, 2007; 84 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0566
Report No.(s): AD-A469898; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This final report describes progress and accomplishments of the MIT MURI Microchemical Systems for Fuel Processing and Conversion to Electrical Power. The program aimed to develop a fundamental understanding of the different physical phenomena underlying fuel processing at millimeter to micron scale as well as to establish the engineering principles needed to realize portable electrical power generation from hydrocarbon fuels. Competing approaches to fuel conversions were addressed with particular emphasis on two basic strategies: (i) conversion of hydrocarbons to hydrogen by partial oxidation, reforming, and product separation steps; and (ii) direct conversion of hydrocarbon fuels in microfabricated solid oxide fuel (SOFC) cell systems. Advances have been made in design and microfabrication strategies for microchemical systems capable of operating at elevated temperatures and being rapidly cycled between low and high temperatures; microfabrication and characterization of SOFC electrolyte and electrode materials; synthesis of novel catalytic materials; understanding and engineering approaches to integration of materials with different thermophysical properties into systems undergoing large spatial and temporal temperature variations; and development of systems engineering concepts and tools for understanding and predicting the performance of integrated microchemical systems at steady state and during transients.
DTIC
Solid Oxide Fuel Cells; Energy Conversion; Microminiaturization

45
ENVIRONMENT POLLUTION

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

20070034168 NASA Ames Research Center, Moffett Field, CA, USA
Reactive Nitrogen Distribution and Partitioning in the North American Troposphere and Lowermost Stratosphere
Singh, H. B.; Salas, L.; Herlth, D.; Kolyer, R.; Czech, E.; Crawford, J. H.; Pierce, R. B.; Sachse, G. W.; Blake, D. R.; Cohen, R. C.; Bertram, T. H.; Perring, A.; Wooldridge, P. J.; Dibb, J.; Huey, G.; Hudman, R. C.; Turquety, S.; Emmons, L. K.; Flocke, F.; Tang, Y.; Carmichael, G. R.; Horowitz, L. W.; Journal of Geophysical Research; April 04, 2007; ISSN 0148-0227; Volume 112; 15 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNA04CC92A; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006JD007664

A comprehensive group of reactive nitrogen species (NO, NOz, HN03, HOzN02, PANs, alkyl nitrates, and aerosol-NO3) were measured over North America during July/August 2004 from the NASA DC-8 platform (0.1 - 12 km). Nitrogen containing tracers of biomass combustion (HCN and CH3CN) were also measured along with a host of other gaseous (CO, VOC, OVOC, halocarbon) and aerosol tracers. Clean background air as well as air with influences from biogenic emissions, anthropogenic pollution, biomass combustion, convection, lightning, and the stratosphere was sampled over the continental USA, the Atlantic, and the Pacific. The North American upper troposphere (UT) was found to be greatly influenced by both lightning NO, and surface pollution lofted via convection and contained elevated concentrations of PAN, ozone, hydrocarbons, and NO,. Observational data suggest that lightning was a far greater contributor to NO, in the UT than previously believed. PAN provided a dominant reservoir of reactive nitrogen in the UT while nitric acid dominated in the lower troposphere (LT). Peroxynitric acid (H02N02) was present in sizable concentrations peaking at around 8 km. Aerosol nitrate appeared to be mostly contained in large soil based particles in the LT. Plumes from Alaskan fires contained large amounts of PAN and aerosol nitrate but little enhancement in ozone. A comparison of observed data with simulations from four 3-D models shows significant differences between observations and models as well as among models. We investigate the partitioning and interplay of the reactive nitrogen species within characteristic air masses and further examine their role in ozone formation. Author
Air Quality; Convection; Lightning; Nitrogen; North America; Reactivity; Stratosphere; Troposphere; Ozone

20070034181 NASA Ames Research Center, Moffett Field, CA, USA
Trajectory Studies of Large HNO3-Containing PSC Particles in the Arctic: Evidence for the Role of NAT
McKinney, K. A.; Wennberg, P. O.; Dhaniyala, S.; Fahey, D. W.; Northway, M. J.; Kuenzi, K. F.; Kleinboehl, A.; Sinnhuber, M.; Kuellmann, H.; Bremer, H.; Mahoney, M. J.; Bui, T. P.; Geophysical Research Letters; March 06, 2004; ISSN 0094-8276; Volume 31; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNA04CC92A; NSF ATM-98-71353; NAG5-8922; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2003GL018430

Large (5 to >20 micron diameter) nitric-acid-containing polar stratospheric cloud (PSC) particles were observed in the Arctic stratosphere during the winter of 1999-2000. We use a particle growth and sedimentation model to investigate the environment in which these particles grew and the likely phase of the largest particles. Particle trajectory calculations show that, while simulated nitric acid dihydrate (NAD) particle sizes are significantly smaller than the observed maximum particle sizes, nitric acid trihydrate (NAT) particle trajectories are consistent with the largest observed particle sizes.
Author
Arctic Regions; Nitric Acid; Particle Trajectories; Polar Meteorology; Stratosphere; Atmospheric Composition

20070034182 NASA Ames Research Center, Moffett Field, CA, USA
Analysis of the Atmospheric Distribution, Sources, and Sinks of Oxygenated Volatile Organic Chemicals Based on Measurements over the Pacific during TRACE-P
Singh, H. B.; Salas, L. J.; Chatfield, r. B.; Czech, E.; Fried, A.; Walega, J.; Evans, M. J.; Field, B. D.; Jacob, D. J.; Blake, D.; Heikes, B.; Talbot, R.; Sachse, G.; Crawford, J. H.; Avery, M. A.; Sandholm, S.; Fuelberg, H.; Journal of Geophysical Research; June 03, 2004; ISSN 0148-0227; Volume 109; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNA04CC92A; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2003JD003883

Airborne measurements of a large number of oxygenated volatile organic chemicals (OVOC) were carried out in the

Pacific troposphere (0.1-12 km) in winter/spring of 2001 (24 February to 10 April). Specifically, these measurements included acetone (CH3COCH3), methylethyl ketone (CH3COC2H5, MEK), methanol (CH3OH), ethanol (C2H5OH), acetaldehyde (CH3CHO), propionaldehyde (C2H5CHO), peroxyacylnitrates (PANs) (C(sub n)H(sub 2n+1)COO2NO2), and organic nitrates (C(sub n)H(sub 2n+1)ONO2). Complementary measurements of formaldehyde (HCHO), methyl hydroperoxide (CH3OOH), and selected tracers were also available. OVOC were abundant in the clean troposphere and were greatly enhanced in the outflow regions from Asia. Background mixing ratios were typically highest in the lower troposphere and declined toward the upper troposphere and the lowermost stratosphere. Their total abundance (Summation of OVOC) was nearly twice that of nonmethane hydrocarbons (Summation of C2-C8 NMHC). Throughout the troposphere, the OH reactivity of OVOC is comparable to that of methane and far exceeds that of NMHC. A comparison of these data with western Pacific observations collected some 7 years earlier (February-March 1994) did not reveal significant differences. Mixing ratios of OVOC were strongly correlated with each other as well as with tracers of fossil and biomass/biofuel combustion. Analysis of the relative enhancement of selected OVOC with respect to CH3Cl and CO in 12 plumes originating from fires and sampled in the free troposphere (3-11 km) is used to assess their primary and secondary emissions from biomass combustion. The composition of these plumes also indicates a large shift of reactive nitrogen into the PAN reservoir thereby limiting ozone formation. A three-dimensional global model that uses state of the art chemistry and source information is used to compare measured and simulated mixing ratios of selected OVOC. While there is reasonable agreement in many cases, measured aldehyde concentrations are significantly larger than predicted. At their observed levels, acetaldehyde mixing ratios are shown to be an important source of HCHO (and HO x) and PAN in the troposphere. On the basis of presently known chemistry, measured mixing ratios of aldehydes and PANs are mutually incompatible. We provide rough estimates of the global sources of several OVOC and conclude that collectively these are extremely large (150-500 Tg C / yr) but remain poorly quantified. Author

Atmospheric Composition; Combustion; Methyl Compounds; Mixing Ratios; Troposphere; Pacific Ocean

20070034183 NASA Ames Research Center, Moffett Field, CA, USA

Nitric Acid Uptake on Subtropical Cirrus Cloud Particles

Popp, P. J.; Gao, R. S.; Marcy, T. P.; Fahey, D. W.; Hudson, P. K.; Thompson, T. L.; Kaercher, B.; Ridley, B. A.; Weinheimer, A. J.; Knapp, D. J.; Montzka, D. D.; Baumgardner, D.; Garrett, T. J.; Weinstock, E. M.; Smith, J. B.; Sayres, D. S.; Pittman, J. V.; Dhaniyala, S.; Bui, T. P.; Mahoney, M. J.; Journal of Geophysical Research; March 17, 2004; ISSN 0148-0227; Volume 109; 14 pp.; In English; Original contains black and white illustrations

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ONLINE: http://dx.doi.org/10.1029/2003JD004255

The redistribution of HNO3 via uptake and sedimentation by cirrus cloud particles is considered an important term in the upper tropospheric budget of reactive nitrogen. Numerous cirrus cloud encounters by the NASA WB-57F high-altitude research aircraft during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL-FACE) were accompanied by the observation of condensed-phase HNO3 with the NOAA chemical ionization mass spectrometer. The instrument measures HNO3 with two independent channels of detection connected to separate forward and downward facing inlets that allow a determination of the amount of HNO3 condensed on ice particles. Subtropical cirrus clouds, as indicated by the presence of ice particles, were observed coincident with condensed-phase HNO3 at temperatures of 197-224 K and pressures of 122-224 hPa. Maximum levels of condensed-phase HNO3 approached the gas-phase equivalent of 0.8 ppbv. Ice particle surface coverages as high as 1.4 # 10(exp 14) molecules/ square cm were observed. A dissociative Langmuir adsorption model, when using an empirically derived HNO3 adsorption enthalpy of -11.0 kcal/mol, effectively describes the observed molecular coverages to within a factor of 5. The percentage of total HNO3 in the condensed phase ranged from near zero to 100% in the observed cirrus clouds. With volume-weighted mean particle diameters up to 700 ?m and particle fall velocities up to 10 m/s, some observed clouds have significant potential to redistribute HNO3 in the upper troposphere.

Author

Cirrus Clouds; Ice; Nitric Acid; Reactivity; Troposphere; Atmospheric Composition

20070034304 Desert Research Inst., Reno, NV USA

Development and Validation of a Predictive Model to Assess the Impact of Coastal Operations On Urban Scale Air Quality

Gertler, Alan W; Kahyaoglu, Julide; Koracin, Darko; Luria, Menachem; Stockwell, William; Weinroth, Erez; Sep 29, 2006; 50 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA72-02-C-0008; Proj-SI-1253

Report No.(s): AD-A469780; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469780

Elevated levels of ozone (O3) remain a serious issue throughout the U.S. Approximately 90 urban areas in the U.S., containing some 30% of the U.S. population, still exceed the O3 standard, with little immediate prospect of attainment. All the major urban areas in California are classified as non-attainment for O3. Control of O3 in the troposphere is complicated by the fact that it is a secondary pollutant. Particulate matter (PM) is also a serious environmental issue. Recognizing the health impacts of fine particulates, i.e., PM2.5, there are new standards for PM2.5. Unlike PM10, a significant fraction of ambient PM2.5 is produced by secondary reactions. Many of the urban areas classified as non-attainment for O3 or PM10 and facing non-attainment for PM2.5 are located along the east and west coasts of the U.S. and are home to major DoD facilities. These operations can be significant sources of the O3 and PM2.5 forming precursors, direct PM2.5 and PM10 emissions, and emissions of toxic species. Much of the uncertainty in developing an understanding of the causes of reduced air quality in urban areas is due to uncertainty in the emissions inventories; however, in coastal areas the situation is confounded by the complex meteorology associated with the land/sea interface. To evaluate the impact of emissions from DoD activities and control elevated pollutant levels, there is a need to develop forecasting models that incorporate the processes leading to secondary pollutant formation. These processes include emissions, meteorology (transport and dispersion), and transformation chemistry. In order to address this need, the primary objective of this study was to develop a prognostic modeling system capable of assessing the potential influence of DoD facilities and operations on air quality in coastal zones. An additional objective was to develop an approach applicable to other complex environments.

DTIC

Air Quality; Cities; Coasts; Models; Predictions

20070034832 Maryland Univ., College Park, MD, USA; NASA Langley Research Center, Hampton, VA, USA

A Side by Side Comparison of Filter-Based PM(sub 2.5) Measurements at a Suburban Site: A Closure Study

Haines, Jennifer C.; Chen, Lung-Wen A.; Taubman, Brett F.; Doddridge, Bruce G.; Dickerson, Russell R.; [2008]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Reliable determination of the effects of air quality on public health and the environment requires accurate measurement of PM(sub 2.5) mass and the individual chemical components of fine aerosols. This study seeks to evaluate PM(sub 2.5) measurements that are part of a newly established national network by comparing them with a more conventional sampling system. Experiments were carried out during 2002 at a suburban site in Maryland, USA, where two samplers from the U.S. Environmental Protection Agency (USEPA) Speciation Trends Network: Met One Speciation Air Sampling System STNS and Thermo Scientific Reference Ambient Air Sampler STNR, two Desert Research Institute Sequential Filter Samplers DRIF, and a continuous TEOM monitor (Thermo Scientific Tapered Element Oscillating Microbalance) were sampling air in parallel. These monitors differ not only in sampling configuration but also in protocol-specific sample analysis procedures. Measurements of PM(sub 2.5) mass and major contributing species were well correlated among the different methods with r-values > 0.8. Despite the good correlations, daily concentrations of PM(sub 2.5) mass and major contributing species were significantly different at the 95% confidence level from 5 to 100% of the time. Larger values of PM(sub 2.5) mass and individual species were generally reported from STNR and STNS. The January STNR average PM(sub 2.5) mass (8.8 (micro)g/per cubic meter) was 1.5 (micro)g/per cubic meter larger than the DRIF average mass. The July STNS average PM(sub 2.5) mass (27.8 (micro)g/per cubic meter) was 3.8 (micro)g/per cubic meter larger than the DRIF average mass. These differences can only be partially accounted for by known random errors. Variations in flow control, face velocity, and sampling artifacts likely influence the measurement of PM(sub 2.5) speciation and mass closure. Simple statistical tests indicate that the current uncertainty estimates used in the STN network may underestimate the actual uncertainty.

Author

Air Quality; Air Sampling; Particulate Sampling; Particulates; Cross Correlation

20070034889 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Regional Aerosol Optical Properties and Radiative Impact of the Extreme Smoke Event in the European Arctic in Spring 2006

Lund Myhre, C.; Toledano, C.; Myhre, G.; Stebel, K.; Yttri, K.; Aaltonen, V.; Johnsrud, M.; Frioud, M.; Cachorro, V.; deFrutos, A.; Lihavainen, H.; Campbell, J.; Chaikovsky, A.; Shiobara, M.; Welton, E.; Torseth, K.; [2007]; 23 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

In spring 2006 a special meteorological situation occurred in the European Arctic region giving record high levels of air pollution. The synoptic situation resulted in extensive transport of pollution predominantly from agricultural fires in Eastern Europe into the Arctic region and record high air-pollution levels were measured at the Zeppelin observatory at Ni-Alesun(78deg 54'N, 11deg 53'E) in the period from 25 April to 12 May. In the present study we investigate the optical properties of the aerosols from this extreme event and we estimate the radiative forcing of this episode. We examine the aerosol optical properties from the source region and into the European Arctic and explore the evolution of the episode and the changes in the optical properties. A number of sites in Eastern Europe, Northern Scandinavia and Svalbard are included in the study. In addition to AOD measurements, we explored lidar measurements from Minsk, ALOMAR (Arctic Lidar Observatory for Middle Atmosphere Research at Andenes) and Ny-Alesund. For the AERONET sites included (Minsk, Toravere, Hornsund) we have further studied the evolution of the aerosol size. Importantly, at Svalbard it is consistency between the AERONET measurements and calculations of single scattering albedo based on aerosol chemical composition. We have found strong agreement between the satellite dally MODIS AOD and the ground-based AOD observations. This agreement is crucial for the radiative forcing calculations. We calculate a strong negative radiative forcing for the most polluted days employing the analysed ground based data, MODIS AOD and a multi-stream model for radiative transfer of solar radiation.

Author

Aerosols; Smoke; Air Pollution; Optical Properties; Arctic Regions; MODIS (Radiometry); Radar Measurement; Radiative Transfer

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*.

20070034215 Emory Univ., Atlanta, GA USA

Theoretical Studies of Gas Phase Elementary Reactions

Morokuma, Keiji; Jun 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-04-1-0080; F49620-02-1-0357

Report No.(s): AD-A469625; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469625

This final technical report begins with the objective the project, followed by summary reports on new accomplishments and findings obtained in the project. They are presented in four sections: A. Potential Energy Surfaces of Ion-Molecule Reactions and Ionic Species, B. Potential Energy Surfaces for Elementary Reactions of Atmospheric Importance, C. Potential Energy Surfaces for Electronic Spectroscopy, Photochemical Reactions and Nonadiabatic Processes. D. Interaction of Oxygen and Other Small Molecules with Electron and Other Molecules.

DTIC

Potential Energy; Vapor Phases

20070034737 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Flux Transfer Events Simultaneously Observed by Polar and Cluster: Flux Rope in the Subsolar Region and Flux Tube Addition to the Polar Cusp

Le, G.; Zheng, Y.; Russell, C. T.; Pfaff, R. F.; Lin, N.; Slavin, J. A.; Parks, G.; Wilber, M.; Petrinec, S. M.; Lucek, E. A.; Reme, H.; [2007]; 2 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The phenomenon called flux transfer events (FTEs) is widely accepted as the manifestation of time-dependent reconnection. In this paper, we present observational evidence of a flux transfer event observed simultaneously at low-latitude by Polar and at high-latitude by Cluster. This event occurs on March 21, 2002, when both Cluster and Polar are located near local noon but with a large latitudinal separation. During the event, Cluster is moving outbound from the polar cusp to the

magnetosheath, and Polar is in the magnetosheath near the equatorial magnetopause. The observations show that a flux transfer event occurs between the equator and the northern cusp. Polar and Cluster observe the FTE s two open flux tubes: Polar encounters the southward moving flux tube near the equator; and Cluster the northward moving flux tube at high latitude. The low latitude FTE appears to be a flux rope with helical magnetic field lines as it has a strong core field and the magnetic field component in the boundary normal direction exhibits a strong bi-polar variation. Unlike the low-latitude FTE, the high-latitude FTE observed by Cluster does not exhibit the characteristic bi-polar perturbation in the magnetic field. But the plasma data clearly reveal its open flux tube configuration. It shows that the magnetic field lines have straightened inside the FTE and become more aligned to the neighboring flux tubes as it moves to the cusp. Enhanced electrostatic fluctuations have been observed within the FTE core, both at low- and high-latitudes. This event provides a unique opportunity to understand high-latitude FTE signatures and the nature of time-varying reconnection.
Author
Flux Transfer Events; Polar Regions; Polar Cusps; Time Dependence; Magnetic Flux

20070034783 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Enhanced Positive Water Vapor Feedback Associated with Tropical Deep Convection: New Evidence from Aura MLS
Su, Hui; Read, William G.; Jiang, Jonathan H.; Waters, Joe W.; Wu, Dong L.; Fetzer, Eric J.; Geophysical Research Letters; March 11, 2006; ISSN 0094-8276; Volume 33; 5 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40309; http://dx.doi.org/10.1029/2005GL025505

Recent simultaneous observations of upper tropospheric (UT) water vapor and cloud ice from the Microwave Limb Sounder (MLS) on the Aura satellite provide new evidence for tropical convective influence on UT water vapor and its associated greenhouse effect. The observations show that UT water vapor increases as cloud ice water content increases. They also show that, when sea surface temperature (SST) exceeds approx.300 K, UT cloud ice associated with tropical deep convection increases sharply with increasing SST. The moistening of the upper troposphere by deep convection leads to an enhanced positive water vapor feedback, about 3 times that implied solely by thermodynamics. Over tropical oceans when SST greater than approx.300 K, the 'convective UT water vapor feedback' inferred from the MLS observations contributes approximately 65% of the sensitivity of the clear-sky greenhouse parameter to SST.
Author
Water Vapor; Troposphere; Greenhouse Effect; Microwave Sounding; Positive Feedback; Moisture Content; Sea Surface Temperature

20070034784 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Spatiotemporal Filtering Using Principal Component Analysis and Karhunen-Loeve Expansion Approaches for Regional GPS Network Analysis
Dong, D.; Fang, P.; Bock, F.; Webb, F.; Prawirondirdjo, L.; Kedar, S.; Jamason, P.; Journal of Geophysical Research; March 9, 2006; Volume 110; 16 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40310; http://dx.doi.org/10.1029/2005JB003806

Spatial filtering is an effective way to improve the precision of coordinate time series for regional GPS networks by reducing so-called common mode errors, thereby providing better resolution for detecting weak or transient deformation signals. The commonly used approach to regional filtering assumes that the common mode error is spatially uniform, which is a good approximation for networks of hundreds of kilometers extent, but breaks down as the spatial extent increases. A more rigorous approach should remove the assumption of spatially uniform distribution and let the data themselves reveal the spatial distribution of the common mode error. The principal component analysis (PCA) and the Karhunen-Loeve expansion (KLE) both decompose network time series into a set of temporally varying modes and their spatial responses. Therefore they provide a mathematical framework to perform spatiotemporal filtering.We apply the combination of PCA and KLE to daily station coordinate time series of the Southern California Integrated GPS Network (SCIGN) for the period 2000 to 2004. We demonstrate that spatially and temporally correlated common mode errors are the dominant error source in daily GPS solutions. The spatial characteristics of the common mode errors are close to uniform for all east, north, and vertical components, which implies a very long wavelength source for the common mode errors, compared to the spatial extent of the GPS network in southern California. Furthermore, the common mode errors exhibit temporally nonrandom patterns.
Author
Global Positioning System; Karhunen-Loeve Expansion; Network Analysis; Time Series Analysis; Principal Components Analysis; Spatial Filtering; Deformation

20070034785 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Vertical Profiles of Aerosol Volume from High Spectral Resolution Infrared Transmission Measurements: Results

Eldering, Annmarie; Kahn, Brian H.; Mills, Franklin P.; Irion, Fredrick W.; Steele, Helen M.; Gunson, Michael R.; Journal of Geophysical Research; October 19, 2004; Volume 109; 11 pp.; In English; Original contains color and black and white illustrations

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ONLINE: http://hdl.handle.net/2014/40303; http://dx.doi.org/10.1029/2004JD004623

The high-resolution infrared absorption spectra of the Atmospheric Trace Molecule Spectroscopy (ATMOS) experiment are utilized to derive vertical profiles of sulfate aerosol volume density and extinction coefficient. Following the eruption of Mt. Pinatubo in June 1991, the ATMOS spectra obtained on three Space Shuttle missions (1992, 1993, and 1994) provide a unique opportunity to study the global stratospheric sulfate aerosol layer shortly after a major volcanic eruption and periodically during the decay phase. Synthetic sulfate aerosol spectra are fit to the observed spectra, and a global fitting inversion routine is used to derive vertical profiles of sulfate aerosol volume density. Vertical profiles of sulfate aerosol volume density for the three missions over portions of the globe are presented, with the peak in aerosol volume density occurring from as low as 10 km (polar latitudes) to as high as 20 km (subtropical latitudes). Derived aerosol volume density is as high as 2-3.5 (mu)m(exp 3) per cubic centimeter +/-10% in 1992, decreasing to 0.2-0.5 (mu)m(exp 3) per cubic centimeter +/-20% in 1994, in agreement with other experiments. Vertical extinction profiles derived from ATMOS are compared with profiles from Improved Stratospheric And Mesospheric Sounder (ISAMS) and Cryogenic Limb Array Etalon Spectrometer (CLAES) that coincide in space and time and show good general agreement. The uncertainty of the ATMOS vertical profiles is similar to CLAES and consistently smaller than ISAMS at similar altitudes.

Author

Absorption Spectra; Aerosols; Spectral Resolution; Cryogenics; Infrared Spectra; Atmospheric Composition; Sulfates; Stratosphere; Etalons; Air Pollution

20070034850 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Using the GeoFEST Faulted Region Simulation System

Parker, Jay W.; Lyzenga, Gregory A.; Donnellan, Andrea; Judd, Michele A.; Norton, Charles D.; Baker, Teresa; Tisdale, Edwin R.; Li, Peggy; July 9, 2004; 5 pp.; In English; 4th International Asia Pacific Economic Cooperation (APEC) Cooperation for Earthquake Simulation (ACES) Workshop, 9-14 Jul. 2004, Beijing, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40445

GeoFEST (the Geophysical Finite Element Simulation Tool) simulates stress evolution, fault slip and plastic/elastic processes in realistic materials, and so is suitable for earthquake cycle studies in regions such as Southern California. Many new capabilities and means of access for GeoFEST are now supported. New abilities include MPI-based cluster parallel computing using automatic PYRAMID/Parmetis-based mesh partitioning, automatic mesh generation for layered media with rectangular faults, and results visualization that is integrated with remote sensing data. The parallel GeoFEST application has been successfully run on over a half-dozen computers, including Intel Xeon clusters, Itanium II and Altix machines, and the Apple G5 cluster. It is not separately optimized for different machines, but relies on good domain partitioning for load-balance and low communication, and careful writing of the parallel diagonally preconditioned conjugate gradient solver to keep communication overhead low. Demonstrated thousand-step solutions for over a million finite elements on 64 processors require under three hours, and scaling tests show high efficiency when using more than (order of) 4000 elements per processor. The source code and documentation for GeoFEST is available at no cost from Open Channel Foundation. In addition GeoFEST may be used through a browser-based portal environment available to approved users. That environment includes semi-automated geometry creation and mesh generation tools, GeoFEST, and RIVA-based visualization tools that include the ability to generate a flyover animation showing deformations and topography. Work is in progress to support simulation of a region with several faults using 16 million elements, using a strain energy metric to adapt the mesh to faithfully represent the solution in a region of widely varying strain.

Author

Earthquakes; Finite Element Method; Geological Faults; Conjugate Gradient Method; Remote Sensing; Topography

20070034977 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Global Simulations of Magnetotail Reconnection

Kuznetsova, M. M.; Hesse, M.; Rastatter, L.; Toth, G.; Gombosi, T.; March 26, 2007; 1 pp.; In English; 2007 US-Japan Reconnection Workshop, 26-29 Mar. 2007, Saint Michaels, MD, USA; Copyright; Avail.: Other Sources; Abstract Only

There is a growing number of observational evidences of dynamic quasi-periodical magnetosphere response to

continuously southward interplanetary magnetic field (IMF). However, traditional global MHD simulations with magnetic reconnection supported by numerical dissipation and ad hoc anomalous resistivity driven by steady southward IMF often produce only quasi-steady configurations with almost stationary near-earth neutral line. This discrepancy can be explained by the assumption that global MHD simulations significantly underestimate the reconnection rate in the magnetotail during substorm expansion phase. Indeed, comparative studies of magnetic reconnection in small scale geometries demonstrated that traditional resistive MHD did not produce the fast reconnection rates observed in kinetic simulations. The major approximation of the traditional MHD approach is an isotropic fluid assumption) with zero off-diagonal pressure tensor components. The approximation, however, becomes invalid in the diffusion region around the reconnection site where ions become unmagnetized and experience nongyrotropic behaviour. Deviation from gyrotropy in particle distribution function caused by kinetic effects manifests itself in nongyrotropic pressure tensor with nonzero off-diagonal components. We use the global MHD code BATS-R-US and replace ad hoc parameters such as 'critical current density' and 'anomalous resistivity' with a physically motivated dissipation model. The key element of the approach is to identify diffusion regions where the isotropic fluid MHD approximation is not applicable. We developed an algorithm that searches for locations of magnetotail reconnection sites. The algorithm takes advantage of block-based domain-decomposition technique employed by the BATS-R-US. Boundaries of the diffusion region around each reconnection site are estimated from the gyrotropic orbit threshold condition, where the ion gyroradius is equal to the distance to the reconnection site. Inside diffusion regions ions are treated as nongyrotropic fluid with nonzero off-diagonal components of the pressure tensor. The primary kinetic mechanism controlling the dissipation in the diffusion region is incorporated into global MHD simulations in terms of spatially localized nongyrotropic corrections to the induction equation. The magnitude of the non-gyrotropic corrections to the electric field and spatial scales of the diffusion regions are calculated self-consistently at each time step of the simulation using local MHD plasma and field parameters at the reconnection site without introduction of any ad hoc parameters. We demonstrated that magnetotail reconnection is inherently unsteady even when the solar wind is steady. Global MHD simulations with nongyrotropic corrections produce bursts of fast reconnection typically observed in small-scale kinetic simulations. During the bursts the length of the diffusion region does not exceed 2R(sub E) approximates 12(c/omega * pi). The bursts of the fast reconnection last only for a few minutes. After reaching the maximum value the reconnection rate decreases while the length of the diffusion region increases. The decreased rate, however, is still significantly larger that the steady reconnection rate characteristic for MHD simulations with reconnection supported by numerical resistivity alone. Magnetotail reconnection supported by nongyrotropic effects results in a tailward retreat of the reconnection site with average speed of the order of 100 km/s, accompanied by magnetotail stretching and thin current sheet formation in the near-Earth plasma sheet. Overall magnetotail response to the steady low-mach-number solar wind with southward IMF exhibits quasi-periodic loading/unloading dynamics typical for frequently observed multiple substorms.

Author

Geomagnetic Tail; Magnetic Field Reconnection; Magnetohydrodynamics; Simulation; Geomagnetism

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070034157 Colorado Univ., Boulder, CO, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Recent Changes in the Arctic Melt Season

Stroeve, Julienne; Markus, Thorsten; Meier, Walter N.; Miller, Jeff; Annals of Glaciology; [2007]; Volume 44, No. 1, pp. 367-374; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04GO51G; Copyright; Avail.: Other Sources

ONLINE: http://www.ingentaconnect.com/content/igsoc/agl/2006/00000044/00000001/art0

Melt-season duration, melt-onset and freeze-up dates are derived from satellite passive microwave data and analyzed from 1979 to 2005 over Arctic sea ice. Results indicate a shift towards a longer melt season, particularly north of Alaska and Siberia, corresponding to large retreats of sea ice observed in these regions. Although there is large interannual and regional variability in the length of the melt season, the Arctic is experiencing an overall lengthening of the melt season at a rate of about 2 weeks decade(sup -1). In fact, all regions in the Arctic (except for the central Arctic) have statistically significant (at the 99% level or higher) longer melt seasons by greater than 1 week decade(sup -1). The central Arctic shows a statistically significant trend (at the 98% level) of 5.4 days decade(sup -1). In 2005 the Arctic experienced its longest melt season, corresponding with the least amount of sea ice since 1979 and the warmest temperatures since the 1880s. Overall, the length of the melt season is

inversely correlated with the lack of sea ice seen in September north of Alaska and Siberia, with a mean correlation of -0.8. Author

Arctic Ocean; Sea Ice; Seasons; Melting; Multichannel Communication; Climatology

20070034169 NASA Ames Research Center, Moffett Field, CA, USA

Small-Scale Gravity Waves in ER-2 MMS/MTP Wind and Temperature Measurements during CRYSTAL-FACE

Wang, L.; Alexander, M. J.; Bui, T. P.; Mahoney, M. J.; Atmospheric Chemistry and Physics; April 03, 2006; Volume 6, Issue 4, pp. 1091-1104; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNA04CC92A; NSF ATM-02-34230; Copyright; Avail.: Other Sources

Lower stratospheric wind and temperature measurements made from NASA's high-altitude ER-2 research aircraft during the CRYSTAL-FACE campaign in July 2002 were analyzed to retrieve information on small scale gravity waves (GWs) at the aircraft's flight level (typically approximately 20 km altitude). For a given flight segment, the S-transform (a Gaussian wavelet transform) was used to search for and identify small horizontal scale GW events, and to estimate their apparent horizontal wavelengths. The horizontal propagation directions of the events were determined using the Stokes parameter method combined with the cross S-transform analysis. The vertical temperature gradient was used to determine the vertical wavelengths of the events. GW momentum fluxes were calculated from the cross S-transform. Other wave parameters such as intrinsic frequencies were calculated using the GW dispersion relation. More than 100GW events were identified. They were generally high frequency waves with vertical wavelength of approximately 5 km and horizontal wavelength generally shorter than 20 km. Their intrinsic propagation directions were predominantly toward the east, whereas their ground-based propagation directions were primarily toward the west. Among the events, approximately 20% of them had very short horizontal wavelength, very high intrinsic frequency, and relatively small momentum fluxes, and thus they were likely trapped in the lower stratosphere. Using the estimated GW parameters and the background winds and stabilities from the NCAR/NCEP reanalysis data, we were able to trace the sources of the events using a simple reverse ray-tracing. More than 70% of the events were traced back to convective sources in the troposphere, and the sources were generally located upstream of the locations of the events observed at the aircraft level. Finally, a probability density function of the reversible cooling rate due to GWs was obtained in this study, which may be useful for cirrus cloud models.

Author

Atmospheric Temperature; Gravity Waves; Temperature Gradients; Temperature Measurement; Wind (Meteorology); Atmospheric Circulation; Tropical Meteorology

20070034170 NASA Ames Research Center, Moffett Field, CA, USA

Evolution of a Florida Cirrus Anvil

Garrett, T. J.; Navarro, B.C.; Twohy, C. H.; Jensen, E. J.; Bui, P. T.; Baumgardner, D. G.; Gerber, H.; Herman, R. L.; Heymsfield, A. J.; Lawson, P.; Minnis, P.; Nguyen, L.; Poellot, M.; Pope, S. K.; Valero, F. P. J.; Weinstock, E. M.; Journal of Atmospheric Sciences; July 2005; Volume 62, No. 7, pp. 2352-2372; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNA04CC92A; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/JAS3495.1

This paper presents a detailed study of a single thunderstorm anvil cirrus cloud measured on 21 July 2002 near southern Florida during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers--Florida Area Cirrus Experiment (CRYSTAL-FACE). NASA WB-57F and University of North Dakota Citation aircraft tracked the microphysical and radiative development of the anvil for 3 h. Measurements showed that the cloud mass that was advected downwind from the thunderstorm was separated vertically into two layers: a cirrus anvil with cloud-top temperatures of -45-C lay below a second, thin tropopause cirrus (TTC) layer with the same horizontal dimensions as the anvil and temperatures near -70-C. In both cloud layers, ice crystals smaller than 50 ?m across dominated the size distributions and cloud radiative properties. In the anvil, ice crystals larger than 50 ?m aggregated and precipitated while small ice crystals increasingly dominated the size distributions; as a consequence, measured ice water contents and ice crystal effective radii decreased with time. Meanwhile, the anvil thinned vertically and maintained a stratification similar to its environment. Because effective radii were small, radiative heating and cooling were concentrated in layers approximately 100 m thick at the anvil top and base. A simple analysis suggests that the anvil cirrus spread laterally because mixing in these radiatively driven layers created horizontal pressure gradients between the cloud and its stratified environment. The TTC layer also spread but, unlike the anvil, did not dissipate--perhaps because the anvil shielded the TTC from terrestrial infrared heating. Calculations of top-of-troposphere

radiative forcing above the anvil and TTC showed strong cooling that tapered as the anvil evolved.
Author
Anvil Clouds; Cloud Physics; Florida; Climatology; Precipitation (Meteorology); Atmospheric Moisture

20070034174 Atmospheric and Environmental Research, Inc., Lexington, MA, USA
Coupled Stochastic Time-Inverted Lagrangian Transport/Weather Forecast and Research/Vegetation Photosynthesis and Respiration Model, Part II, Simulations of Tower-Based and Airborne CO2 Measurements
Eluszkiewicz, Janusz; Nehrkorn, Thomas; Wofsy, Steven C.; Matross, Daniel; Gerbig, Christoph; Lin, John C.; Freitas, Saulo; Longo, Marcos; Andrews, Arlyn E.; Peters, Wouter; [2007]; 1 pp.; In English
Contract(s)/Grant(s): NNH05CC42C; Copyright; Avail.: Other Sources; Abstract Only

This paper evaluates simulations of atmospheric CO2 measured in 2004 at continental surface and airborne receptors, intended to test the capability to use data with high temporal and spatial resolution for analyses of carbon sources and sinks at regional and continental scales. The simulations were performed using the Stochastic Time-Inverted Lagrangian Transport (STILT) model driven by the Weather Forecast and Research (WRF) model, and linked to surface fluxes from the satellite-driven Vegetation Photosynthesis and Respiration Model (VPRM). The simulations provide detailed representations of hourly CO2 tower data and reproduce the shapes of airborne vertical profiles with high fidelity. WRF meteorology gives superior model performance compared with standard meteorological products, and the impact of including WRF convective mass fluxes in the STILT trajectory calculations is significant in individual cases. Important biases in the simulation are associated with the nighttime CO2 build-up and subsequent morning transition to convective conditions, and with errors in the advected lateral boundary condition. Comparison of STILT simulations driven by the WRF model against those driven by the Brazilian variant of the Regional Atmospheric Modeling System (BRAMS) shows that model-to-model differences are smaller than between an individual transport model and observations, pointing to systematic errors in the simulated transport. Future developments in the WRF model s data assimilation capabilities, basic research into the fundamental aspects of trajectory calculations, and intercomparison studies involving other transport models, are possible venues for reducing these errors. Overall, the STILT/WRF/VPRM offers a powerful tool for continental and regional scale carbon flux estimates.
Author
Atmospheric Composition; Carbon Dioxide; Simulation; Mathematical Models; Atmospheric Models; Vegetation

20070034362 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: July 2007
July 2007; In English; Copyright; Avail.: Other Sources

The CD-ROM concerning the July 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

20070034554 Naval Research Lab., Bay Saint Louis, MS USA
The Adriatic Circulation Experiment Winter 2002/2003 Mooring Data Report:: A Case Study in ADCP Data Processing
Book, Jeffrey W; Perkins, Henry; Signell, Richard P; Wimbush, Mark; Jun 26, 2007; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469990; NRL/MR/7330-007-8999; XB-NRL/MR/7332; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a case study of Acoustic Doppler Current Profiler (ADCP) data processing for long-term coastal deployments, using data collected by the Naval Research Laboratory and the NATO Undersea Research Centre from 14 trawl-resistant bottom moorings (BARNYs) during winter 2002/2003 across the northern Adriatic Sea. New methods were developed to maximize data quality and quantity. The data were truncated moving with the sea surface instead of using a constant level. An objective method based on horizontal velocity noise was developed for quality control of data using the ADCP error velocities. Tests were developed to reject fish-echo-contaminated data from an ADCP in which the fish-detection algorithm

had been disabled. Spurious linear compass drifts were identified and corrected. In summary, this report documents the complete preparation of velocity, velocity error, temperature, pressure, echo intensity, surface wave, and salinity datasets from the ADCP's and wave/tide gauges in the main Adriatic Circulation Experiment.
DTIC
Adriatic Sea; Data Processing; Mooring; Ocean Currents; Oceanographic Parameters; Shallow Water; Wind (Meteorology); Winter

20070034740 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Microphysical Timescales in Clouds and their Application in Cloud-Resolving Modeling
Zeng, Xiping; Tao, Wei-Kuo; Simpson, Joanne; [2007]; 49 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Independent prognostic variables in cloud-resolving modeling are chosen on the basis of the analysis of microphysical timescales in clouds versus a time step for numerical integration. Two of them are the moist entropy and the total mixing ratio of airborne water with no contributions from precipitating particles. As a result, temperature can be diagnosed easily from those prognostic variables, and cloud microphysics be separated (or modularized) from moist thermodynamics. Numerical comparison experiments show that those prognostic variables can work well while a large time step (e.g., 10 s) is used for numerical integration.
Author
Cloud Physics; Numerical Integration; Atmospheric Models; Thermodynamics

20070034778 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
AIRS: Improving Weather Forecasting and Providing New Data on Greenhouse Gases
Chahine, Moustafa T.; Pagano, Thomas S.; Aumann, Hartmut H.; Atlas, Robert; Barnet, Christopher; Blaisdell, John; Chen, Luke; Divakarla, Murty; Fetzer, Eric J.; Goldberg, Mitch; Gautier, Catherine; Granger, Stephanie; Hannon, Scott; Irion, Fredrick W; Kakar, Ramesh; Kalnay, Eugenia; Lambrigtsen, Bjorn H.; Lee, Sung-Yung; Marshall, John Le; McMillan, W. Wallace; McMillin, Larry; Olsen, Edward T.; Revercomb, Henry; Rosenkranz, Philip; Smith, William L., et al.; Bulletin of the American Meterological Society; July 2006; Volume 87, No. 7, pp. 911-926; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40298; http://dx.doi.org/10.1175/BAMS-87-7-911

This paper discusses the performance of AIRS and examines how it is meeting its operational and research objectives based on the experience of more than 2 yr with AIRS data. We describe the science background and the performance of AIRS in terms of the accuracy and stability of its observed spectral radiances. We examine the validation of the retrieved temperature and water vapor profiles against collocated operational radiosondes, and then we assess the impact thereof on numerical weather forecasting of the assimilation of the AIRS spectra and the retrieved temperature. We close the paper with a discussion on the retrieval of several minor tropospheric constituents from AIRS spectra.
Author
Atmospheric Moisture; Numerical Weather Forecasting; Temperature Profiles; Greenhouse Effect; Water Vapor; Troposphere

20070034788 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Computation of the Streamfunction and Velocity Potential for Limited and Irregular Domains
Li, Zhijin; Chao, Yi; McWilliams, James C.; Monthly Weather Review; December 14, 2005; Volume 134, Issue 11, pp. 3384-3394; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40297; http://dx.doi.org/10.1175/MWR3249.1

An algorithm is proposed for the computation of streamfunction and velocity potential from given horizontal velocity vectors based on solving a minimization problem. To guarantee the uniqueness of the solution and computational reliability of the algorithm, a Tikhonov regularization is applied. The solution implies that the obtained streamfunction and velocity potential have minimal magnitude, while the given velocity vectors can be accurately reconstructed from the computed streamfunction and velocity potential. Because the formulation of the minimization problem allows for circumventing the explicit specification of separate boundary conditions on the streamfunction and velocity potential, the algorithm is easily applicable to irregular domains. By using an advanced minimization algorithm with the use of adjoint techniques, the method is computationally efficient and suitable for problems with large dimensions. An example is presented for coastal oceans to illustrate the practical application of the algorithm.
Author
Boundary Conditions; Optimization; Domains; Algorithms; Reliability

20070034806 Columbia Univ., New York, NY, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Look at Stratospheric Sudden Warmings. Part II: Evaluation of Numerical Model Simulations
Charlton, Andrew J.; Polvani, Lorenza M.; Perlwitz, Judith; Sassi, Fabrizio; Manzini, Elisa; Shibata, Kiyotaka; Pawson, Steven; Nielsen, J. Eric; Rind, David; Journal of Climate; February 2007; Volume 20, Issue 3, pp. 470-488; In English
Contract(s)/Grant(s): NNX06AC95G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/JCLI3994.1

The simulation of major midwinter stratospheric sudden warmings (SSWs) in six stratosphere-resolving general circulation models (GCMs) is examined. The GCMs are compared to a new climatology of SSWs, based on the dynamical characteristics of the events. First, the number, type, and temporal distribution of SSW events are evaluated. Most of the models show a lower frequency of SSW events than the climatology, which has a mean frequency of 6.0 SSWs per decade. Statistical tests show that three of the six models produce significantly fewer SSWs than the climatology, between 1.0 and 2.6 SSWs per decade. Second, four process-based diagnostics are calculated for all of the SSW events in each model. It is found that SSWs in the GCMs compare favorably with dynamical benchmarks for SSW established in the first part of the study. These results indicate that GCMs are capable of quite accurately simulating the dynamics required to produce SSWs, but with lower frequency than the climatology. Further dynamical diagnostics hint that, in at least one case, this is due to a lack of meridional heat flux in the lower stratosphere. Even though the SSWs simulated by most GCMs are dynamically realistic when compared to the NCEP-NCAR reanalysis, the reasons for the relative paucity of SSWs in GCMs remains an important and open question.
Author
Stratosphere; Atmospheric Heating; Climatology; Climate Models

20070034825 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Trends in the Sea Ice Cover Using Enhanced and Compatible AMSR-E, SSM/I and SMMR Data
Comiso, Josefino C.; Nishio, Fumihiko; [2007]; 40 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Arguably, the most remarkable manifestation of change in the polar regions is the rapid decline (of about -10 %/decade) in the Arctic perennial ice cover. Changes in the global sea ice cover, however, are more modest, being slightly positive in the Southern Hemisphere and slightly negative in the Northern Hemisphere, the significance of which has not been adequately assessed because of unknown errors in the satellite historical data. We take advantage of the recent and more accurate AMSR-E data to evaluate the true seasonal and interannual variability of the sea ice cover, assess the accuracy of historical data, and determine the real trend. Consistently derived ice concentrations from AMSR-E, SSM/I, and SMMR data were analyzed and a slight bias is observed between AMSR-E and SSM/I data mainly because of differences in resolution. Analysis of the combine SMMR, SSM/I and AMSR-E data set, with the bias corrected, shows that the trends in extent and area of sea ice in the Arctic region is -3.4 +/- 0.2 and -4.0 +/- 0.2 % per decade, respectively, while the corresponding values for the Antarctic region is 0.9 +/- 0.2 and 1.7 .+/- 0.3 % per decade. The higher resolution of the AMSR-E provides an improved determination of the location of the ice edge while the SSM/I data show an ice edge about 6 to 12 km further away from the ice pack. Although the current record of AMSR-E is less than 5 years, the data can be utilized in combination with historical data for more accurate determination of the variability and trends in the ice cover.
Author
Sea Ice; Remote Sensing; Antarctic Regions; Polar Regions; Microwave Imagery; Annual Variations; Arctic Regions

20070034830 Tokyo Univ., Japan; NASA Langley Research Center, Hampton, VA, USA
Measurements of Reactive Nitrogen Produce by Tropical Thunderstorms during BIBLE-C
Koike, M.; Kondo, Y.; Kita, K.; Takegawa, N.; Nishi, N.; Liley, B.; Kashihara, T.; Kudoh, S.; Kawakami, S.; Blake, D.; Shirai, T.; Ko, M.; Miyazaki, Y.; Kawasaki, Z.; Ogawa, T.; [2007]; 77 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Biomass Burning and Lightning Experiment phase C (BIBLE-C) aircraft 2 mission was carried out near Darwin, Australia (12 S, 131 E) in December 2000. This was the first aircraft experiment designed to estimate lightning NO production rate at tropics, where the production is considered to be most intense. During the two flights (flights 10 and 13 made on December 9 and 11-12, respectively) enhancements of NOx (NO + NO2) up to 1000 or 1600 parts per trillion by volume (pptv, 10-s data) were observed at altitudes between 11.5 and 14 km. The Geostationary Meteorological Satellite (GMS) cloud (brightness temperature) data and ground based lightning measurements by Global Positioning and Tracking System (GPATS) indicate that there were intensive lightning events over the coast of Carpentarii bay, which took place upstream from our measurement area 10 to 14 hours prior to the measurements. In flight 10 and 13, air in which NOx exceeds 100 pptv extended

over 620 x 140 or 400 x 170 km (wind direction x perpendicular direction), respectively. From our knowledge, it has never been reported before that high NOx air produced by a single thunderstorm system extended over such a wide area, suggesting a significant impact of lightning NO production on NOx levels in the tropics. By estimating an area in which air influenced by lightning spread, a total NO amount produced by individual lightning events was estimated to be 3.28 and 1.90 x 10(exp 29) NO molecules for flight 10 and 13, respectively, in the 11.5-14 km altitude range. Although there were some uncertainties in the lightning flash counts obtained by GPATS and in the estimation of total lightning flash counts (cloud-to-ground flash and intra-cloud flash, CG + IC flash) from CG flash counts, an NO production rate per single lightning flash was estimated to be 0.571-1.32 and 6.91-16.2 x 10(exp 25) NO molecules per single flash (11.5-14 km range) for these two flight data. Using a global flash rate of 44 S(exp -1) [Christian et al., 2003], a global NO production rate is estimated to be 0.619-1.43 and 7.36-17.3 Tg(N)/yr. Impact on ozone production rate and observed features of enhancement of condensation nuclei (CN) concentrations are also described.

Author

Lightning; Nitrogen Oxides; Tropical Regions; Thunderstorms

20070034833 Villanova Univ., PA, USA; NASA Langley Research Center, Hampton, VA, USA

An Overview of Snow Photochemistry: Evidence, Mechanisms and Impacts

Grannas, A. M.; Jones, A. E.; Dibb, J.; Ammann, M.; Anastasio, C.; Beine, H. J.; Bergin, M.; Bottenheim, J.; Boxe, C. S.; Carver, G.; Chen, G.; Crawford, J. H.; Domine, F.; Frey, M. M.; Guzman, M. I.; Heard, D. E.; Helmig, D.; Hoffmann, M. R.; Honrath, R. E.; Huey, L. G.; Hutterli, M.; Jacobi, H.-W.; Klan, P.; McConnell, J.; Plane, J.; [2007]; 107 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS:281945.02.03.01.32; Copyright; Avail.: CASI: A06, Hardcopy

It has been shown that sunlit snow and ice plays an important role in processing atmospheric species. Photochemical production of a variety of chemicals has recently been reported to occur in snow/ice and the release of these photochemically generated species may significantly impact the chemistry of the overlying atmosphere. Nitrogen oxide and oxidant precursor fluxes have been measured in a number of snow covered environments, where in some cases the emissions significantly impact the overlying boundary layer. For example, photochemical ozone production (such as that occurring in polluted mid-latitudes) of 3-4 ppbv/day has been observed at South Pole, due to high OH and NO levels present in a relatively small boundary layer. Field and laboratory experiments have determined that the origin of the observed NOx flux is the photochemistry of nitrate within the snowpack, however some details of the mechanism have not yet been elucidated. A variety of low molecular weight organic compounds have been shown to be emitted from sunlit snowpacks, the source of which has been proposed to be either direct or indirect photo-oxidation of natural organic materials present in the snow. Although myriad studies have observed active processing of species within irradiated snowpacks, the fundamental chemistry occurring remains poorly understood. Here we consider the nature of snow at a fundamental, physical level; photochemical processes within snow and the caveats needed for comparison to atmospheric photochemistry; our current understanding of nitrogen, oxidant, halogen and organic photochemistry within snow; the current limitations faced by the field and implications for the future.

Author

Atmospheric Composition; Organic Compounds; Photochemical Reactions; Snow; Snow Cover; Polar Regions; Nitrogen Oxides

20070034849 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Moisture Advection and Fresh Water Flux over Oceans

Tang, Wenqing; Liu, W. Timothy; January 13, 2002; 5 pp.; In English; 82nd Annual Meeting American Meteorological Society (AMS), 13-17 Jan. 2002, Orlando, FL, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40403

Moisture transport in the atmosphere is one of the most significant components in the hydrological cycle. Under stationary condition, ocean surface fresh water flux, which is the difference between precipitation (P) and evaporation (E), is balanced by the divergence of column-integrated moisture transport (IMT) in the atmosphere. Characterizing accurately a global picture of IMT from observation is a difficult task. It requires measurements of vertical profiles for wind vector and humidity. More specifically, IMT can be defined as the integration in pressure coordinates the product of specific humidity q and wind vector u, where g is the gravitational acceleration, and p, is the atmospheric pressure at ocean surface.In this study, a statistical relationship is derived between u, and u(sub)s using data from numerical weather prediction model. The relationship is then

validated using surface and vertical profile from radiosonde data, before applied to spacebased measurements.
Author
Ocean Surface; Moisture; Hydrological Cycle; Atmospheric Pressure; Evaporation; Wind Velocity; Humidity; Mathematical Models

20070034884 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Role of Atmospheric Aerosol Concentration on Deep Convective Precipitation: Cloud-resolving Model Simulations
Tao, W.-K.; Li, X.; Khain, A.; Mastsui, T.; Lang, S.; Simpson, J.; [2007]; 55 pp.; In English; Copyright; Avail.: CASI: A04, Hardcopy

Aerosols and especially their effect on clouds are one of the key components of the climate system and the hydrological cycle [Ramanathan et al., 20011. Yet, the aerosol effect on clouds remains largely unknown and the processes involved not well understood. A recent report published by the National Academy of Science states 'The greatest uncertainty about the aerosol climate forcing - indeed, the largest of all the uncertainties about global climate forcing - is probably the indirect effect of aerosols on clouds NRC [2001].' The aerosol effect on clouds is often categorized into the traditional 'first indirect (i.e., Twomey)' effect on the cloud droplet sizes for a constant liquid water path and the 'semi-direct' effect on cloud coverage. The aerosol effect on precipitation processes, also known as the second type of aerosol indirect effect, is even more complex, especially for mixed-phase convective clouds. ln this paper, a cloud-resolving model (CRM) with detailed spectral-bin microphysics was used to examine the effect of aerosols on three different deep convective cloud systems that developed in different geographic locations: South Florida, Oklahoma and the Central Pacific. In all three cases, rain reaches the ground earlier for the low CCN (clean) case. Rain suppression is also evident in all three cases with high CCN (dirty) case. However, this suppression only occurs during the first hour of the simulations. During the mature stages of the simulations, the effects of increasing aerosol concentration range from rain suppression in the Oklahoma case, to almost no effect in the Florida case, to rain enhancement in the Pacific case. These results show the complexity of aerosol interactions with convection.
Author
Aerosols; Atmospheric Models; Climatology; Rain; Precipitation; Clouds (Meteorology); Hydrological Cycle

20070034888 NASA Goddard Space Flight Center, Greenbelt, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
New, Improved Bulk-microphysical Schemes for Studying Precipitation Processes in WRF, Part 1, Comparisons with Other Schemes
Tao, W.-K.; Shi, J.; Chen, S. S>; Lang, S.; Hong, S.-Y.; Thompson, G.; Peters-Lidard, C.; Hou, A.; Braun, S.; Simpson, J.; [2007]; 50 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Advances in computing power allow atmospheric prediction models to be mn at progressively finer scales of resolution, using increasingly more sophisticated physical parameterizations and numerical methods. The representation of cloud microphysical processes is a key component of these models, over the past decade both research and operational numerical weather prediction models have started using more complex microphysical schemes that were originally developed for high-resolution cloud-resolving models (CRMs). A recent report to the USA Weather Research Program (USWRP) Science Steering Committee specifically calls for the replacement of implicit cumulus parameterization schemes with explicit bulk schemes in numerical weather prediction (NWP) as part of a community effort to improve quantitative precipitation forecasts (QPF). An improved Goddard bulk microphysical parameterization is implemented into a state-of the-art of next generation of Weather Research and Forecasting (WRF) model. High-resolution model simulations are conducted to examine the impact of microphysical schemes on two different weather events (a midlatitude linear convective system and an Atllan'ic hurricane). The results suggest that microphysics has a major impact on the organization and precipitation processes associated with a summer midlatitude convective line system. The 31CE scheme with a cloud ice-snow-hail configuration led to a better agreement with observation in terms of simulated narrow convective line and rainfall intensity. This is because the 3ICE-hail scheme includes dense ice precipitating (hail) particle with very fast fall speed (over 10 m/s). For an Atlantic hurricane case, varying the microphysical schemes had no significant impact on the track forecast but did affect the intensity (important for air-sea interaction)
Author
Atmospheric Models; Cloud Physics; Numerical Weather Forecasting; Numerical Analysis; Air Water Interactions

20070034992 NASA Goddard Inst. for Space Studies, New York, NY, USA
AO/NAO Response to Climate Change, 1, Respective Influences of Stratospheric and Tropospheric Climate Changes
Rind, D.; Perlwitz, J.; Lonergan, P.; Journal of Geophysical Research; June 21, 2005; Volume 110; 1 pp.; In English
Contract(s)/Grant(s): NNX06AC95G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2004JD005103

We utilize the GISS Global Climate Middle Atmosphere Model and 8 different climate change experiments, many of them focused on stratospheric climate forcings, to assess the relative influence of tropospheric and stratospheric climate change on the extratropical circulation indices (Arctic Oscillation, AO; North Atlantic Oscillation, NAO). The experiments are run in two different ways: with variable sea surface temperatures (SSTs) to allow for a full tropospheric climate response, and with specified SSTs to minimize the tropospheric change. The results show that tropospheric warming (cooling) experiments and stratospheric cooling (warming) experiments produce more positive (negative) AO/NAO indices. For the typical magnitudes of tropospheric and stratospheric climate changes, the tropospheric response dominates; results are strongest when the tropospheric and stratospheric influences are producing similar phase changes. Both regions produce their effect primarily by altering wave propagation and angular momentum transports, but planetary wave energy changes accompanying tropospheric climate change are also important. Stratospheric forcing has a larger impact on the NAO than on the AO, and the angular momentum transport changes associated with it peak in the upper troposphere, affecting all wavenumbers. Tropospheric climate changes influence both the A0 and NAO with effects that extend throughout the troposphere. For both forcings there is often vertical consistency in the sign of the momentum transport changes, obscuring the difference between direct and indirect mechanisms for influencing the surface circulation.
Author
Climate Models; Middle Atmosphere; Climate Change; Stratospheric Warming; Oscillations; Sea Surface Temperature; Troposphere

20070034993 NASA Goddard Inst. for Space Studies, New York, NY, USA
AO/NAO Response to Climate Change, 2, Relative Importance of Low- and High-Latitude Temperature Changes
Rind, D.; Perlwitz, J.; Lonergan, P.; Lerner, J.; Journal of Geophysical Research; June 21, 2005; Volume 110; 2 pp.; In English
Contract(s)/Grant(s): NNX06AC95G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2004JD005686

Using a variety of GCM experiments with various versions of the GISS model, we investigate how different aspects of tropospheric climate changes affect the extratropical Arctic Oscillation (AO)/North Atlantic Oscillation (NAO) circulation indices. The results show that low altitude changes in the extratropical latitudinal temperature gradient can have a strong impact on eddy forcing of the extratropical zonal wind, in the sense that when this latitudinal temperature gradient increases, it helps force a more negative AO/NAO phase. In addition, local conditions at high latitudes can stabilize/destabilize the atmosphere, inducing negative/positive phase changes. To the extent that there is not a large temperature change in the tropical upper troposphere (either through reduced tropical sensitivity at the surface, or limited transport of this change to high levels), the changes in the low level temperature gradient can provide the dominate influence on the extratropical circulation, so that planetary wave meridional refraction and eddy angular momentum transport changes become uncorrelated with potential vorticity transports. In particular, the climate change that produces the most positive NAO phase change would have substantial warming in the tropical upper troposphere over the Pacific Ocean, with high latitude warming in the North Atlantic. An increase in positive phase of these circulation indices is still more likely than not, but it will depend on the degree of tropical and high latitude temperature response and the transport of low level warming into the upper troposphere. These are aspects that currently differ among the models used for predicting the effects of global warning, contributing to the lack of consensus of future changes in the AO/NAO.
Author
Low Temperature; Temperature Gradients; Atmospheric Temperature; Arctic Regions; Climate Change; Oscillations; Wind (Meteorology); Low Altitude; Tropical Regions

20070034994 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observation Sensitivity Calculations Using the Adjoint of the Gridpoint Statistical Interpolation (GSI) Analysis System
Zhu, Yanqiu; Gelaro, Ronald; February 2007; 41 pp.; In English; Original contains color illustrations; No Copyright; Avail.: Other Sources

The adjoint of a data assimilation system provides an efficient way of estimating sensitivities of analysis or forecast measures with respect to observations. The NASA Global Modeling and Assimilation Office (GMAO) has developed an exact adjoint of the Gridpoint Statistical Interpolation (GSI) analysis scheme developed at the National Centers for Environmental

Prediction (NCEP). The development approach is unique in that the adjoint is derived from a line-by-line tangent linear version of the GSI. Availability of the tangent linear scheme provides an explicit means of assessing not only the fidelity of the adjoint, but also the effects of nonlinear processes in the GSI itself. In this paper, we discuss the development of the tangent linear and adjoint versions of the GSI and show observation sensitivity results for a near-operational version of the system. Results indicate that the GSI adjoint provides accurate assessments of the sensitivities with respect to observations of wind, temperature, satellite radiances and, to a lesser extent, moisture. Sensitivities with respect to ozone observations are quite linear for the ozone fields themselves, but highly nonlinear for other variables. The sensitivity information provided by the adjoint is used to estimate the contribution, or impact, of various observing systems on locally defined response functions based on the analyzed increments of temperature and zonal wind. It is shown, for example, that satellite radiances have the largest impact of all observing systems on the temperature increments over the eastern North Pacific, while conventional observations from rawinsondes and aircraft dominate the impact on the zonal wind increments over the continental US. The observation impact calculations also provide an additional means of validating the observation sensitivities produced by the GSI adjoint.
Author
Interpolation; Wind (Meteorology); Statistical Analysis; Forecasting; Atmospheric Temperature; Data Systems; Estimating

20070035026 Karlsruhe Univ., Germany; NASA Langley Research Center, Hampton, VA, USA
Bias Determination and Precision Validation of Ozone Profiles from MIPAS-Envisat Retrieved with the IMK-IAA Processor
Steck, T.; vonClarmann, T.; Fischer, H.; Funke, B.; Glatthor, N.; Grabowski, U.; Hoepfner, M.; Kelman, S.; Kiefer, M.; Linden, A.; Milz, M.; Stiller, G. P.; Wang, D. Y.; Allaart, M.; Blumenstock, Th.; vonderGathen, P.; Hansen, G.; Hase, F.; Hochschild, G.; Kopp, G.; Kyroe, E.; Oelhaf, H.; Raffalski, U.; Redondas Marrero, A.; Remsberg, E.; [2007]; 41 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

This paper describes the quality of vertical ozone profiles retrieved with the IMK-IAA (Institute for Meteorology and Climate Research, Karlsruhe - Instituto de Astrofisica de Andalucia) science-oriented processor from spectra measured by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) aboard the environmental satellite Envisat. Bias determination and precision validation is performed with correlative measurements by ground-based lidars, Fourier transform infrared spectrometers, and microwave radiometers as well as balloon-borne ozonesondes, MIPAS balloon, and two satellite instruments (Halogen Occultation Experiment and Polar Ozone and Aerosol Measurement III). Percentage mean differences between MIPAS and the comparison instruments for stratospheric ozone are within +/- 10%. The precision in this altitude region is estimated to values between 5 and 10% which gives an accuracy of 15 to 20%. Below 18 km, the spread of the percentage mean differences is larger and the precision increases to values of more than 20% depending on altitude and latitude. The main reason for the degraded precision can be attributed to undetected thin clouds which affect MIPAS retrievals and to the influence of uncertainties in the water vapor concentration.
Author
Bias; Ozone; Instrument Errors; Vertical Distribution; Atmospheric Composition; Precision; Satellite Instruments

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*.

20070035051 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Influence of Sea Ice on Primary Production in the Southern Ocean: A Satellite Perspective
Smith, Walker O., Jr.; Comiso, Josefino C.; [2007]; 45 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Sea ice in the Southern Ocean is a major controlling factor on phytoplankton productivity and growth, but the relationship is modified by regional differences in atmospheric and oceanographic conditions. We used the phytoplankton biomass (binned at 7-day intervals), PAR and cloud cover data from SeaWiFS, ice concentrations data from SSM/I and AMSR-E, and sea-surface temperature data from AVHRR, in combination with a vertically integrated model to estimate primary productivity throughout the Southern Ocean (south of 60‘s). We also selected six areas within the Southern Ocean and analyzed the variability of the primary productivity and trends through time, as well as the relationship of sea ice to productivity. We found substantial interannual variability in productivity from 1997 - 2005 in all regions of the Southern Ocean, and this variability

appeared to be driven in large part by ice dynamics. The most productive regions of Antarctic waters were the continental shelves, which showed the earliest growth, the maximum biomass, and the greatest areal specific productivity. In contrast, no large, sustained blooms occurred in waters of greater depth (> 1,000 m). We suggest that this is due to the slightly greater mixed layer depths found in waters off the continental shelf, and that the interactive effects of iron and irradiance (that is, increased iron requirements in low irradiance environments) result in the limitation of phytoplankton biomass over large regions of the Southern Ocean.
Author
Sea Ice; Phytoplankton; Productivity; Oceanography; Biomass; Advanced Very High Resolution Radiometer; Sea-Viewing Wide Field-of-View Sensor; Antarctic Ocean

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*.

20070034218 Army War Coll., Carlisle Barracks, PA USA
Caring for Wounded Veterans: A Strategy in the GWOT
Talley, Steve; Mar 5, 2007; 18 pp.; In English
Report No.(s): AD-A469635; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469635

Winning the long war against terror and radical ideology requires maintaining the will of the American people through active Strategic Communication. To maintain long-term national will, one paramount message must be conveyed to the American public in no uncertain terms. The nation must be assured that when they entrust their most precious and valued asset, their sons and daughters, to the USA Government, the government will ensure the long-term mental and physical well-being of its veterans. This project examines what needs to be done to ensure that the USA Government provides immediate and long-term care and support to America's wounded veterans, regardless of their physical injury or mental illness. To ensure the long-term care of wounded veterans, true 'seamless transition' between government interagency as well as non-governmental organizations is essential.
DTIC
Disorders; Injuries; Medical Services; Mental Health

20070034224 McGill Univ., Montreal, Quebec Canada
Genome-Wide Approaches to Detecting Stromal-Epithelial Interactions in Breast Cancer
Pepin, Francois; Mar 2007; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0311
Report No.(s): AD-A469651; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469651

The work done to date has helped to better characterize the breast cancer microenvironment. We have confirmed that the expression normal adjacent tissue is not distinct from healthy breast reduction tissue. The genes specific to normal epithelium also identify basal-like breast tumors, potentially explaining their resistance to treatment. The interactions involving the tumor immune cells have the strongest detectable signals using the methods developed by this project. We are the first group to characterize the expression of the blood vessels in breast cancer. We have confirmed the presence of low-density mature vessels and high-density immature vessels. Surprisingly, the expression from those mature tumor vessels more closely match the characteristics of tumor vessels in other cancers. This will open new roads for a better understanding of neo-vascularization in breast cancer as well as helping to target treatment more effectively. Our work in mouse models has also identified osteoactivin as a potential effector of bone metastasis.
DTIC
Breast; Cancer; Detection; Genome; Mammary Glands; Tumors

20070034228 Cincinnati Univ., OH USA

A Novel Therapy System for the Treatment of Occult Prostate Cancer

Dong, Zhongyun; May 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0186

Report No.(s): AD-A469669; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469669

The goal of this research was to investigate efficacy and mechanisms of H5BVIFN-beta, a novel immunotherapeutic agent, against prostate cancer in animal models. The objective in year 3 was to investigate mechanisms by which H5BVIFN-beta inhibits tumor growth. We found that the therapeutic effects of H5BVIFN-beta were significantly reduced in macrophage-compromised mice and in mice deficient in inducible nitric oxide synthase. We found that intratumoral injection of H5BVIFN-beta, reduced microvessel density and downregulated expression of several angiogenic molecules, including transforming growth factor-beta1, vascular endothelial cell growth factor, and platelet-derived growth factor. Expression of antiapoptotic molecule endothelin-1 was also downregulated. Our data suggest that H5BVIFN-beta therapy suppressed tumor growth by downregulating expression of angiogenic molecules and, hence, tumor angiogenesis. This therapy should be beneficial to patient with localized prostate cancer.

DTIC

Angiogenesis; Cancer; Endothelium; Prostate Gland; Therapy

20070034269 California Univ., Irvine, CA USA

The Role of the Caspase-8 Inhibitor FLIP in Androgen-Withdrawal Induced Death of Prostate Epithelium

Krolewski, John; Nastiuk, Kent; Jan 2007; 60 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0149

Report No.(s): AD-A469732; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469732

Secretory prostatic epithelial cells undergo apoptosis in response to androgen deprivation. Similarly,metastatic prostate cancers, which resemble secretory epithelium, also undergo apoptosis following androgen deprivation. Recent evidence suggests that death receptor signaling is required for prostate epithelial cell death following androgen withdrawal. We sought to extend this observation by investigating the role of death receptor signaling components in models of prostate epithelial cell death. Preliminary experiments suggest that FLIP can inhibit apoptosis of prostate epithelial cells. FLIP is an enzymatically inactive version of pro-caspase-8 which negatively regulates cell death, apparently via a dominant- negative mechanism. Based on our preliminary data, we hypothesize that FLIP is a key regulator of prostate apoptosis in response to androgen withdrawal. To address our hypothesis we propose a systematic approach involving, sequentially, correlative (aim 1), functional (aim 2) and mechanistic (aims 3 and 4) experiments. The specific aims are: i) correlate the pattern of FLIP expression with prostate epithelial cell death; ii) assess the functional consequences of forced FLIP expression on prostate epithelial apoptosis; iii) determine which death receptor pathway is involved in prostate epithelial cell death and iv) determine if androgens regulate the level of FLIP expression at the level of gene transcription.

DTIC

Apoptosis; Cancer; Death; Enzymes; Epithelium; Hormones; Inhibitors; Males; Prostate Gland

20070034285 City of Hope Medical Center, Duarte, CA USA

Examining the Role of Msh2 and Mre11 in Telomere Rescue

Meyer, Damon; Apr 2007; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0407

Report No.(s): AD-A469755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469755

Tumorigenesis is characterized by genome instability that results in genetic changes that promote a cancerous state I. Instability at telomeres can result in uncapping' of the ends of linear chrnmosomes, making them vulnerable to recombination, mutation and gross-chromosomal rearrangement (GCR)2,3,4. Continuously dividing human somatic cells and S. cerevisiae cells lacking functional telomerase, a ribonucleoprotein complex required for telomere replication, experience progressive telomere degradation that culminates in replicative senescence 5,6. Our research has shown that during replicative senescence genes located proximal to telomeres experience increases in mutationand GCR that are dependent on the error- prone polymerase genes REVi and REV7. Interestingly, viability is increased and replicative senescence is delayed in telomerase deficient diploid cells. This may be because the presence of a homologous chromosome provides the opportunity to rescue defective chromosomes by inter-homolog exchange (IHE), or to tolerate their loss. In support of this idea both IHE and

chromosome loss (CL) increase during replicative senescence. Senescence-associated IHE is dependent on the central homologous recombination gene, RAD52, but is independent from the error-prone polymerase genes REV1 and REV7. Finally, we have identified a new role for telomerase in facilitating the formation of translocations after double-strand breaks are made on two different chromosomes.
DTIC
Chromosomes; Molecular Biology; Mutations; Rescue Operations; Telomeres

20070034286 Georgetown Univ., Washington, DC USA
Polyphosphate Affects on Breast Cancer Cell Survival
Haakenson, Christine; Apr 2007; 85 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0379
Report No.(s): AD-A469756; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469756

The research supported by the Department of Defense Breast Cancer Research Program (BCRP) studies whether the polyphosphate survival function is conserved between prokaryotes and eukaryotes and specifically whether polyphosphates are involved in the increased survival of breast cancer cells. While in the process of developing modified MCF-7 breast cancer cells, an exciting opportunity arose to investigate polyphosphates and their effect on DNA damage response. It is well documented that DNA damaging agents can cause genomic instability and lead to various forms of cancer including breast cancer. Without proper cell cycle checkpoints that trigger repair of the damage or induction of apoptosis, genetic mutations can be propagated, possibly initiating tumorigenesis. Functional analysis of DNA damage response, cell cycle checkpoints which involve BRCA1, genome integrity, and tumor evolution will build the knowledge of the mechanisms involved in breast cancer The principle investigator ceased this opportunity to study polyphosphates and DNA damage response with respect to cell survival and DNA repair mutagenesis and the DNA damage response (SOS response) which follows extensive DNA damage. It has been discovered that: Loss of ability to synthesize polyphosphates compromises cellular survival after DNA damage; This effect is not exclusive to a specific DNA damaging agent; This loss of survival is not directly linked to the general stress response pathway; This compromised survival is independent of cellular growth phase or growth rate; Polyphosphates levels increase transiently after DNA damage; Elevated polyphosphate levels are not dependent on the SOS genes recA, dinB, or umuDC; The ability to synthesize polyphosphates influences Pol IV activity.
DTIC
Breast; Cancer; Mammary Glands; Survival

20070034287 Harvard Medical School, Boston, MA USA
Rho GTPase Involvement in Breast Cancer Migration and Invasion
Simpson, Kaylene J; Mar 2007; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0360
Report No.(s): AD-A469757; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469757

Using a high throughput small interfering RNA approach (siRNA) I have screened 1081 human genes (kinases phosphatases and a library of migration-related genes) using an automated wound healing assay to identify genes that regulate cell migration using the normal mammary epithelial cell line MCF10A. Genes were classified into hit bins based on motility (either accelerated or impaired migration) and metabolism (measured by Alamar Blue). Focusing in greater detail on the 101 genes that accelerate migration extensive validation assays were performed reducing the set of high confidence genes to 31. Signaling network analysis of these genes reveals the Beta-catenin pathway is heavily involved. Analysis of published breast tumour microarray data has directed our immediate priorities towards a number of genes that were hits in our screen and identified in the arrays. The signaling pathways regulating cell migration of these new targets remains to be elucidated.
DTIC
Breast; Cancer; Mammary Glands; Migration; Ribonucleic Acids

20070034291 Wisconsin Univ., Madison, WI USA
Metabolic Mapping of Breast Cancer with Multiphoton Spectral and Lifetime Imaging
Yan, Long; Mar 2007; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0397
Report No.(s): AD-A469761; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469761

Currently we designed and implemented a combined spectral and lifetime imaging system which combines the benefits

of multiphoton microscopy, spectral discrimination, lifetime analysis and temporal information. This system has efficiencies of > 50% and capability to collect broad spectrums (from 380nm-700nm). We determined the fluorescence source under our imaging condition is from NADH by this combined spectral and lifetime imaging system. Furthermore, we validated the accuracy of our lifetime analysis method. Our preliminary results of metabolic mapping in different human breast cell lines via fluorescence lifetime measurement of Co-Enzyme NADH showed very interesting results in differences of the lifetime and contribution of bound NADH between human normal breast cell line (MCF10a) and human breast cancer cell lines (T47D and MBA_MD_231). A 2-Deoxy-D-glucose (2DG) perturbation study is underway to link these finds with glycolysis.
DTIC
Breast; Cancer; Fluorescence; Imaging Techniques; Mammary Glands; Metabolism; Spectra

20070034293 Colorado Univ., Aurora, CO USA
In Vivo Role of Six1 in Mammary Gland Tumorigenesis
McCoy, Erica; Apr 2007; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0409
Report No.(s): AD-A469764; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469764

Homeobox transcription factor Six 1 has been identified as a critical mediator of tumorigenesis and metastasis in a number of organ systems and has been implicated in epithelial to mesenchymal transitions (EMT) during normal development. Our research is aimed at utilizing mouse models to understand its role in the onset and progression of breast cancer. Most significantly, we have determined that Six 1 is indeed sufficient to induce tumor formation in the mammary glands of mice genetically engineered to inducibly overexpress the gene. The latency for tumor formation is between 12-15 months and the tumors that arise in these animals are very aggressive and have morphological features of EMT, a phenomenon that has recently been suggested to contribute to metastasis. Further molecular analysis of these tumors will allow us to more carefully dissect the role of Six 1 in tumor onset. Additionally, in a number of animals that do not develop tumors, a hyperplastic phenotype is observed. Future experiments will involve turning off Six 1 expression after tumor formation to determine if Six 1 is required for tumor maintenance, thus determining the potential benefits of targeting Six 1 in a therapeutic setting.
DTIC
Breast; Cancer; Epithelium; In Vivo Methods and Tests; Mammary Glands

20070034294 Texas Univ., Galveston, TX USA
The Role of the Sonic Hedgehog Pathway for Prostate Cancer Progression
Xie, Jingwu; Feb 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0286
Report No.(s): AD-A469765; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469765

The hedgehog pathway plays a critical role in the development of prostate cancer. However the role of the hedgehog pathway in prostate cancer is not clear. In the previous funding period we have reported activation of hedgehog signaling in advanced and metastatic tumors. We also reported one possible molecular mechanism by which activated hedgehog signaling alter cell functions. Here we report another mechanism by which hedgehog signaling is activated in prostate cancer. We found that the Shh promoter activity is elevated in several cancer cell lines with hedgehog signaling activation including LNCaP Huh7 cells. Growth of these cells depends on the presence of ligand sonic hedgehog. Following treatment of neutralizing antibodies to sonic hedgehog we observed reduced cell growth and apoptosis in several cancer cell lines. Through further analyses we narrowed the region responsible for sonic hedgehog promoter activity to a region less than 1 kb. Currently we are trying to identify the transcriptional factors involved in regulation of sonic hedgehog expression. Furthermore we have made some progress in animal models for hedgehog signaling-mediated carcinogenesis. Currently we have established conditioned knockout of Ptch1 (or knock/in of activated SMO) in mice using Keratin 14 promoter which targets not only skin epidermis but also prostate epithelium. These mice will be mated with other genetically engineered mice to obtain bigenic mice in our analysis of prostate carcinogenesis.
DTIC
Cancer; Prostate Gland

20070034295 North Carolina Univ., Chapel Hill, NC USA

Determining the Effect of Cryptochrome Loss and Circadian Clock Disruption on Tumorigenesis in Mice

Gauger, Michele A; Mar 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0387

Report No.(s): AD-A469766; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469766

Circadian clock disruption may be correlated to increased risk of breast cancer in humans and has been linked to tumor progression and development in mice. We have previously reported that circadian clock disruption by loss of Cryptochrome expression does not cause DNA damage checkpoint or repair defects in mammalian fibroblasts, nor does it cause an increase in tumor predisposition or sensitivity to ionizing radiation in mice. Also of interest is the effect of Cryptochrome loss on gene expression; specifically, we are interested in the role CRYPTOCHROME protein plays in inhibition of circadian gene expression. We find that CRY does not affect the DNA binding of the circadian transcriptional activator CLOCK342-BMAL1, consisting of a 342-amino acid fragment of mammalian CLOCK and full-length BMAL1. In addition, preliminary results indicate that CRY does not affect the DNA binding of CLOCK-BMAL1, consisting of full-length mammalian CLOCK and BMAL1 proteins; however, these results are not yet entirely conclusive and will be investigated further in the future.

DTIC

Amino Acids; Breast; Cancer; Circadian Rhythms; Clocks; Deoxyribonucleic Acid; Epidemiology; Losses; Mammary Glands; Mice

20070034296 Texas Univ., Houston, TX USA

Immunity by Hydrophobic Appendage Bearing Antigens

Ioannides, Constantin G; Jul 2006; 27 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0299

Report No.(s): AD-A469767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469767

The objective of this study was to discover how we can enhance the immunity to tumor Antigens (TA) , in the cancer vaccines. Preventive immunity to cancer in high risk patients or in patients with primary disease is important. The importance rests with a better quality of life and decrease medical costs. To reach the immunopreventive level a vaccine should activate strongly immunity to TA. The strong activation consists in expansion and differentiation of T cells specific for TA. The more effectors expanded by vaccine, the more memory cells. The more differentiated the T cells, the more functional. Our hypothesis is that optimization of the contacts: TA -T cell receptor (TCR) contacts will activate more T cells and it will induce their differentiation. We focused on the side chains of the amino acids in the tumor A. We avoided the changes in the peptide core to minimize cross-reactivity. We discovered that: (1) if side chains are introduced in the amino acid glycine, then the immunogenicity of the TA increase following a bell-shaped plot. (2) if side chains which form the points of contact(link) TA-T cell receptor are replaced with others which induce electrostatic repulsion, then activation of cells is attenuated. The attenuation minimized death of memory like cells. (3) Increase in distance between TA and TCR with one CH2 group also increase survival of cells activated by TA. (3). Changes in the length and orientation of the N-terminus of the TA also result in increased activation of T cells. The N-terminal variants are effective at low concentrations, but induce death by over-activation. Additional studies were performed towards future goals. The findings of this study were recognized for joint technology elopment and commercialization by MDACC and the Henry Jackson Foundation.

DTIC

Amino Acids; Antigens; Appendages; Breast; Cancer; Hydrophobicity; Lymphocytes; Mammary Glands; Ovaries; Peptides

20070034297 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA

Circadian Rhythms of Heart Rate and Locomotion After Treatment With Low-Dose Acetylcholinesterase Inhibitors

Scremin, Oscar U; Shih, Tsung-Ming; Huynh, Ly; Roth, Margareth; Sun, Wei; Chialvo, Dante R; Jenden, Donald J; Jan 2006; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-20015

Report No.(s): AD-A469768; USAMRICD-P05-029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469768

This study tested the hypothesis that repeated exposure to low levels of sarin, pyridostigmine bromide (PB) or their combination, at doses equivalent to these possibly experienced by veterans of the 1991 Persian Gulf War, could lead to persistent or delayed autonomic effects and thus help to explain the cause of clinical findings in this population. Male Sprague-Dawley rats were treated for 3 weeks with: saline injection (0.5 ml kg(-1), s.c., 3 times weekly) with tap drinking

water (control): saline injection with PB (80 mg 1(-1) in drinking water); sarin injection (62.5 mug kg(-1), s.c., 0.5 x LD)50, 3 times weekly) with tap drinking water (sarin); or sarin injection with PB in drinking water (sarin + PB). At 2, 4 or 16 weeks post-treatment, heart rate (HR) and locomotor activity (LA) were studied by radiotelemetry. Two weeks posttreatment, HR in drug-treated animals was significantly lower than in controls. A decrease in low-frequency HR power spectrum (PS) was found at 00:00 h and 08:00 h with sarin + PB and at 00:00 h with sarin, while total power was enhanced with sarin + PB at 22:00 h. Minimal effects of drug treatments on HR and HR PS were detected at 4 and 16 weeks post-treatment. No significant differences in LA between control and other groups were found. Since no consistent long-term effects were found in any of the variables studied, these experiments do not support the hypothesis that repeated administration of low doses of PB and the nerve agent sarin can induce persistent or delayed alterations in autonomic function.
DTIC
Acetyl Compounds; Cholinesterase; Circadian Rhythms; Dosage; Heart Rate; Inhibitors; Locomotion

20070034298 Georgetown Univ., Washington, DC USA
Targeting of the Nuclear Receptor Coactivator Isoform DELTA3AIB1 in Breast Cancer
Chien, Christopher; Mar 2007; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0344
Report No.(s): AD-A469769; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469769

AIB1 which stands for Amplified in Breast Cancer , codes for a protein that is a member of the steroid receptor coactivator (SRC) family. AIB1 is amplified in approximately 5-10% of breast cancers and the mRNA and protein overexpressed in >30% of breast cancers. AIB1 interacts with a superfamily of ligand activated nuclear receptors to potentiate transcriptional activity leading to upregulation of downstream target gene expression. An important finding was that an isoform of AIB1 (Delta3AIB1) is a significantly more effective coactivator of the estrogen receptor than AIB1 and is highly overexpressed in human breast cancer. Prior work in our lab showed that the downregulation of overall levels of AIB1 plus DELTA3AIB1, using a regulatable AIB1 directed ribozyme, resulted in reduced tumor growth in vivo. Overall, these data indicate a major role for AIB1 and its isoform DELTA3AIB1 in breast cancer development and growth. However the relative roles of AIB1 versus the more highly active DELTA3AIB1 in phenotypic changes in the breast has not been determined. In this investigation, we are developing a method to use siRNA directed at DELTA3AIB1 in order investigate its role in breast cancer and as a possible future therapeutic approach to breast cancer.
DTIC
Breast; Cancer; Estrogens; Mammary Glands; Nuclear Medicine

20070034299 State Univ. of New York, Stony Brook, NY USA
Family Maltreatment, Substance Problems, and Suicidality: Randomized Prevention Effectiveness Trial
Heyman, Richard E; Slep, Amy M; Feb 2007; 152 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0165
Report No.(s): AD-A469775; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469775

This study to enhance the ability of base, major command (MAJCOM) and Air Staff IDS to reduce death, injury, and degraded force readiness through (a) dissemination of base, MAJCOM, and AF prevalences of secretive problems; (b) provision of baselevel information to identify and prioritize risk and protective factors, (c) assistance in bases selecting and implementing empirically supported interventions, and (d) evaluation of whether prevalences were lowered.alc
DTIC
Health; Injuries; Prevention

20070034302 Johns Hopkins Univ., Baltimore, MD USA
Self Managing the Consequences of Major Limb Trauma
MacKenzie, Ellen J; Wegener, Stephen; Castillo, Renan; Frey, Katherine; Mar 2007; 12 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0343
Report No.(s): AD-A469778; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469778

The objective of this research is to develop and evaluate the efficacy of a computer-based self management program (heretofore referred to as OSMP-T) for reducing secondary conditions and improving function following major lower limb

trauma. The intervention will build on widely accepted self-management programs developed for persons with arthritis as well as components of a faceto- face self-management program for civilians with long-standing limb loss. It will be necessary, however, to tailor the content and delivery of these programs to better accommodate the needs of a young, acutely injured population. Specific needs not typically addressed in the existing programs include the management of acute anxiety and post-traumatic stress disorder (PTSD), and the maintenance or acquisition of employment or return to active duty. The specific aims of the proposed study are three-fold: (1) to develop the OSMP-T; (2) to evaluate the efficacy of the OSMP-T in 225 civilians initially treated at 5 level I trauma centers; and (3) to modify the OSMP-T for application in the military and to pilot the modified program in a smaller group of 24 injured soldiers treated at the Walter Reed Army Medical Center. If shown to be efficacious, computer based self management programs for the acutely injured will provide a much-needed adjunct to the orthopedic care now available and contribute to a comprehensive trauma management program to improve long-term outcomes and quality of life. The military version of SM program will provide injured soldiers with an ongoing mechanism of support as they transition from inpatient rehabilitation to the community whether that be in the military or
DTIC

Anxiety; Injuries; Medical Services

20070034303 Miami Univ., FL USA

Role of the PY Motif Containing Protein, WBP-2 in ER, PR Signaling and Breast Tumorigenesis

Dhananjayan, Sarath C; Nawaz, Zafar; Mar 2007; 49 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0384

Report No.(s): AD-A469779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469779

Our data demonstrates that WBP-2 is recruited onto the hormone responsive promoters in the presence of hormone and it specifically enhances the transactivation functions of PR and ER. Our data also demonstrates that WBP-2 contains an intrinsic activation domain and the cPPXY of WBP-2 is essential for its coactivation and intrinsic activation functions. Our preliminary data also demonstrates that the WBP-2 binding protein, YAP1 enhances PR and ER transactivation but YAP1 s coactivation function is absolutely dependent on WBP-2. Furthermore, cPPXY motif of WBP-2 and WW-domain of YAP1 is required for YAP1 to work as a transcriptional coactiva-tor. Additionally, our data also indicate that the coactivation functions of WBP-2 and YAP1 are suppressed by WWOX1, suggesting that WWOX1 may regulates the transactivation functions of ER and PR by antagonizing the functions of WBP-2 and YAP1. Taken together our data estab-lished the role of WBP-2 and YAP1 as coactivators and WWOX1 as a repressor for ER and PR transactivation pathways.
DTIC

Breast; Cancer; Estrogens; Mammary Glands; Proteins

20070034305 Dana Farber Cancer Inst., Boston, MA USA

Promoter and Cofactor Requirements for SERM-ER Activity

Carroll, Jason S; May 2007; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0512

Report No.(s): AD-A469781; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469781

We aimed to understand the mechanisms by which Estrogen Receptor can regulate transcription both in a positive context after estrogen stimulation and in a negative context after tamoxifen. We originally planned to develop a methodology for specifically isolating chromatin to assess associated proteins but due to technical limitations we developed the ChiP-on-chip technique to map ER binding sites initially on a chromosome-wide scale but eventually on a genome-wide level. These experiments revealed surprising insight into ER acbon namely that ER rarely binds to promoter sequences but in a majority of cases binds to regions distant from transcription start sites. We also found an enrichment of motifs that gave us insight into the factors involved in augmenting ER activity. This led to the identification of FoxAl as a pioneer factor which we subsequently showed to be an essential component in recruiting ER to the chromatin. The whole-genome analysis revealed another class of cofactors including Oct-I C/EBPa and AP-I proteins. We used this information to identify the mechanisms by which ER can repress gene transcription. This included physiologic squelching at the early time point and direct repression via AP-I elements at the later time points. This study revealed exceptional information about ER function and provides the first complete list of the cis- regulatory elements that may be involved in breast cancer resistance to tamoxifen.
DTIC

Breast; Cancer; Estrogens; Genes; Mammary Glands; Proteins

20070034315 Seattle Biomedical Research Inst., Seattle, WA USA
Antigens for a Vaccine that Prevents Severe Malaria
Duffy, Patrick E; Mar 2007; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-2-0014
Report No.(s): AD-A469793; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469793

Malaria is the primary infectious disease threat facing the U.S. solider and is the leading cause of all casualties during tropical deployments. The long-term objective of this project is to identify and prepare the malaria parasite forms causing severe anemia and then apply functional genomics and bioinformatics tools to identify 15 to 30 proteins that could form the basis for an effective vaccine at both the pre-erythrocytic and blood stages of malaria infection. The project will then evaluate these lead candidates for their recognition by sera collected from immune individuals in order to identify the leading 3 to 5 candidates for a blood stage vaccine that prevents severe malarial anemia.
DTIC
Antigens; Infectious Diseases; Parasitic Diseases; Vaccines

20070034318 Duke Univ., Durham, NC USA
A Novel Combination of Thermal Ablation and Heat-Inducible Gene Therapy for Breast Cancer Treatment
Liu, Yunbo; Zhong, Pei; Apr 2007; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0461
Report No.(s): AD-A469803; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469803

This investigation aims to test the hypothesis that HIFU not only can destroy primary tumor tissues by thermal ablation but also is capable of inducing therapeutic effects in sub-lethally injured tumor cells via the heat shock response. During the current funding period, we have fully developed an image-guided, computer-controlled experimental HIFU system and characterized its corresponding acoustic and thermal fields. The efficiency of HIFU-induced maker gene (GFP) activation under the control of hsp70B promoter was investigated in vitro by using a mice breast cancer cell line (4T1). Furthermore, a 3D cell-embedded tissue mimicking phantom was developed, which possesses similar acoustic and thermal properties to that of breast tissues. Using this 3D phantom model, we have performed preliminary experiments to determine the correlation between the spatial thermal dose distribution and resultant gene activation during HIFU treatment. Future work will focus on completion of the HIFU-induced gene activation in the 3-D tissue mimicking phantom and on gene activation during HIFU thermal ablation in vivo.
DTIC
Ablation; Breast; Cancer; Gene Therapy; Genes; Heat Tolerance; Mammary Glands

20070034455 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Aerobic Biodegradation of Fuel Oxygenates
Gutshall, Adam M; Jun 2007; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469812; AFIT/GES/ENV/07-J1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Methyl tert-Butyl Ether (MTBE) is the most commonly used fuel oxygenate in the world. Its recalcitrant nature as well as its chemical properties have led to widespread groundwater contamination. Questions regarding its toxicity have spurred a search for viable oxygenate alternatives. Since biodegradability is a key indicator of a chemical's environmental impact, this research used three different well-known methods, BOD5, respirometry, and GC analysis, to examine the extent and rates of aerobic biodegradation of MTBE along with tert-butyl alcohol (TBA). The common fuel component toluene was added to some of the samples to determine if the presence of a co-contaminant would effect aerobic microbial degradation of TBA or MTBE. This group of experiments used an acclimatized microbial consortium to enhance degradation of the oxygenates. BOD5 experiments were performed separately from the GC and respirometric analyses. The respirometry used 250ml microcosms containing a mix of microbial seed, BOD buffer, and varying concentrations of the oxygenates or oxygenate/ toluene mixtures. The respirometer also maintained the microcosms in aerobic conditions for the duration of each experiment. For GC analysis, samples were drawn from the respirometer microcosms at predetermined intervals and first order degradation rate constants were calculated from established calibration curves. The oxygenates degraded much slower than toluene in all experiments. This degradation characteristic made BOD5 analysis impractical for MTBE or TBA. BOD5 did provide valid results for toluene. The respirometer data was not as good as gas chromatography to provide specific measurements of degradation. To facilitate comparison of degradation across experiments with differing seed, oxygenate degradation was

compared to toluene. MTBE was effectively degraded under these experimental conditions and degraded more recalcitrant and only degraded at 1.37% of toluene.
DTIC
Aerobes; Biodegradation; Chemical Properties; Fuels

20070034457 Wayne State Univ., Detroit, MI USA
Examination pf Potential Anti-Tumor Activity of N-Thiolated B-Lactam Antibiotics in Nude Mice Bearing Human Breast Tumors
Dou, Q P; Aug 1, 2005; 85 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0688
Report No.(s): AD-A469814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Activation of the cellular apoptotic program is a current strategy for the prevention and treatment of human cancer including breast cancer. Because of the ease of synthesis and structural manipulation, small molecules with apoptosis-inducing ability have great potential to be developed into chemotherapeutic drugs. The beta-lactam antibiotics have for the past 60 years played an essential role in treating bacterial infections without causing toxic side effects in the host. We hypothesized that active N-thiolated b-lactams can damage DNA and induce apoptosis in human breast cancer cells in nude mice. In this summary report, we have first evaluated potencies of several novel synthetic beta-lactams to inhibit proliferation and induce apoptosis in human cancer cells. We then determined whether one of these b-lactams, HY14, could inhibit breast tumor growth in vivo. We have found that HY14 inhibited growth of implanted MDA-MB-231 breast tumors in a concentrationdependent manner, associated with its DNA-damaging activity. We are currently testing more novel beta-lactams in nude mice bearing human breast tumors. Our studies have provided strong support for proof-of-concept of the potential use of these Nthiolated beta-lactams in breast cancer prevention and treatment.
DTIC
Antibiotics; Bacterial Diseases; Breast; Cancer; Chemotherapy; Deoxyribonucleic Acid; Drugs; Health; Mammary Glands; Mice; Toxicity; Tumors

20070034464 Mayo Clinic, Rochester, MN USA
Elucidation of the Molecular Mechanism Underlying Lymph Node Metastasis in Prostate Cancer
Datta, Kaustubh; Oct 2006; 24 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0901
Report No.(s): AD-A469826; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Metastatic spread of prostate cancer is the second leading cause of deaths of men in theUnited States. Although there are many ways to treat non-metastatic form of prostate cancer ,only androgen-deprivation therapy is available for the extensive stage. Again, the cancerwill often progress to an androgen refractory (independent), metastatic stage. Recent reportshave suggested that the expression of VEGF-C and its receptor VEGFR-3 are directly correlatedwith lymph node dissemination in prostate cancer. This finding leads us to think thatunderstanding the role of angiogenic molecules like VEGF-C, -D in molecular detail forlymphatic formation in prostate cancer will provide us the information regarding theirrelationship with lymph node metastasis. We have observed significant increase in reactiveoxygen species and activation of small GTPase RalA upon androgen withdrawal, which in turnupregulates VEGF-C in prostate cancer cells. Interestingly our results suggest a function ofVEGF-C, which is directly related to its role in increasing the metastatic propensity ofprostate cancer rather than inducing lymphangiogenesis.
DTIC
Cancer; Lymph; Lymphatic System; Metastasis; Prostate Gland

20070034470 Connecticut Univ., Storrs, CT USA
Relationship of Neurocognitive Function to Breast Cancer Treatment and Induced Menopause
Kenefick, Amy L; May 2006; 25 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0528
Report No.(s): AD-A469834; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This clinical nurse research award builds directly on the principal investigator's extensive clinical background in women's health and primary care by facilitating her transition from geriatric research to breast cancer research. The overall purpose of this award is to provide training for the development of a career in breast cancer research. The proposed training plan will lead to advanced skills in research design, data management and analysis and in working with interdisciplinary research teams to

improve outcomes of care of patients with breast cancer. The purpose of the research is to (1) describe NCF in women undergoing chemotherapy and in those undergoing surgically-induced menopause; (2) identify changes in NCF over time; (3) describe nature, severity, onset, duration, persistence of changes; (4) identify relationship between NCF and chemotherapy, menopause, symptom distress and functional status.
DTIC
Breast; Cancer; Mammary Glands

20070034472 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA
Poly (ADP-Ribose) Polymerase (PARP) is Essential for Sulfur Mustard-Induced DNA Damage Repair, But Has No Role in DNA Ligase Activation
Bhat, K R; Benton, Betty J; Ray, Radharaman; Jan 2006; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469851; USAMRICD-P04-038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Concurrent activation of poly (ADP-ribose) polymerase (PARP) and DNA ligase was observed in cultured human epidermal keratinocytes (HEK) exposed to the DNA alkylating compound sulfur mustard (SM), suggesting that DNA ligase activation could be due to its modification by PARP. Using HEK, intracellular (3)H-labeled NAD+ ((3)H-adenine) was metabolically generated and then these cells were exposed to SM (1 mM). DNA ligase I isolated from these cells was not (3)H-labeled, indicating that DNA ligase I is not a substrate for (ADP-ribosyl)ation by PARP. In HEK, when PARP was inhibited by 3-amino benzamide (3-AB, 2 mM), SM-activated DNA ligase had a half-life that was four-fold higher than that observed in the absence of 3-AB. These results suggest that DNA repair requires PARP, and that DNA ligase remains activated until DNA damage repair is complete. The results show that in SM-exposed HEK, DNA ligase I is activated by phosphorylation catalysed by DNA-dependent protein kinase (DNA-PK). Therefore, the role of PARP in DNA repair is other than that of DNA ligase I activation. By using the DNA ligase I phosphorylation assay and decreasing PARP chemically as well as by PARP anti-sense mRNA expression in the cells, it was confirmed that PARP does not modify DNA ligase I. In conclusion, it is proposed that PARP is essential for efficient DNA repair: however, PARP participates in DNA repair by altering the chromosomal structure to make the DNA damage site(s) accessible to the repair enzymes.
DTIC
Damage; Deoxyribonucleic Acid; Enzymes; Ribose; Sulfur

20070034476 California Univ., San Francisco, CA USA
Outcomes of Screening Mammography in Elderly Women
Smith-Bindman, Rebecca; Oct 2005; 105 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9112
Report No.(s): AD-A469869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is uncertainty about whether women older than age 65 should undergo screening mammography. Although screening mammography may benefit some elderly women through the detection of early breast cancer, it may potentially harm other women through false positive diagnoses and the diction and surgical treatment of clinically insignificant lesions. Further it is not known how the use of mammography and breast cancer outcomes varies by demographic factors such as race and ethnicity. The research designed in this proposal was targeted to try to understand the balance between benefit and harm associated with mammography screening. Much of the research involved the design and implementation of data analyses of data from the Center for Medicaid and Medicare Services, data from the National Surveillance Epidemiology and End Results (SEER) program and data from the NCI funded Breast Cancer Surveillance System. Additional related projects were focused on assessing the quality of mammography and the outcomes associated with mammographic screening. Further the specific aims of this research will evaluate 1) differences in breast cancer mortality, 2) differences in breast cancer treatment and 3) differences in breast cancer tumor attributes between women who were screened and those who were not, by age and race and ethnicity. The project involves defining whether Medicare billing claims data were accurate for assessment of mammography utilization and completion of the outlined aims once these data were shown to be reliable.
DTIC
Age Factor; Breast; Cancer; Females; Mammary Glands; Medical Services

20070034479 Duke Univ., Durham, NC USA

Novel Gbeta Mimic Kelch Proteins Gpb1 and Gpb2 Connect G-Protein Signaling to Ras via Yeast Neurofibromin Homologs Ira 1 and Ira 2: A Model for Human NF1

Heitman, Joseph; Mar 2006; 115 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0208

Report No.(s): AD-A469875; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Neurofibromatosis type 1 (NF1) gene encodes a large tumor suppressor protein, neurofibromin, which is a Ras GTPase-activating protein (RasGAP) activity. Although the NF1 gene was identified over a decade ago, the biological roles of neurofibromin in cellular processes remain unclear. Therefore it is crucial for therapy and developing new drugs for NF1 patients to elucidate how the RasGAP activity of neurofibromin is controlled. To achieve this goal, it is also important to identify regulatory elements for neurofibromin. We are investigating the molecular mechanisms by which the Ras GAP activity of the yeast neurofibromin homologs Ira1/2 is regulated as a model to understand human NF1. We have found that the kelch Gb subunit mimics Gpb1/2 interact with Ira1/2 and control the Ras GAP activity of Ira1/2. Here, we found that the Gpb1/2 proteins are localized to the cell membrane in a Gpa2 dependent manner and function at the cell membrane. Gpb1/2 bind to the C-terminus of Ira1/2 and stabilize the Ira1/2 proteins. Moreover we also identified a Gpb1/2 binding domain near the C-terminus of Ira1/2 (GBD) that is significantly conserved in neurofibromin homologs, including a human counterpart. Therefore, similar regulatory mechanisms might be conserved in evolution.

DTIC

Diseases; Genetics; Proteins; Yeast

20070034491 Wisconsin Univ., Madison, WI USA

Sonic Hedgehog Signaling Promotes Tumor Growth

Bushman, Wade; Feb 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0263

Report No.(s): AD-A469894; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have shown that the Sonic hedgehog (Shh) signaling pathway is absolutely required for normal prostate development and our studies performed with the support of the DOD New Investigator award indicate that Shh signaling promotes tumor growth. This proposal addresses the hypothesis that Sonic hedgehog signaling promotes tumor growth by activating stromal cell gene expression. To address this hypothesis, we have developed the DLPlacZ-LNCaP xenograft, a model that provides us with the opportunity to selectively assay gene expression in the stromal and epithelial compartments of the tumor using species specific PCR primers and to make specific modifications in stromal cell gene expression. We will use this model to: (1) determine whether Shh promotes tumor growth by activating expression of Gli-1 in the tumor stromal cells; (2) characterize the mechanisms by which tumor growth is promoted; and (3) examine the action of a specific stromal Shh target genes in tumor growth.

DTIC

Cancer; Prostate Gland; Tumors

20070034492 Brigham and Women's Hospital, Boston, MA USA

Downregulation of ErbB2 by Perturbing its Endocytic Recycling

Hsu, Victor W; Mar 2007; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0445

Report No.(s): AD-A469899; No Copyright; Avail.: Defense Technical Information Center (DTIC)

About 25% of breast cancers arise from the overexpression of ErbB2, which increases its cell surface level on mammary cells to result in enhanced mitogenic signaling. Recent evidence suggests that endocytic recycling contributes to the high surface level of ErbB2, but unlike all other currently known intracellular transport pathways, the conventional mechanism of protein sorting by coat proteins is thought not to play a significant role in endocytic recycling. However, in light of emerging evidence that this prevailing view might not be correct, we had originally proposed to gain insight into whether ErbB2 recycling follows the conventional mechanism of cargo sorting by testing whether it possessed recycling sorting signal(s), which are recognized by distinct coat proteins for sorting into different transport pathways. Since then, we have identified a novel clathrin coat complex that contains ACAP1 to mediate all examples of recycling that we have examined. This finding has led us to revise our originally proposed experiments, and we show that a pool of internalized ErbB2 colocalize and interact with the novel clathrin coat complex that we have recently identified for endocytic recycling. Significantly, our findings also

suggest a more direct approach in the future to study whether ErbB2 recycling modulates its signaling.
DTIC
Estrogens; Mammary Glands; Recycling; Tyrosine

20070034493 Baylor Coll. of Medicine, Houston, TX USA
The Scaffold Attachment Factor SAFB1: A New Player in G2/M Checkpoint Control
Lee, Adrian; Oesterreich, Steffi; Apr 2007; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0423
Report No.(s): AD-A469900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Loss of G2/M checkpoint plays an important role in tumorigenesis, however, few genes involved in this checkpoint control have been shown to be deregulated in human breast tumors. SAFB1 is a multifunctional protein which maps to a locus of high LOH, and mutations have been identified inboth breast cancer cell lines and tumors. Our preliminary data show that inactivation of SAFB1 in MEFs result in loss of G2/M checkpoint control, and that loss of SAFB1 expression is associated with Taxotere resistance in human breast tumors. We therefore hypothesize that SAFB1 is critical for G2/M checkpoint control, and that its inactivation results in resistance to breast cancer therapies that utilize a block in G2/M and subsequent apoptosis. We will identify the mechanism by which SAFB1 controls the G2/M checkpoint, and will subsequently analyze whether Taxotere-resistant tumors show altered expression of genes involved in these pathway(s).
DTIC
Apoptosis; Breast; Cancer; Genes; Mammary Glands; Neoplasms

20070034504 Rutgers - The State Univ., New Brunswick, NJ USA
In Situ Enhancement of Anaerobic Microbial Dechlorination of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in Marine and Estuarine Sediments
Haeggblom, Max M; Fennell, Donna E; Kerkhof, Lee J; Dec 18, 2006; 66 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-ER-1208; Proj-ERDP-CU-1208
Report No.(s): AD-A469917; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The management of marine and estuarine sediments contaminated with toxic organic compounds, including polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), is a major problem with far-reaching economic and ecological consequences. Enhancement of microbial degradation of PCDD/Fs in situ is an attractive remediation alternative that could potentially detoxify sediments, avoid the problematic redistribution of contaminants that is associated with dredging, and decrease the cost of sediment management. Reductive dehalogenation is a promising mechanism for the removal of toxic organohalides from estuarine and marine sediments. Anaerobic dechlorination of PCDD/Fs has been reported in marine and estuarine sediments, however, rates are slow and the activity may be the result of a combination of both respiratory and cometabolic processes. For in situ bioremediation, it would be most desirable to stimulate respiratory dechlorination, which is typically associated with higher dechlorination rates. Anaerobic reductive dechlorination is the first step required for the ultimate complete degradation of highly chlorinated PCDD/F congeners. Therefore, identification of the organisms involved, determination of their dechlorinating potential, characterization of how they compete for reducing equivalents with other members of the community, and development of strategies for enhancing their dehalogenating activities, are all needed. The overarching goal of this project, therefore, was to identify environmental conditions and amendments that enhance and accelerate dechlorination of PCDD/Fs by indigenous microbial populations and to identify the organisms responsible for the dechlorination using biomolecular methods. Results from this project show that anaerobic dehalogenation of PCDD/Fs was readily promoted in estuarine, marine and freshwater, sediments from several sites. This project has expanded our understanding of the microorganisms that carry out dehalogenation of PCDD/Fs.
DTIC
Activity (Biology); Anaerobes; Augmentation; Coasts; Estuaries; Microorganisms; Organic Compounds; Sediments

20070034508 Wayne State Univ., Detroit, MI USA
The Functional Effect of an Amphiregulin Autocrine Loop on Inflammatory Breast Cancer Progression
Willmarth, Nicole E; Ethier, Stephen P; Mar 1, 2007; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0405
Report No.(s): AD-A469921; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The epidermal growth factor (EGF) family ligand amphiregulin (AR) has been associated with breast cancer. We demonstrate that EGF-independent SUM149 breast cancer cells are synthesizing and secreting AR. MCF10A human

mammary epithelial cells made to over express AR (MCF10A AR) are also EGF-independent for growth. Treatment with the pan-erbB inhibitor CI1033 and the anti-EGFR antibody C225 demonstrated that ligand mediated activation of EGFR is required for SUM149 cell proliferation. AR neutralizing antibody reduced both SUM149 EGFR activity and cell proliferation confirming that an AR autocrine loop is required for mitogenesis. EGFR tyrosine phosphorylation was dramatically decreased in both SUM149 and MCF10A AR cells after inhibition of AR cleavage indicating that an AR autocrine loop is strictly dependent on AR cleavage in culture. However a juxtacrine assay where fixed SUM149 cells and MCF10A AR cells were overlain on top of EGF starved MCF10A cells showed that the AR membrane precursor can activate EGFR. SUM149 cells MCF10A AR cells and MCF10A cells growing in exogenous AR were all considerably more invasive and motile than MCF10A cells grown in EGF. Moreover AR upregulates genes involved in motility and invasion suggesting AR contributes to breast cancer progression.
DTIC
Breast; Cancer; Mammary Glands

20070034510 McGill Univ. Health Center, Montreal, Quebec Canada
Breast Cancer in Three Dimensions: Revealing Telomere Dysfunction in Breast Cancer
Foulkes, William; Sep 2006; 144 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-04-1-0783
Report No.(s): AD-A469923; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The structural re-modeling of the mammalian nucleus is a key feature of cancer cells. Such reorganization of the nucleus impacts the genomic integrity of the cell. Our focus is on the genetic alterations that affect the telomeres (the ends of chromosomes) in breast cancer. In this study, we wished to determine if mutations in either of the two main breast cancer susceptibility genes, known as BRCA1 and BRCA2 can influence the way in which telomeres are organized. To do this, we studied the three-dimensional (30) organization of telomeres in breast cancers derived from BRCA1 and BRCA2 gene mutation carriers. We used breast cancers arising in non-BRCA1/2 mutation carriers as controls. In addition, we studied three cancer cell lines derived from BRCA1-, BRCA2- and non-carriers to see if we found the same effect. There were two main measures- the length of the telomeres and the aggregation of the telomeres (i.e. to what extent telomeres were found 'stuck together')- this is usually the result of chromosomes with broken ends becoming fused. To summarize, the results were not conclusive. It was clear that the BRCA1 and BRCA2 cell lines had shorter telomeres and more aggregations compared with the controls, but in the tumors, the results were less clear. There was, however, a non-significant trend in the same direction as observed in the cell lines. This work is now continuing, and we aim to submit this work for publication in the coming year. The role of MYC in this process is of particular interest, as many BRCA1 tumors show amplification of MYC, and MYC is known to interact with other proteins in the maintenance of telomere length. We are currently analyzing the same set of tumors for MYC amplification by FISH.
DTIC
Breast; Cancer; Mammary Glands; Telomeres

20070034519 California Univ., Irvine, CA USA
Roles of Breast Cancer Susceptibility Genes BRCA's in Mammary Epithelial Cell Differentiation
Furuta, Saori; Mar 2007; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0322
Report No.(s): AD-A469943; No Copyright; Avail.: Defense Technical Information Center (DTIC)

BRCA1 exerts transcriptional repression through interaction with CtIP in the C-terminal BRCT domain and ZBRK1 in the central domain. A dozen of genes including angiopoietin-1 (ANG1), a secreted angiogenic factor, are co-repressed by BRCA1 and CtIP based on microarray analysis of mammary epithelial cells in 3-D culture. BRCA1, CtIP and ZBRK1 form a complex that coordinately represses ANG1expression via a ZBRK1 recognition site in ANG1 promoter. Impairment of this complex upregulates ANG1,which stabilizes endothelial cells forming capillary-like network structure. Consistently, Brca1-deficient mouse mammary tumors exhibit accelerated growth, pronounced vascularization and overexpressed ANG1. These results suggest, besides its role in maintaining genomic stability, BRCA1 directly regulates the expression of angiogenic factors to modulate the tumor microenvironment.
DTIC
Breast; Cancer; Genes; Mammary Glands; Oncogenes

20070034523 International Brain Mapping, West Hollywood, CA USA
International Brain Mapping
Kateb, Babek; Aug 1, 2007; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0661
Report No.(s): AD-A469947; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The third annual meeting International Brain Mapping & Intra-operative Surgical Planning Society (IBMISPS) was held in Clermont Ferrand, France (Sep 5-8, 2006). The Society is organized for the purpose of encouraging leading basic and clinical scientists who are interested in or active in areas of Brain Mapping (BM) and Intra-operative Surgical Planning (ISP) to share their findings with other physicians and scientists across disciplines. Currently there is no combined conference on both subjects. This meeting intends to build a bridge between the two fields. The meeting has be organized by the board of directors and will form the organizing committees: Search, Medical Education, Program and Finance. The event did have significant clinical and basic science components. Thus it was a multidisciplinary venue to explore and clarify a defined subject, problem, or area of knowledge related to IBM and ISP with leaders in the field. The 4th annual meeting of IBMISPS is set for Sep. 6-8, 2007 in Washington DC. IBMISPS is also intended for the purpose of promoting public welfare through the advancement of Intra-operative Surgical Planning and Brain Mapping, by a commitment to excellence in education, and by dedication to research and scientific discovery. The mission of the association will be achieved through multi-disciplinary collaboration of government agencies, patient advocacy groups, educational institutes and private sector (industry) brought together to address issues and problems related to BM and ISP and implement new technologies. We had specific scientific sessions on ranging from Image Guided Surgery, OR and the Hospital of the future to nanomedicine and stem cell imaging. All talks and abstracts that are presented at the meeting will be published on line and selected ones will be published in IBMISPS-NeuroImage.

DTIC
Brain; Medical Science; Neurology

20070034530 Cold Spring Harbor Lab., New York, NY USA
Dicer in Mammary Tumor Stem Cell Maintenance
Murchison, Elizabeth P; Mar 2007; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0256
Report No.(s): AD-A469955; No Copyright; Avail.: Defense Technical Information Center (DTIC)

RNA interference (RNAi) is a gene silencing pathway with roles in mRNA stability, translational control, chromatin organization and genome regulation. MicroRNAs (miRNAs) are a set of small RNAs produced by the RNAi machinery that play important functions in tissue organization and maintenance of cell identity. Several miRNAs have been shown to collaborate with oncogenes in the progression of cancer, and in addition, miRNA expression profiling has revealed widespread miRNA misregulation in cancer. To address the role of miRNAs in the onset and maintenance of cancer, we have created embryonic stem (ES) cells and mice in which Dicer, a key enzyme in miRNA biogenesis, can be conditionally inactivated. We have demonstrated loss of Dicer delays onset of teratomas derived from subcutaneously injected ES cells. In addition, we have identified a miRNA family that is regulated by the master tumor-suppressor gene p53. We show that the miR-34 family is a direct target of p53 transcriptional regulation. Our work places miR-34 in the p53 tumor suppressor network, implicated in many cancers, including breast cancer.

DTIC
Cells (Biology); Maintenance; Mammary Glands; Ribonucleic Acids; Stem Cells; Tumors

20070034531 Children's Hospital of Pittsburgh, Pittsburgh, PA USA
New Advanced Technology to Improve Prediction and Prevention of Type 1 Diabetes
Vigersky, Robert A; Nov 2005; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0009
Report No.(s): AD-A469956; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hypothesis to be tested is that there are allelic variations of some genes that make the development of diabetesrelated complications more likely in patients who carry them than those who do not. The 3 major complications to be evaluated are diabetic nephropathy, diabetic neuropathy, and diabetic retinopathy. This is an observational study in which the investigators will obtain DNA samples from the blood of patients with one or more of these complications and from as many their first-degree relatives as possible for testing in the laboratory of Dr. Massimo Trucco is an internationally known immunologist and respected leader in genetic research in diabetes. He will evaluate these samples by studying candidate genes selected a

priori and testing for transmission/disequilibrium a standard for analysis of linkage between a candidate gene and a specific disease.
DTIC
Metabolic Diseases; Prevention

20070034532 Children's Hospital of Pittsburgh, Pittsburgh, PA USA
New Advanced Technology to Improve Prediction and Prevention of Type 1 Diabetes
Trucco, Massimo; Nov 2006; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0009
Report No.(s): AD-A469957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Type 1 diabetes is considered an autoimmune disease characterized by the presence of inflammatory cells in the islets of Langerhans. These cells are T lymphocytes, considered responsible for the destruction of the insulin producing beta-cells present in the islets. When the majority of the beta cells are dead, the disease presents, frequently with an abrupt and clinically serious onset. The aim of this program is to determine whom among the Army personnel is at high risk to develop the disease in order to prevent the unexpected onset of the disease that may be associated with tragic consequences, and to initiate an educational program aimed at reducing practical and psychological hurdles. Furthermore, different individuals develop disease complications (i.e., retinopathy, nephropathy, neuropathy) at different timepoints after the onset. The susceptibility to complications could also be genetic. The human genome will be scanned systematically to characterize these susceptibility genes. Proteomic analysis will be performed in tandem to confirm the genetic associations.
DTIC
Metabolic Diseases; Prevention

20070034533 Wisconsin Univ., Madison, WI USA
Estrogen-Related Receptor alpha (ERR (alpha))-Coactivator Interactions as Targets for Discovery of New Anti-Breast Cancer Therapeutics
Burgess, Richard R; Mar 2007; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0243
Report No.(s): AD-A469959; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The steroid nuclear receptor estrogen receptor alpha (ERalpha) is the primary target of current breast cancer therapies, which block ERo activation or estrogen synthesis. Estrogen-related receptor alpha (ERRalpha), a protein with high sequence similarity to ERalpha, has functional similarity to ERalpha in certain breast cancer cell types; though unlike ERalpha, ERRalpha acts independently of steroid ligand. We hypothesize that its activity may be due in part to its interaction with coactivator proteins, and in some instances, ERRalpha may be functionally substituting for ERalpha and playing an important role in the progression of a subset of breast cancers. We found that coactivator recruitment is necessary for full ERRalpha activation of transcription; furthermore, GRIP1 (SRC-2, TIF-2) is cell type- and promoter- specific in its coactivation of transcription with a constitutively active form of ERRalpha. We used this information to develop a cell-based, high-throughput screen for small molecules that inhibit the transcription of an estrogen response element (ERE)-containing luciferase reporter gene in the presence of overexpressed GRIP1 and 'activated' ERRalpha. This screen, performed in MCF-7 cells in 96-well plates, used a 4,160 'known bloactives' compound library. Recently, we were able to improve the cell-based screen by converting to batch transfection of cells and to a 384-well plate format, which allowed us to use 75% less cells and chemical per well, thereby making the assay much more efficient, reproducible, and adaptable to larger chemical libraries. We also have developed four cell-based, high-throughput counter screens to validate 'hits' from primary screens by ruling out compounds that are toxic to cells or that generally inhibit transcription or translation. Lastly, we are generating a targeted, high-throughput screen to determine the effects of remaining 'hits' on inhibition of the GRIP1-ERRalpha interaction in vitro.
DTIC
Breast; Cancer; Estrogens; Mammary Glands; Targets

20070034534 Colorado Univ., Denver, CO USA
NSAIDS and the Osteogenic Response to Mechanical Stress in Premenopausal Women
Kohrt, Wendy; Schwartz, Robert S; Apr 2007; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0805
Report No.(s): AD-A469961; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is a study of the effects of ibuprofen, a non-steroidal anti-inflammatory drug (NSAID), on the osteogenic response

to 9 months of exercise training in healthy, premenopausal women, aged 21 to 40 years (N=102). The hypotheses are: H1a: taking short-acting NSAIDS before exercise will diminish increases in bone mineral density (BMD) in response to exercise training H1b: taking short-acting NSAIDS after exercise will not diminish the increases in BMD in response to exercise training Participants take either ibuprofen (400mg) or placebo capsules before and after each exercise session. Women are randomized to three treatment arms: 1) NSAID before exercise, placebo after exercise (NSAID/placebo; n=34); 2) placebo before exercise, NSAID after exercise (placebo/NSAID; n=34); and 3) placebo before exercise, placebo after exercise (placebo/placebo; n=34). One hundred thirteen women completed baseline testing and were randomized to treatment. Final follow-up testing was completed approximately 7 months ago and most sample analysis has been completed. Re-analysis of some samples and review of the database continues for quality assurance. Manuscript preparation is underway. These studies could lead to the development of new strategies to reduce the incidence of, and treatment for, stress fractures that occur in response to vigorous physical activity.
DTIC
Bones; Cytogenesis; Females; Osteogenesis

20070034535 California Univ., San Francisco, CA USA
Biological Function of Plasma Kallikrein in Mammary Gland Stromal Development and Tumor Metastasis
Lilla, Jennifer; Mar 2007; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0272
Report No.(s): AD-A469962; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The plasminogen cascade of serine proteases has been affiliated in the mammary gland with both development and tumorigenesis. We have found that the dominant plasminogen activator during mammary gland stromal involution is plasma kallikrein (PKal), and that active PKal appears in connective tissue-type mast cells in the mammary stroma during different phases of development. Examination of the extra hepatic expression of PKal has shown that PKal message is present in the mammary gland, and that increased expression levels correlate to periods of stromal remodeling. Additionally, an inhibitor of PKal that has been demonstrated to diminish mammary gland involution may be used to characterize PKal expression in the mammary gland as well as to identify targets of PKal activity during involution. Furthermore, mast cells are required for normal mammary duct branching morphogenesis during puberty. Lastly, a PKal knockout mouse has been produced that has the unexpected consequence of embryonic lethality.
DTIC
Enzymes; Mammary Glands; Metastasis; Plasmas (Physics); Protease; Tumors

20070034536 Henry Ford Health System, Detroit, MI USA
Population Based Assessment of MHC Class I Antigens Down Regulation as Markers of Increased Risk for Development and Progression of Breast Cancer from Benign Breast Lesions
Worsham, Maria J; Jan 2007; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0288
Report No.(s): AD-A469963; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Despite advances in chemotherapy and radiation therapies, advanced breast cancer still carries a high mortality rate. The need for effective therapies is urgent. The overall aim of this research proposal is to recognize early markers of disease and their interaction with other epidemiological risk factors that can serve as risk indicators for subsequent development of breast cancer from precancerous lesions, and as prognostic markers for progression from primary to metastatic disease. The major histocompatibility complex (MHC) class I molecules are found on the cell membrane of all cells in the body and are involved in intercellular communications and in complex interactions with the immune system. Cancer cells with reduced or aberrant MHC molecules have been shown to evade immune surveillance and become selected for cancer progression and spread of disease to distant sites of the body. About half of all breast cancers have complete loss or reduced level of MHC class I molecules and this finding has been associated with increased tumor invasiveness and more aggressive cancers with poorer outcome. The outlined studies are expected to better define the clinical significance of abnormal MHC class I molecules in precancerous and invasive breast lesions as markers of immunological events that could affect survival, selection, and outgrowth of precancerous cells, and their subsequent progression to breast cancer. These MHC losses could also mark more aggressive tumors and thus contribute to selection of appropriate treatments in individual cases.
DTIC
Antigens; Breast; Cancer; Lesions; Mammary Glands; Markers; Populations; Risk

20070034537 Texas Univ., Houston, TX USA

Epigenetic Silencing and Resistance to Imatinib Mesylate in CML

Issa, Jean-Pierre; Jul 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0448

Report No.(s): AD-A469966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Resistance to Imatinib mesylate is emerging as a real clinical problem in the management of chronic myelogenous leukemia (CML). In this project we are exploring the hypothesis that epigenetic silencing associated with promoter DNA methylation mediates resistance in selected cases and that reversal of silencing by decitabine-induced hypomethylation can be of therapeutic benefit in CML. In progress to date we have identified samples from patients with CML prior to Imatinib therapy as well as from patients with established resistance to Imatinib. Bisulfite based analysis identified methylation of p15 and CDH13 in subsets of patients but ruled these genes out as major causes of resistance. In parallel clinical trials of decitabine have shown activity as single agent and when combined with Imatinib in CML resistant to Imatinib. Analysis of samples from patients on trial showed hypomethylation after therapy. Hypmethylation dynamics suggest that decitabine leads to CML cell death 5-10 days after treatment and suggest that resistance to decitabine is not pharmacologic. These studies are ongoing to clarify the role of methylation in the pathogenesis and therapy of Imatinib resistant CML.

DTIC

Genetics; Leukemias

20070034539 New Mexico Univ., Albuquerque, NM USA

Role of the 5HT3 Receptor in Alcohol Drinking and Aggression Using a Transgenic Mouse Model

Allan, Andrea M; Sep 1, 2006; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0680

Report No.(s): AD-A469970; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We hypothesized that over-expression of 5-HT3 receptors decreases alcohol consumption because the presence of an increased number of 5-HT3 receptors increased the potentiation of dopamine release at lower alcohol concentrations. Thus, the animal requires less alcohol to obtain the same behavioral effect. Thus, the lower level of alcohol consumption seen in the 5-HT3 receptor over-expressing mice may be the result of increased inhibitory control over alcohol consumption We found that the 5-HT3 receptor over-expressing mice fail to behave aggressively in an intruder aggression test. They display less learned helpless behavior than wild type mice and have greater neuronal survival. We examined the impact of 5HT3 receptor over-expression on alcohol preference using a two-bottle free choice test and the impact of 5HT3 receptor over-expression on natural aggressive behavior. We found that reduced drinking behavior continued to be presented even when the transgene was expressed on an inbred strain background. These studies indicate the 5HT3 receptor plays a role in impulse control.

DTIC

Alcohols; Drinking; Mice; Serotonin

20070034540 Alabama Univ., Birmingham, AL USA

Chemoprevention Against Breast Cancer with Genistein and Resveratrol

Whitsett Jr , Timothy G; Lamartiniere, Coral A; Mar 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0308

Report No.(s): AD-A469973; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer a destructive disease despite new therapeutics. It is well accepted that environmental factors, especially diet, can play an important role in determining one s future risk of the disease. We believe that two natural polyphenols, genistein (a component of soy) and sesveratrol (a component of grapes and red wine), can suppress mammary carcinogenesis. We and others have clearly shown a mammary-protective effect against chemically-induced mammary cancer. This pronect aims to elucidate mechanisms through which these polyphenols may exert their effects. We show that genistein and resveratrol can modulate the protein expression of several critical proteins in the mammary gland that are involved in growth and proliferation. We see changes in both the MAPK signaling pathway, the PI3K/Akt pathway, as well as changes in sex steroid receptor co-activators. We have demonstrated that the estrogen receptors play an important role in the mechanisms of genistein and resveratrol. Lastly, we show that a novel mouse model that over-expresses AIB1 may not be suitable for early exposure, chemoprevention experiments.

DTIC

Breast; Cancer; Mammary Glands

20070034541 Maryland Univ., Baltimore, MD USA

Magnetic Resonance Imaging of Polymeric Drug Delivery Systems in Breast Cancer Solid Tumors

Zarabi, Bahar; Ghandehari, Hamid; Jul 2006; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0341

Report No.(s): AD-A469974; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall purpose of this research is to develop a polymeric drug delivery system containing magnetic resonance contrast agents for the treatment of breast cancer. This drug-imaging agent delivery system will allow the follow up of the fate of the drug delivery system and its relation to reduced tumor mass, improved efficacy and reduced toxicity in individual patients. In year two progress was made in the following areas: 1) Synthesis of polymer- contrast agent- doxorubicin conjugates; 2) Physicochemical characterization of polymer- contrast agent- doxorubicin conjugates; and 3) Relaxivity measurements. In addition, a series of polymer- contrast agent conjugates targetable to macrophages were synthesized, characterized, and evaluated in vitro.

DTIC

Breast; Cancer; Drugs; Imaging Techniques; Magnetic Resonance; Mammary Glands; Polymers; Tumors

20070034542 Howard Univ., Washington, DC USA

Strategies for Treatment of Bone Metastases from Breast Cancer

Sridhar, Rajagopalan; Oct 2005; 45 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0759

Report No.(s): AD-A469975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major goal of this project is to optimize the strategies for using radioactive strontium for palliation of bone pain due to breast cancer metastases. One approach is to determine ways of selectively increasing strontium uptake at the metastatic site. Bisphosphonates are useful in the treatment of osteoporosis and bone metastases. Bisphosphonates sequester calcium and strontium. Strontium was non toxic to human breast cancer cells. Bisphosphonates are charged molecules that do not easily cross hydrophobic cell membranes. The nature of the counter ion to the anionic phosphonate was found to have an effect on the cellular uptake of bisphosphonate such as etidronate. The cytotoxicty of zoledronic acid towards MCF-7 cells greater than pamidronate and etidronate. The presence of strontium chloride in the culture medium inhibited calcium uptake by MDA-MB 231 cells. Etidronic acid treatment perturbed cell cycle progression of MCF-7 cells, causing a G2/M block and decreased the proportion of cells in S-phase. This suggests that a bisphosphonate such as etidronate may be useful in combination with ionizing radiation for treatment of bone metastases.

DTIC

Bones; Breast; Cancer; Mammary Glands; Metastasis

20070034543 Beth Israel Deaconess Medical Center, Boston, MA USA

New Approaches for Prostate Cancer Combination Therapy

Zerbini, Luiz F; Apr 1, 2007; 20 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0459

Report No.(s): AD-A469976; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Numerous studies demonstrate that non-steroidal anti-inflammatory drugs (NSAIDs) are effective in chemoprevention or treatment of cancer. Nevertheless, the mechanisms underlying the antineoplastic actions of NSAIDs remain poorly understood. We started deciphering now the mechanisms by which NSAIDs induce programmed cell death and growth arrest in cancer. In this report we show that induction of the pro-apoptotic cytokine melanoma differentiation associated gene-7/Interleukin-24 (MDA-7/IL-24) and the expression of growth arrest and DNA damage inducible (GADD) 45 alpha and gamma by several NSAIDs is an essential step for G2/M growth arrest and apoptosis induction of cancer cells and inhibition of tumor growth in vivo. MDA-7/IL24 dependent upregulation of GADD45 alpha and gamma expression is sufficient for cancer cell apoptosis, since inhibition of GADD45 alpha and gamma by small interfering RNA abrogates apoptosis and growth arrest induction by the NSAID, blocks JNK activation and restores CDC2 kinase activity. Our results establish MDA-7/IL-24 and GADD45 alpha and gamma as critical mediators of apoptosis and growth arrest in response to NSAIDs in cancer cells.

DTIC

Apoptosis; Cancer; Drugs; Prostate Gland; Steroids; Sulfides; Therapy

20070034551 Center for Telehealth and E-Health Law, Washington, DC USA
4th Annual Conference Enhancing Awareness of Medical Simulation
Eder-Van Hook, Jackie; Waters, Robert J; Sep 2007; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-1-0391
Report No.(s): AD-A469987; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Meeting summary of the Fourth Annual Advanced Initiatives in Medical Simulation held May 2007.
DTIC
Conferences; Medical Science; Simulation

20070034562 Integrated Wave Technologies, Inc., Fremont, CA USA
Medical Effects and Dosimetric Data from Nuclear Tests at the Semipalatinsk Test Site
Balmukhanov, S B; Abdrakhmanov, J N; Balmukhanov, T S; Gusev, B I; Kurakina, N N; Raisov, T G; Jun 2006; 135 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA01-03-D-0022-0015
Report No.(s): AD-A470000; DTRA-TR-06-23; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In the former Soviet Union, two sites were used for most surface or atmospheric nuclear tests. One of these was at Novaya Zemlya in the arctic, but the earlier and more used of the two was in what is now the Republic of Kazakhstan. The Semipalatinsk Test Site (STS), or Polygon as it was called, was instituted in 1947. Data relating to the radiation levels were declassified in 1992 and are published in the first two tables of this report. Basically, the population was exposed to three sources of radiation: acute external gamma irradiation as the plume from the explosion passed over the areas; external gamma (and probably beta) irradiation from the fallout as it settled on the ground and the people themselves; and internal gamma, beta, and small amounts of alpha irradiation. Medical examinations conducted under this report and compared with data from previous expeditions have shown a significant disparity in health status between inhabitants of villages in the immediate neighborhood of the STS and inhabitants of similar settlements remote from the STS.
DTIC
Dosimeters; Health; Nuclear Explosions

20070034566 New York Univ., New York, NY USA
BTG2 Antiproliferative Gene and Prostate Cancer
Walden, Paul D; Feb 2007; 8 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0216
Report No.(s): AD-A470017; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Levels of the BTG2 tumor suppressor protein diminish during the transition of normal prostate epithelial cells into prostate cancer cells and restoration of BTG2 expression in prostate cancer cells significantly reduces cell proliferation and tumorigenicity. Our working hypothesis being tested is that the tumor suppressive activity of BTG2 is diminished as an early event in prostate carcinogenesis due to increased proteasomal degradation, leading to compromised cell cycle regulation, increased cell invasion and cancer progression. To date we have shown that BTG2 protein expression is lost as a very early event in prostate cancer and that prostate cancer tissue and cells degrade BTG2 at a greater rate than non-cancer tissue and cells. We have also shown that BTG2 has a predominantly nuclear localization consistent with its antiproliferative function, but that BTG2 is transiently sequestered in the nucleolus at 4 hours following growth stimulation of quiescent cells indicating that BTG2 might additionally influence some aspect of ribosome biosynthesis. In the present reporting period we have shown that steady state levels of BTG2 during the cell cycle are influenced by changes in BTG2 ubiquitination (consistent with proteasomal degradation) and not by changes in the level of the deubiquitinating enzyme USP4.
DTIC
Cancer; Genes; Prostate Gland

20070034568 Mount Sinai School of Medicine, New York, NY USA
Microtubule-Targeting Therapy for Prostate Cancer
Atweh, George F; Feb 2007; 30 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0219
Report No.(s): AD-A470022; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Prostate cancer is the most frequently diagnosed malignancy and the second leading cause of cancer-related deaths in men in the U.S. In the early stage of the disease, the treatments of choice are extensive surgery and/or radiation therapy. Although

both treatment modalities are effective, they are associated with significant morbidity and mortality. When local therapies for prostate cancer fail and the disease progresses, systemic androgen ablation therapy, with or without chemotherapy, can frequently lead to tumor regression. However, the disease inevitably progresses to an androgen-independent state that is resistant to hormonal therapy and chemotherapy. Thus, the development of alternative therapeutic strategies for prostate cancer in the early and the late stages remains a high priority. The focus of our research is to develop a novel therapeutic strategy for the treatment of prostate cancer that targets the microtubules that make up the mitotic spindle. Stathmin is a founding member of a family of microtubule-destabilizing proteins that play a critical role in the regulation of mitosis. This protein is expressed at high levels in a wide variety of human malignancies, including prostate carcinoma. When biopsy specimens from human prostate cancers were immunostained with an antistathmin antibody, immunoreactivity was seen in poorly differentiated tumors but not in hyperplastic prostate or in highly differentiated prostate cancer. More importantly, the level of expression of stathmin was shown to correlate with the malignant behavior of prostate cancer cells. As a matter of fact, it was proposed that the level of expression of stathmin may serve as an important prognostic marker in prostate cancer. Thus, stathmin provides an attractive target for prostate cancer therapy.
DTIC
Cancer; Chemotherapy; Prostate Gland; Proteins; Therapy

20070034847 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cancer Detection Using Neural Computing Methodology
Toomarian, Nikzad; Kohen, Hamid S.; Bearman, Gregory H.; Seligson, David B.; October 20, 2001; 5 pp.; In English; 13th European Simulation Symposium (ESS), 18-20 Oct. 2001, Marseilles, France; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40401

This paper describes a novel learning methodology used to analyze bio-materials. The premise of this research is to help pathologists quickly identify anomalous cells in a cost efficient method. Skilled pathologists must methodically, efficiently and carefully analyze manually histopathologic materials for the presence, amount and degree of malignancy and/or other disease states. The prolonged attention required to accomplish this task induces fatigue that may result in a higher rate of diagnostic errors. In addition, automated image analysis systems to date lack a sufficiently intelligent means of identifying even the most general regions of interest in tissue based studies and this shortfall greatly limits their utility. An intelligent data understanding system that could quickly and accurately identify diseased tissues and/or could choose regions of interest would be expected to increase the accuracy of diagnosis and usher in truly automated tissue based image analysis.
Author
Cancer; Image Analysis; Diseases; Diagnosis; Data Systems

20070034878 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Virtual Bioinformatics Knowledge Environment for Early Cancer Detection
Crichton, Daniel; Srivastava, Sudhir; Johnsey, Donald; July 28, 2003; 5 pp.; In English; 7th World Multiconference on Systemics, Cybernetics and Informatics, 27-30 Jul. 2003, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40408

Discovery of disease biomarkers for cancer is a leading focus of early detection. The National Cancer Institute created a network of collaborating institutions focused on the discovery and validation of cancer biomarkers called the Early Detection Research Network (EDRN). Informatics plays a key role in enabling a virtual knowledge environment that provides scientists real time access to distributed data sets located at research institutions across the nation. The distributed and heterogeneous nature of the collaboration makes data sharing across institutions very difficult. EDRN has developed a comprehensive informatics effort focused on developing a national infrastructure enabling seamless access, sharing and discovery of science data resources across all EDRN sites. This paper will discuss the EDRN knowledge system architecture, its objectives and its accomplishments.
Author
Biomarkers; Detection; Cancer; Real Time Operation; Architecture (Computers); Diseases

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20070034734 NASA Johnson Space Center, Houston, TX, USA
Airlock Retreat Metabolic Data Analysis
Kuznetz, L. H.; Gernhardt, M.; Bue, Grant; October 2007; 134 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2007-213737; S-995; Copyright; Avail.: CASI: A07, Hardcopy

This study, conducted on behalf of the EVA Physiology, Systems and Performance Project at NASA-JSC, was initiated to verify and correlate mathematical models used to predict the thermal limits of crewmembers practicing rescue techniques aboard the International Space Station (ISS) during Extravehicular Activity (EVA). While the impetus for this work came from excessive heat storage predictions by an existing EMU SINDA model, the resulting correlations and results have potential benefits for a wide range of safety-of-flight operations performed by astronauts during nominal and contingency operations. Author

Air Locks; Data Processing; Extravehicular Activity; Mathematical Models; Thermal Analysis; Metabolism; Aerospace Medicine

20070035021 NASA Johnson Space Center, Houston, TX, USA
Overview and Results of ISS Space Medicine Operations Team (SMOT) Activities
Johnson, H. Magee; Sargsyan, Ashot E.; Armstrong, Cheryl; McDonald, P. Vernon; Duncan, James M.; Bogomolov, V. V.; May 13, 2007; 8 pp.; In English; ASMA Annual Conference, 13-17 May 2007, New Orleans, LA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS9-02078; Copyright; Avail.: CASI: A02, Hardcopy

The Space Medicine Operations Team (SMOT) was created to integrate International Space Station (ISS) Medical Operations, promote awareness of all Partners, provide emergency response capability and management, provide operational input from all Partners for medically relevant concerns, and provide a source of medical input to ISS Mission Management. The viewgraph presentation provides an overview of educational objectives, purpose, operations, products, statistics, and its use in off-nominal situations.
Derived from text

International Space Station; General Overviews; Aerospace Medicine; Mission Planning

20070035022 NASA Johnson Space Center, Houston, TX, USA
Monitoring Immune System Function and Reactivation of Latent Viruses in the Artificial Gravity Pilot Study
Mehta, Satish K.; Crucian, Brian; Pierson, Duane L.; Sams, Clarence; Stowe, Raymond P.; [2007]; 9 pp.; In English; Copyright; Avail.: CASI: A02, Hardcopy

Numerous studies have indicated that dysregulation of the immune system occurs during or after spaceflight. Using 21 day -6 degrees head-down tilt bed rest as a spaceflight analog, this study describes the effects of artificial gravity (AG) as a daily countermeasure on immunity, stress and reactivation of clinically important latent herpes viruses. The specific aims were to evaluate psychological and physiological stress, to determine the status of the immune system, and to quantify reactivation of latent herpes viruses. Blood, saliva, and urine samples were collected from each participating subject at different times throughout the study. An immune assessment was performed on all treatment and control subjects that consisted of a comprehensive peripheral immunophenotype analysis, intracellular cytokine profiles and a measurement of T cell function. The treatment group displayed no differences throughout the course of the study with regards to peripheral leukocyte distribution, cytokine production or T cell function. Shedding of Epstein barr virus (EBV), Cytomegalovirus (CMV), and Varicella zoster virus (VZV) was quantified by real time PCR in saliva and urine samples, respectively. There was no significant difference in CMV DNA in the treatment group as compared to the control group. EBV and VZV on the other hand showed a mild reactivation during the study. There were no significant differences in cortisol between the control and treatment groups. In addition, no significant differences between antiviral antibody titers (EBV-VCA, -EA, -EBNA, CMV) or

tetramer-positive (EBV, CMV) were found between the two groups. EBV DNA copies in blood were typically undetectable but never exceeded 1,500 copies per 106 PBMCs. Overall, these data indicate that the artificial gravity countermeasure and the 21 day head-down tilt bed rest regimen had no observable adverse effect on immune function.
Author
Physiological Responses; Stress (Psychology); Artificial Gravity; Viruses; Weightlessness Simulation; Head Down Tilt; Gravitational Physiology; Immunology

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*.

20070034172 San Jose State Univ., Moffett Field, CA, USA
Modeling the Scheduling of Eye Movements and Manual Responses in Performing a Sequence of Discrete Tasks
Wu, Shu-Chieh; Remington, Roger W.; Lewis, Richard; Proceedings of the 28th Annual Conference of the Cognitive Science Society; July 2006, pp. 900-905; In English; The 28th Annual Conference of the Cognitive Science Society, 26-29 July 2006; Original contains black and white illustrations
Contract(s)/Grant(s): NNA06CB16A; Copyright; Avail.: Other Sources

Common tasks in daily life are often accomplished by a sequence of actions that interleave information acquisition through the eyes and action execution by the hands. How are eye movements coordinated with the release of manual responses and how may their coordination be represented at the level of component mental operations? We have previously presented data from a typing-like task requiring separate choice responses to a series of five stimuli. We found a consistent pattern of results in both motor and ocular timing, and hypothesized possible relationships among underlying components. Here we report a model of that task, which demonstrates how the observed timing of eye movements to successive stimuli could be accounted for by assuming systems: an open-loop system generating saccades at a periodic rate, and a closed-loop system commanding a saccade based on stimulus processing. We relate this model to models of reading and discuss the motivation for dual control.
Author
Coordination; Eye Movements; Mathematical Models; Human Performance; Psychomotor Performance

20070034173 NASA Ames Research Center, Moffett Field, CA, USA
New Integrated Modeling Capabilities: MIDAS' Recent Behavioral Enhancements
Gore, Brian F.; Jarvis, Peter A.; SAE 2005 Transactions Journal of Passenger Cars: Electronic and Electrical Systems; [2005], pp. 752-759; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1302; NNA04CB16A; RTOP 728-20-10
Report No.(s): SAE 2005-01-2701; Copyright; Avail.: Other Sources

The Man-machine Integration Design and Analysis System (MIDAS) is an integrated human performance modeling software tool that is based on mechanisms that underlie and cause human behavior. A PC-Windows version of MIDAS has been created that integrates the anthropometric character 'Jack (TM)' with MIDAS' validated perceptual and attention mechanisms. MIDAS now models multiple simulated humans engaging in goal-related behaviors. New capabilities include the ability to predict situations in which errors and/or performance decrements are likely due to a variety of factors including concurrent workload and performance influencing factors (PIFs). This paper describes a new model that predicts the effects of microgravity on a mission specialist's performance, and its first application to simulating the task of conducting a Life Sciences experiment in space according to a sequential or parallel schedule of performance.
Author
Man Machine Systems; Systems Integration; Human Behavior; Models; Design Analysis; Computer Programs; Anthropometry

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20070034851 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Automated Knowledge Discovery from Simulators
Burl, Michael C.; DeCoste, D.; Enke, B. L.; Mazzoni, D.; Merline, W. J.; Scharenbroich, L.; April 20, 2006; 12 pp.; In English; Science and Industry Advance with Mathematics (SIAM) International Conference on Data Mining, 20-22 Apr. 2006, Bethesda, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40446

In this paper, we explore one aspect of knowledge discovery from simulators, the landscape characterization problem, where the aim is to identify regions in the input/ parameter/model space that lead to a particular output behavior. Large-scale numerical simulators are in widespread use by scientists and engineers across a range of government agencies, academia, and industry; in many cases, simulators provide the only means to examine processes that are infeasible or impossible to study otherwise. However, the cost of simulation studies can be quite high, both in terms of the time and computational resources required to conduct the trials and the manpower needed to sift through the resulting output. Thus, there is strong motivation to develop automated methods that enable more efficient knowledge extraction.
Author
Simulators; Data Mining; Terrain; Topography; Simulation; Motivation; Management Systems

20070034969 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Scalable Architecture of a Structured LDPC Decoder
Lee, Jason Kwok-San; Lee, Benjamin; Thorpe, Jeremy; Andrews, Kenneth; Dolinar, Sam; Hamkins, Jon; June 2004; 6 pp.; In English; The Institute of Electrical and Electronics Engineers (IEEE)International Symposium on Information Theory, 27 Jun. - 2 Jul. 2004, Chicago, IL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40472

We present a scalable decoding architecture for a certain class of structured LDPC codes. The codes are designed using a small (n,r) protograph that is replicated Z times to produce a decoding graph for a (Z x n, Z x r) code. Using this architecture, we have implemented a decoder for a (4096,2048) LDPC code on a Xilinx Virtex-II 2000 FPGA, and achieved decoding speeds of 31 Mbps with 10 fixed iterations. The implemented message-passing algorithm uses an optimized 3-bit non-uniform quantizer that operates with 0.2dB implementation loss relative to a floating point decoder.
Author
Decoders; Counters; Field-Programmable Gate Arrays; Decoding; Floating Point Arithmetic

20070035039 Rice Univ., Houston, TX, USA; Cambridge Univ., UK; NASA Langley Research Center, Hampton, VA, USA
Symbolic LTL Compilation for Model Checking: Extended Abstract
Rozier, Kristin Y.; Vardi, Moshe Y.; October 17, 2007; 3 pp.; In English; Grace Hopper Celebration of Women in Computing 2007, 17-20 Oct. 2007, Orlando, FL, USA
Contract(s)/Grant(s): NSF CNS-04-21109; WBS 411931.02.51.07.01.03; Copyright; Avail.: CASI: A01, Hardcopy

In Linear Temporal Logic (LTL) model checking, we check LTL formulas representing desired behaviors against a formal model of the system designed to exhibit these behaviors. To accomplish this task, the LTL formulas must be translated into automata [21]. We focus on LTL compilation by investigating LTL satisfiability checking via a reduction to model checking. Having shown that symbolic LTL compilation algorithms are superior to explicit automata construction algorithms for this task [16], we concentrate here on seeking a better symbolic algorithm.We present experimental data comparing algorithmic variations such as normal forms, encoding methods, and variable ordering and examine their effects on performance metrics including processing time and scalability. Safety critical systems, such as air traffic control, life support systems, hazardous environment controls, and automotive control systems, pervade our daily lives, yet testing and simulation alone cannot adequately verify their reliability [3]. Model checking is a promising approach to formal verification for safety critical systems which involves creating a formal mathematical model of the system and translating desired safety properties into a formal specification for this model. The complement of the specification is then checked against the system model. When the model

does not satisfy the specification, model-checking tools accompany this negative answer with a counterexample, which points to an inconsistency between the system and the desired behaviors and aids debugging efforts.
Author
Temporal Logic; Automata Theory; Mathematical Models; Program Verification (Computers); Control Systems Design; Life Support Systems

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*.

20070034159 NASA Dryden Flight Research Center, Edwards, CA, USA
Design of a Mission Data Storage and Retrieval System for NASA Dryden Flight Research Center
Lux, Jessica; Bowning, Bob; Sheldon, Jack; October 22, 2007; 10 pp.; In English; International Telemetry Conference (ITC) 2007, 22-25 October 2006, Las Vegas, NV, USA; Original contains black and white illustrations; Copyright; Avail.:
CASI: A02, Hardcopy

The Western Aeronautical Test Range (WATR) at the NASA Dryden Flight Research Center (DFRC) employs the WATR Integrated Next Generation System (WINGS) for the processing and display of aeronautical flight data. This report discusses the post-mission segment of the WINGS architecture. A team designed and implemented a system for the near- and long-term storage and distribution of mission data for flight projects at DFRC, providing the user with intelligent access to data. Discussed are the legacy system, an industry survey, system operational concept, high-level system features, and initial design efforts.
Author
Aeronautics; Test Ranges; Data Storage; Flight Tests; Systems Integration

20070034468 Army Research Lab., Aberdeen Proving Ground, MD USA
Modeling of Toroidal Ordering in Ferroelectric Nanodots
Crone, Joshua C; Chung, Peter W; Jun 2007; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7UH7CL
Report No.(s): AD-A469830; ARL-TR-4165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report details progress and the completed study of ferroelectric properties in nanodots for potential application to toroidal ordering concepts in nonvolatile memory materials. The work was performed under support through the Student Temporary Employment Program at the U.S. Army Research Laboratory. Beginning with an introduction of basic concepts, the report reviews the current state-of-the-art of ferroelectric nanodot technology through a literature review and identifies areas of need for continued study. As part of the review, Ewald's summation for Coulomb interactions in periodic crystals, a critical contribution to the atomistic energy that enables the long-range ordering in ferroelectric solids, was derived and is presented in the appendix.
DTIC
Computer Storage Devices; Ferroelectric Materials; Ferroelectricity; Nanostructures (Devices)

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20070034185 Naval Research Advisory Committee, Arlington, VA USA
Software Intensive Systems
Horvitz, E; Katz, D J; Rumpf, R L; Shrobe, H; Smith, T B; Webber, G E; Williamson, W E; Winston, P H; Wolbarsht, James L; Jul 2006; 84 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469237; NRAC-06-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469237

Consistent production of quality, affordable software. Other countries have surpassed the US in computer manufacturing

and much software production is now outsourced abroad. Recommend that DoN create a software acquisition specialty, mandate basic schooling for software acquisition specialists, close certain acquisition loopholes that permit poor development practices, and promote the careful use of existing technology and the development of gap-filling technology. Additionally, recommend that DoN invest in software engineering, particularly as it complements commercial industry developments and promotes the application of systems engineering methodology. Central recommendation is a three-step mobilize-transform-consolidate process, starting with project-directed RESET teams (Rapid Evolution of Software Engineering Technology) inserted on-site at contractor locations, continuing with a development of Naval Software System Center, and evolving into a larger Naval software organization.
DTIC
Acquisition; Computer Programming; Software Engineering; Technology Assessment

20070034260 Florida Univ., Gainesville, FL USA
Metastable Molecules in the Ground and in Excited States, Theory Development, Implementation and Application
Bartlett, Rodney J; Dec 31, 2006; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0119
Report No.(s): AD-A469721; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469721

Our work for the AFOSR has three primary components: Development of new quantum theory for the accurate description of molecular structure and spectra. Implementation of this new theory into general purpose computer programs (ACES II and pralel ACES III) to make it possible for many investigators, besides ourselves, to readily apply these new methods to problems of their interest. Application of these new methods to challenging molecules chosen to test the new methods, and to other systems of interest to AFOSR. These include high energy, density molecules, where the new methods allow an assessment of their energy content, stability, possible synthetic paths, activation barriers, and provide spectroscopic fingerprints for identification. We also make applications of interesting clusters, atmospheric systems, potential interstellar molecules, and to gas phase molecular reactions of the sort that can occur in flames.
DTIC
Computer Programs; Excitation; Ground State; Metastable State; Molecular Structure; Molecules; Quantum Theory

20070034263 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA
The Application of a Model of Adaptive Performance to Army Leader Behaviors
Tucker, Jennifer S; Gunther, Katie M; Pleban, Robert J; Goodwin, Gregory A; Vaughan, Adam W; May 2007; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-A790
Report No.(s): AD-A469726; ARI-RR-1870; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469726

The present research sought to better define the junior Army leader behaviors reflecting adaptive performance and offer recommendations for enhancing these adaptive capabilities. Pulakos and colleagues' (2000) eight-dimension model of adaptive performance was applied to leader behaviors performed in operational and training contexts. The present research also included White and colleagues' (2005) Leads an Adaptable Team dimension. Interview data from two different archival datasets were examined. Results showed that the majority of the incidents generated by leaders in operational contexts reflected two dimensions of the model: Deals with Uncertain and Unpredictable Work Situations and Handles Emergencies or Crisis Situations. Many of the remaining incidents tapped three other dimensions: Solves Problems Creatively, Learns Work Tasks, Technologies, and Procedures, and Handles Work Stress. For the trainers, the majority of the incidents tapped three dimensions of the model: Solves Problems Creatively, Leads an Adaptable Team, and Deals with Uncertain and Unpredictable Work Situations. For both research projects, the model sufficiently addressed the adaptive capabilities described in the critical incidents when it was modified to include specific military leadership behaviors. However, not all of the dimensions were represented in each sample. Differences in the adaptive capabilities between the two research projects are most likely due to the limitations of the training research project.
DTIC
Leadership; Performance Prediction

20070034272 Physics and Electronics Lab. TNO, The Hague, Netherlands

How to Make an Effective Information Exchange Data Model or The Good and Bad Aspects of the NATO JC3IEDM

Lasschuyt, Eddie; van Hekken, Marcel; Treurniet, Willem; Visser, Marc; Sep 2, 2004; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469736; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469736

No abstract available

Command and Control; Interoperability; North Atlantic Treaty Organization (NATO)

20070034466 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Parallel Fast Multipole Method For Molecular Dynamics

Ormseth, Reid G; Jun 2007; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469828; AFIT/GAP/ENP/07-J02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on a parallel version of the Fast Multipole Method (FMM) implemented in the classical molecular dynamics code, NAMD (Not Another Molecular Dynamics program). This novel implementation of FMM aims to minimize interprocessor communication through the modification of the FMM grid to match the hybrid force and spatial decomposition scheme already present in NAMD. This new implementation has the benefit of replacing all-to-all communications broadcasts with direct communications between nearest neighbors. This results in a significant reduction in the amount of communication compared to earlier attempts to integrate FMM into common molecular dynamics programs. The early performance of FMM is similar to the existing electrostatics methods already in NAMD. In addition, tests of the stability and accuracy of the FMM algorithm in molecular dynamics as applied to several common solvated protein structures are discussed.

DTIC

Molecular Dynamics; Multipoles

20070034501 Naval Postgraduate School, Monterey, CA USA

A Case Study on the Need for and Availability of Patient Tracking Systems

Berg, William R; Jun 2007; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis analyzes the feasibility, efficiency and usability of patient tracking systems in support of military and Humanitarian Assistance/Disaster Relief (HA/DR) operations by reviewing the implications for implementing a medical technology into the field. The initial focus of this research is on determining the need for such a system. Research was conducted that discusses the strengths and weaknesses of each of the currently available systems. This will be followed by combining the strengths of each system into a single, ?best of breed? system. This thesis will also investigate the suitability of currently available COTS hardware and software components for medical operations.

DTIC

Commercial Off-the-Shelf Products; Computer Programs; Patients

20070034507 Naval Postgraduate School, Monterey, CA USA

AEGIS Platforms: Using KVA Analysis to Assess Open Architecture in Sustaining Engineering

Adler, Jameson R; Ahart, Jennifer L; Jun 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to estimate the potential performance improvement in sustaining engineering (SE) when an Open Architecture (OA) approach to system development is used. Its basis is that in Integrated Warfare Systems (IWS) acquisition, eighty percent of total life-cycle costs occur during the Operation and Support phase. This statistic demonstrates the necessity of measuring how the OA approach will affect software upgrade and maintenance process for the AEGIS IWS Life Cycle. Using the OA approach, advances in distance support and monitoring, and maintenance free operating periods are possible, and this is significant in supporting the need to reduce costs and manpower while improving performance. To estimate the potential (Return on Investment) ROI that an OA approach might enable for SE in the form of software maintenance and upgrade, this thesis will apply the Knowledge Value Added (KVA) methodology to establish the baseline, 'As Is,' configuration of the current solutions in AEGIS. The KVA analysis will yield the ROI's and the current models for the approach to software maintenance and upgrade. Based on the assumptions of OA design for original system development, new approaches to distance and maintenance and monitoring will be explored in 'To Be' solutions, and the ROIs will be estimated. The 'To Be' solutions are rooted in the assumptions of MFOP and ARCI, and the results indicate that these solutions

yield a potential improvement of 720% and a cost saving of $365,104.63 over the current methodology for just one ship. For all ships using AEGIS, ROI improves by 71,967% with a cost savings of $26,543,824.56. The conclusion is that OA enables extension of these best practice approaches to AEGIS maintenance and upgrade solutions.
DTIC
Architecture (Computers); Computer Programming; Maintenance; Software Engineering

20070034544 Naval Postgraduate School, Monterey, CA USA
A Venture Capital Mixed Model for the Acquisition of Defense Software Products
Botsakos, Michael T; Jun 2007; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major problem in the Department of Defense's acquisition of software systems is the growing number of cost and schedule overruns that result in failed software acquisitions. Cost and schedule overruns are the consequence of the software development models selected, inaccurate estimation of size, time, and cost, the instability of user requirements, and poor decision-making by acquisition managers. Commercial practices of requirements definition, vendor selection, development process, business practices, integration, development, and testing, maintenance, and rights in data were compared with equivalent Department of Defense practices. Commercial solutions are the implementation of open source standards and architectures, iterative software developments, increased collaboration among competing vendors, and the incorporation of software reuse. The Department of Defense's non-profit venture capital models utilize key practices, such as deal syndication and incremental funding, which are instrumental in managing risk and could be incorporated into how the DoD acquires software.
DTIC
Acquisition; Computer Programs; Defense Program

20070034559 Boeing Phantom Works, Saint Louis, MO USA
Software and Systems Test Track Architecture and Concept Definition
Paunicka, James; Stuart, Doug; Stokes, Patrick; Wilson, Don; Vandivort, Andrew; Bapty, Ted; Sztipanovits, Janos; Sastry, Shankar; Sprinkle, Jonathan; Rohrbough, Larry; May 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0213; Proj-SST
Report No.(s): AD-A469996; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Final Technical Report for the Software and Systems Test Track (SWTT) Architecture and Concept Definition Phase I effort provides documentation on the work accomplished by a Boeing-led team in developing a user Concept of Operations (CONOPS) and Architecture for the emerging SWTT. The objective of the SWTT is to provide an open collaborative research and development environment to demonstrate, evaluate and document the ability of novel tools, methods, techniques and run-time technologies to yield affordable and more predictable software intensive systems.
DTIC
Architecture (Computers); Computer Programs; Software Engineering; Test Stands

20070034729 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Future of Product Line Development at NASA
Lutz, Robyn R.; July 18, 2006; 6 pp.; In English; NASA SARP Software Assurance Program, 18-20 Jul. 2006, Morgantown, WV, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40240

This viewgraph presentation reviews NASA's software production in the light of a product line similar to a commercial product line. The authors propose to identify, investigate, evaluate and apply product-line engineering techniques to NASA's product lines in order to improve the timeliness, robustness and effectiveness of these future systems.
CASI
Product Development; Software Engineering; Computer Systems Design; Software Reliability

20070034776 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

EOS MLS Science Data Processing System: A Description of Architecture and Capabilities

Cuddy, David T.; Echeverri, Mark D.; Wagner, Paul A.; Hanzel, Audrey T.; Fuller, Ryan A.; IEEE Transactions on Geoscience and Remote Sensing; May 5, 2006; ISSN 0196-2892; Volume 44, No. 5, pp. 1192-1198; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS7-03001; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40300; http://dx.doi.org/10.1109/TGRS.2005.863712

This paper describes the architecture and capabilities of the Science Data Processing System (SDPS) for the EOS MLS. The SDPS consists of two major components--the Science Computing Facility and the Science Investigator-led Processing System. The Science Computing Facility provides the facilities for the EOS MLS Science Team to perform the functions of scientific algorithm development, processing software development, quality control of data products, and scientific analyses. The Science Investigator-led Processing System processes and reprocesses the science data for the entire mission and delivers the data products to the Science Computing Facility and to the Goddard Space Flight Center Earth Science Distributed Active Archive Center, which archives and distributes the standard science products.

Author

Data Processing Equipment; Software Engineering; Product Development; Quality Control; Data Reduction

20070034817 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Disk-Based System for Producing and Distributing Science Products from MODIS

Masuoka, Edward; Wolfe, Robert; Sinno, Scott; Ye Gang; Teague, Michael; 23 Jul. 2007; 1 pp.; In English; International Geoscience and Remote Sensing Symposium (IGARSS) '07, 23-27 Jul. 2007, Barcelona, Spain; Copyright; Avail.: Other Sources; Abstract Only

Since beginning operations in 1999, the MODIS Adaptive Processing System (MODAPS) has evolved to take advantage of trends in information technology, such as the falling cost of computing cycles and disk storage and the availability of high quality open-source software (Linux, Apache and Perl), to achieve substantial gains in processing and distribution capacity and throughput while driving down the cost of system operations.

Author

MODIS (Radiometry); Data Processing; Magnetic Disks; Earth Observing System (EOS)

20070034875 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Validating the Autonomous Science Agent

Chien, Steve; Cichy, Benjamin; Schaffer, Steve; Tran, Danny; Rabideau, Gregg; Sherwood, Rob; Bote, Robert; Mandl, Dan; Frye, Stu; Shulman, Seth; Van Gaasbeck, Jim; Boyer, Darrell; July 14, 2003; 9 pp.; In English; Safe Agents Workshop, International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), 14 Jul. 2003, Melbourne, Australia; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40406

This paper describes the validation process for the Autonomous Science Agent, a software agent that will fly onboard the EO-1 spacecraft from 2003-2004. This agent will recognize science events, retarget the spacecraft to respond to the science events, and reduce data downlink to only the highest value science data. The autonomous science agent has been designed using a layered architectural approach with specific redundant safeguards to reduce the risk of an agent malfunction to the EO-1 spacecraft. This 'safe' design is also in the process of being thoroughly validated by informal validation methods and extensive testing. This paper describes the analysis used to define agent safety, elements of the design that increase the safety of the agent, and the process being used to validate agent safety prior to the agent software controlling the spacecraft.

Author

Autonomy; Computer Systems Programs; Downlinking; Computer Programming; Proving

20070034902 Vistology, Inc., Framingham, MA USA

Representability of METT-TC Factors in JC3IEDM: briefing charts

Ulicny, Brian; Matheus, Christopher; Powell, Gerald; Dionne, Robert; Kokar, Mitch; Jun 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Commanders require relevant information about background information in order to exercise effective command and control (C2). METT-TC factors (Mission, Enemy, Terrain & Weather, Troops, Time Available and Civil Considerations)

represent the canonical, militarily significant background against which information is evaluated and military decisions are made. If this background is to be encoded, shared, and, ultimately, processed and reasoned about by computers or computer-assisted C2 systems, the METT-TC background must be represented in some standard format with a shared computer-processable semantics. The JC3IEDM (Joint Command, Control, and Consultation Information Exchange Data Model) represents several years of effort by NATO's Multinational Interoperability Programme at developing a representation of military situations in order to support communication and interoperability among NATO forces. All information to be shared by participants must, therefore, be representable within JC3IEDM. In this paper, we point out aspects of METT-TC that are not currently or not completely representable in JC3IEDM. These include aspects such as cover and concealment, fields of fire, and mission purpose. We end by suggesting ways in which JC3IEDM can be extended to represent these aspects of METT-TC factors.
DTIC
Charts; Command and Control; Standardization

20070034911 Vistology, Inc., Framingham, MA USA
Representability of METT-TC Factors in JC3IEDM
Ulicny, Brian; Matheus, Christopher; Powell, Gerald; Dionne, Robert; Kokar, Mitch; Jun 2007; 15 pp.; In English; International Command and Control Research & Technology Symposium (12th), 19-21 Jun. 2007, Newport, RI, USA
Report No.(s): AD-A469884; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Commanders require relevant information about background information in order to exercise effective command and control (C2). METT-TC factors (Mission, Enemy, Terrain & Weather, Troops, Time Available and Civil Considerations) represent the canonical, militarily significant background against which information is evaluated and military decisions are made. If this background is to be encoded, shared, and, ultimately, processed and reasoned about by computers or computer-assisted C2 systems, the METT-TC background must be represented in some standard format with a shared computer-processable semantics. The JC3IEDM (Joint Command, Control, and Consultation Information Exchange Data Model) represents several years of effort by NATO's Multinational Interoperability Programme at developing a representation of military situations in order to support communication and interoperability among NATO forces. All information to be shared by participants must, therefore, be representable within JC3IEDM. In this paper, we point out aspects of METT-TC that are not currently or not completely representable in JC3IEDM. These include aspects such as cover and concealment, fields of fire, and mission purpose. We end by suggesting ways in which JC3IEDM can be extended to represent these aspects of METT-TC factors.
DTIC
Command and Control; Standardization

20070034914 Military Academy, West Point, NY USA
The Armed Forces Casualty Assistance Readiness Enhancement System (AF-CARES), Version 1.0
Henderson, Dale L; Jun 8, 2007; 54 pp.; In English
Contract(s)/Grant(s): Proj-DSE-R-0619
Report No.(s): AD-A468110; ORCEN-DSE-TR-0619-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report provides details of the implementation of a forms assistance tool designed to help personnel charged with carrying out the USA Army's Casualty Assistance mission. The need for this tool has arisen with the expansion of casualty operations in the Global War on Terror (GWOT), the growing complexity of the system of benefits provided to the surviving family members of soldiers who are killed, and the high level of emphasis placed on executing this mission with compassion and precision. The software tool, called the Armed Forces Casualty Readiness Enhancement System (AF-CARES 1.0), provides form filling assistance and access to case data in a stand alone application. The system uses a run time data representation of the case and an extensible markup language specification for the library of supported forms to automate the routing tasks common to every case of filling out a significant number of forms. The software automatically fills forms and provides access to the forms for viewing, printing, and editing. The software also provides a persistent save file format and case file reader for managing cases over time. AF-CARES 1.0 has been deployed to all of the regional Casualty Assistance Centers (CACs) with 76 users participating in an Army Knowledge Online (AKO) knowledge center implemented to facilitate deployment, support, and the identification of capability gaps against an objective software assistance capability.
DTIC
Armed Forces; Augmentation; Casualties; Software Development Tools

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.

20070034177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Applications of ANSYS/Multiphysics at NASA/Goddard Space Flight Center
Loughlin, Jim; May 15, 2007; 27 pp.; In English; ANSYS U.S. Regional Conference, 14-16 May 2007, Philadelphia, PA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034177

This viewgraph presentation reviews some of the uses that the ANSYS/Multiphysics system is used for at the NASA Goddard Space Flight Center. Some of the uses of the ANSYS system is used for is MEMS Structural Analysis of Micro-mirror Array for the James Web Space Telescope (JWST), Micro-shutter Array for JWST, MEMS FP Tunable Filter, AstroE2 Micro-calorimeter. Various views of these projects are shown in this presentation.
CASI
Microelectromechanical Systems; Structural Analysis; Computer Programs; Design Analysis

20070034216 Army War Coll., Carlisle Barracks, PA USA
Information Operations Roadmap: One Right Turn and We're There
McKiernan, Brian J; Mar 26, 2007; 21 pp.; In English
Report No.(s): AD-A469629; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469629

During Secretary Rumsfeld's tenure, the Department of Defense embarked on one of the most far-reaching transformations in the history of the USA military. This transformation is largely driven by the rapid advances in information technology and the belief that information is more critical now to military success and will become even more critical in the foreseeable future. The Department of Defense addressed this assumption by formulating the Information Operations Roadmap with the objective of making information operations a core capability of future forces and a core military competency. The goal of information operations is to gain information superiority -- the operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting the enemy's ability to do the same. Achieving and sustaining a significant information advantage over the adversary remains problematic, particularly in asymmetric conflicts. This project assesses the Information Operations Roadmap by examining non-military applications of information technology in the Information Age, reviewing current doctrine and assessing information operations during recent USA military operations. This study provides recommended adjustments to the Information Operations Roadmap based on this analysis.
DTIC
Military Operations; Warfare

20070034458 Roke Manor Research Ltd., Hants, UK
Evolving Interoperable Network Architectures for NATO Coalition Forces
Sowerbutts, Barry; Sharman, Richard; West, Mark; Dec 1, 2005; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Communication Networks; North Atlantic Treaty Organization (NATO)

20070034469 Pennsylvania State Univ., University Park, PA USA
Mathematics of Failures in Complex Systems: Characterization and Mitigation of Service Failures in Complex Dynamic Systems
Ray, Asok; Jun 30, 2007; 142 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0646
Report No.(s): AD-A469833; PSU-FR-CSF07001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives: The goal of this MURI project is to enhance dependability of complex engineering systems that include both human-operated and unmanned machinery. It focuses on pervasive fault tolerance based on the emerging information. The specific objective are: 1. Early detection of small anomalies in nonlinear and nonstationary dynamical systems. 2. Analysis and

synthesis of robust decision and control systems to restrict the system behavior within desired specifications. 3. Development of high-fidelity test apparatuses and experimental validation of theoretical results. Results: Principles of Automata Theory and Statistical Signal Processing are applied to retrieve relevant information for failure prognosis and decision and control of complex dynamical systems. Experimental research has been conducted to validate the theoretical results at the following three laboratories: * Electromechanical Systems * Networked Robotic Systems * Engineering Systems Simulation.
DTIC
Anomalies; Complex Systems; Computer Networks; Failure; System Failures; Systems Analysis

20070034497 Army Research Lab., Aberdeen Proving Ground, MD USA
Network Basic Language Translation System: Security Infrastructure
Mittrick, Mark R; Jul 2007; 28 pp.; In English
Contract(s)/Grant(s): Proj-611102H48
Report No.(s): AD-A469904; ARL-MR-668; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense Horizontal-Fusion program was created in 2003 to usher in a new era in defense computation and communications. The Network Basic Language Translation System (NetBLTS) was proposed and accepted as part of the U.S. Army Research Laboratory's offering of initiatives within the Horizontal Fusion portfolio in 2003. This report provides an overview of NetBLTS components, including associated hardware and software, the architecture of the system, data storage, the secure facilities, security requirements, and availability of the system, with the focus on security issues and the difficulties created by them.
DTIC
Machine Translation; Security; Translating

20070034498 Naval Postgraduate School, Monterey, CA USA
Joint Networking Command and Control (C2) Communications Among Distributed Operations, JCAS, and Joint Fires
Bommer, Jr, John S; Jun 2007; 95 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469905; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis postulates that the implementation of Mobile Ad Hoc Networking (MANET), Mesh and IEEE 802.16 products can support a Distributed Operations (DO) platoon. Ground and Air assets will use MANET, Mesh and IEEE 802.16 products to network a tactically deployed DO platoon through communications of ground and air based components. These ground and air components will link in an IP-based network and demonstrate the real-time exchange of data. This analysis will focus on the integration of traditional airborne assets with those of a DO platoon. By connecting those Sense, Decide, and Act (SDA) facets into a networked based architecture, the thesis experiments demonstrate that emerging commercial off the shelf (COTS) technologies can further advance data exchange between Service Oriented Architectures (SOA) and enhance the ability to provide Joint Close Air Support (JCAS) to DO platoons in an environment where Air Force, Navy, and Army components are available for fire support. This thesis focuses on the integration of ground and air nodes into a networked based architecture using emerging COTS MANET, Mesh, and IEEE 802.16 technologies to further advance data exchange between simulated ground and air units.
DTIC
Command and Control; Communication Networks; Fires

20070034697 Washington Univ., WA, USA
Archiving Mars Mission Data Sets with the Planetary Data System
Guinness, Edward A.; April 19, 2006; 10 pp.; In English; Mars Exploration Program Analysis Group, 19 Apr. 2006, Morovia, CA, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40243

This viewgraph presentation reviews the use of the Planetary Data System (PDS) to archive the datasets that are received from the Mars Missions. It reviews the lessons learned in the actual archiving process, and presents an overview of the actual archiving process. It also reviews the lessons learned from the perspectives of the projects, the data producers and the data users.
CASI
Data Systems; Mars Missions; Data Management; Mars Probes

20070034866 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Distributed Data Architecture for 2001 Mars Odyssey Data Distribution

Crichton, Daniel J.; Hughes, J. Steven; Kelly, Sean; July 13, 2003; 6 pp.; In English; International Conference on Space Mission Challenges for Information Technology, 13-16 Jul. 2003, Pasadena, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40441

Newer instruments and communications techniques have given scientists unprecedented amounts of data, more than can be feasibly distributed through traditional methods such as mailed CD-ROM's. Leveraging the web makes sense since it enables scientists to request specific data and retrieve products as soon as they're available. Yet defining the middleware system to support such an application has remained just out of reach, until Odyssey. For the first time ever, data from all Odyssey mission instruments were made available through a single system immediately upon delivery to the Planetary Data System (PDS). The Object Oriented Data Technology (OODT) software made such an application possible.

Author

Architecture (Computers); Data Systems; Distributed Parameter Systems; 2001 Mars Odyssey; Applications Programs (Computers); Computer Programs

20070034944 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Web 2.0 and OGC Standards Enabled Sensor Web Architecture for Global Earth Observing System of Systems

Mandl, Daniel; Unger, Stephen; Ames, Troy; Frye, Stuart; Chien, Steve; Cappelaere, Pat; Tran, Danny; Derezinski, Linda; Paules, Granville; June 19, 2007; 5 pp.; In English; NASA Science and Technology Conference 2007, 19-21 June 2007, College Park, MD, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

This paper will describe the progress of a 3 year research award from the NASA Earth Science Technology Office (ESTO) that began October 1, 2006, in response to a NASA Announcement of Research Opportunity on the topic of sensor webs. The key goal of this research is to prototype an interoperable sensor architecture that will enable interoperability between a heterogeneous set of space-based, Unmanned Aerial System (UAS)-based and ground based sensors. Among the key capabilities being pursued is the ability to automatically discover and task the sensors via the Internet and to automatically discover and assemble the necessary science processing algorithms into workflows in order to transform the sensor data into valuable science products. Our first set of sensor web demonstrations will prototype science products useful in managing wildfires and will use such assets as the Earth Observing 1 spacecraft, managed out of NASA/GSFC, a UASbased instrument, managed out of Ames and some automated ground weather stations, managed by the Forest Service. Also, we are collaborating with some of the other ESTO awardees to expand this demonstration and create synergy between our research efforts. Finally, we are making use of Open Geospatial Consortium (OGC) Sensor Web Enablement (SWE) suite of standards and some Web 2.0 capabilities to Beverage emerging technologies and standards. This research will demonstrate and validate a path for rapid, low cost sensor integration, which is not tied to a particular system, and thus be able to absorb new assets in an easily evolvable, coordinated manner. This in turn will help to facilitate the USA contribution to the Global Earth Observation System of Systems (GEOSS), as agreed by the U.S. and 60 other countries at the third Earth Observation Summit held in February of 2005.

Author

World Wide Web; Earth Sciences; Earth Observing System (EOS); Sensors; Architecture (Computers)

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.*

20070034212 Army War Coll., Carlisle Barracks, PA USA

Strategic Communication: A Department of Defense Approach

Stovicek, Bart E; Mar 28, 2007; 22 pp.; In English

Report No.(s): AD-A469611; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469611

US Government (USG) Strategic Communication (SC) is neither a process to be implemented, nor a capability to be employed, rather, it is an effect achieved through the exercise of all elements of national power. Integrating military operations with other USG activities to achieve SC goals is the responsibility of the Department of Defense (DoD). DoD has developed

a SC Roadmap in order to institutionalize a Strategic Communication process within DoD. This focus on SC as a distinct executable process, rather than an outcome, is an impediment to progress toward achieving SC goals. The SC Roadmap fails to implement the Quadrennial Defense Review's vision for SC, and neglects proper strategic controls to ensure unity of effort is maintained in DOD support to SC. These failures degrade the competitive position of the U.S. in the international information environment. This essay will show why an effective USG SC strategy is necessary, and will seek to define DOD support to SC. Further, this essay will show that effective DOD support to SC can only be achieved by developing an SC culture within DOD, and that existing capabilities must be strengthened in order to ensure strategic competitiveness and effective USG SC during the next century.
DTIC
Decision Making; Defense Program; Information Systems

20070034503 Massachusetts Inst. of Tech., Cambridge, MA USA
Large-Scale Dynamic Observation Planning for Unmanned Surface Vessels
Miller, John V; Jun 2007; 135 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469916; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With recent advances in research and technology, autonomous surface vessel capabilities have steadily increased. These autonomous surface vessel technologies enable missions and tasks to be performed without the direction of human operators, and have changed the way scientists and engineers approach problems. Because these robotic devices can work without manned guidance, they can execute missions that are too difficult, dangerous, expensive, or tedious for human operators to attempt. The USA government is currently expanding the use of autonomous surface vessel technologies through the USA Navy's Spartan Scout unmanned surface vessel (USV) and NASA,s Ocean-Atmosphere Sensor Integration System (OASIS) USV. These USVs are well-suited to complete monotonous, dangerous, and time-consuming missions. The USVs provide better performance, lower cost, and reduced risk to human life than manned systems. In this thesis, we explore how to plan multiple USV observation schedules for two significant notional observation scenarios, collecting water temperatures ahead of the path of a hurricane, and collecting fluorometer readings to observe and track a harmful algal bloom. A control system must be in place that coordinates a fleet of USVs to targets in an efficient manner. We develop three algorithms to solve the unmanned surface vehicle observation-planning problem. A greedy construction heuristic runs fastest, but produces suboptimal plans; a 3-phase algorithm which combines a greedy construction heuristic with an improvement phase and an insertion phase, requires more execution time, but generates significantly better plans; an optimal mixed integer programming algorithm produces optimal plans, but can only solve small problem instances.
DTIC
Autonomous Navigation; Data Acquisition; Dynamic Tests; Observation; Oceanographic Parameters; Robotics

20070034739 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Status of the NASA Robotic Mission Conjunction Assessment Effort
Newman, Lauri Kraft; April 26, 2007; 36 pp.; In English; Space Surveillance Work Group Meeting, 24-26 Apr. 2007, Colorado Springs, CO, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034739

This viewgraph presentation discusses NASA's processes and tools used to mitigate threats to NASA's robotic assets. The topics include: 1) Background; 2) Goddard Stakeholders and Mission Support; 3) ESC and TDRS Mission Descriptions; 4) TDRS Conjunction Assessment Process; 5) ESMO Conjunction Assessment Process; 6) Recent Operations Experiences; 7) Statistics Collected for ESC Regime; and 8) Current and Future Analysis Items.
CASI
Robotics; NASA Space Programs; Space Missions; Technology Assessment; Project Management

20070034842 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Algorithms and Sensors for Small Robot Path Following
Hogg, Robert W.; Rankin, Arturo L.; Roumeliotis, Stergios I.; McHenry, Michael C.; Helmick, Daniel M.; Bergh, Charles F.; Matthies, Larry; May 11, 2002; 8 pp.; In English; IEEE International Conference on Robotics and Automation, 11-15 May 2002, Washington, DC, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS7-1407; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40396

Tracked mobile robots in the 20 kg size class are under development for applications in urban reconnaissance. For efficient

deployment, it is desirable for teams of robots to be able to automatically execute path following behaviors, with one or more followers tracking the path taken by a leader. The key challenges to enabling such a capability are (l) to develop sensor packages for such small robots that can accurately determine the path of the leader and (2) to develop path following algorithms for the subsequent robots. To date, we have integrated gyros, accelerometers, compass/inclinometers, odometry, and differential GPS into an effective sensing package. This paper describes the sensor package, sensor processing algorithm, and path tracking algorithm we have developed for the leader/follower problem in small robots and shows the result of performance characterization of the system. We also document pragmatic lessons learned about design, construction, and electromagnetic interference issues particular to the performance of state sensors on small robots.
Author
Robots; Reconnaissance; Global Positioning System; Deployment; Robot Sensors; Algorithms

20070034865 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Sustainable Cooperative Robotic Technologies for Human and Robotic Outpost Infrastructure Construction and Maintenance
Stroupe, Ashley W.; Okon, Avi; Robinson, Matthew; Huntsberger, Terry; Aghazarian, Hrand; Baumgartner, Eric; November 9, 2004; 10 pp.; In English; Robosphere, 9-10 Nov. 2004, Moffett Field, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40439

Robotic Construction Crew (RCC) is a heterogeneous multi-robot system for autonomous acquisition, transport, and precision mating of components in construction tasks. RCC minimizes resources constrained in a space environment such as computation, power, communication and, sensing. A behavior-based architecture provides adaptability and robustness despite low computational requirements. RCC successfully performs several construction related tasks in an emulated outdoor environment despite high levels of uncertainty in motions and sensing. Quantitative results are provided for formation keeping in component transport, precision instrument placement, and construction tasks.
Author
Robotics; Construction; Aerospace Environments; Autonomy; Maintenance; Precision; Robots

20070034960 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Precision Manipulation with Cooperative Robots
Stroupe, Ashley; Huntsberger, Terry; Okon, Avi; Aghzarian, Hrand; March 14, 2005; 12 pp.; In English; 3rd International Maulit-Robot Systems Workshop, 14-16 Mar. 2005, Washington, DC, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40492

This work addresses several challenges of cooperative transportThis work addresses several challenges of cooperative transport and precision manipulation. Precision manipulation requires a rigid grasp, which places a hard constraint on the relative rover formation that must be accommodated, even though the rovers cannot directly observe their relative poses. Additionally, rovers must jointly select appropriate actions based on all available sensor information. Lastly, rovers cannot act on independent sensor information, but must fuse information to move jointly; the methods for fusing information must be determined.
Author
Robots; Safety; Space Exploration; Roving Vehicles; Precision; Robotics; Deployment

20070034965 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Landmark Based Position Estimation for Pinpoint Landing on Mars
Cheng, Yang; Ansar, Adnan; April 18, 2005; 6 pp.; In English; International Conference on Robotics and Automation, 18-22 Apr. 2005, Barcelona, Spain; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40480

Real-time position estimation for a descent lander is a critical technological need for many of NASA's planned in situ missions including landing on a number of bodies at locations of greatest scientific interest and sample return. In particular, it enables the capability to land precisely and safely in a scientifically promising but hazardous site and is a key technology to be demonstrated by NASA in the next decade. The key challenge of pinpoint landing (PPL) is how to localize the lander by recognizing the landmarks (craters) in the landing area and match them positively to a preexisting landmark database while the spacecraft is descending. In this paper, a real-time landmark based position estimation technique for pinpoint landing is

suggested. This system includes three crucial components: (1) real time landmark detection, (2) real-time landmark matching and (3) state (both position and velocity) estimation. We discuss the performance analysis of this system. Finally, we show that the suggested technology is able to deliver a spacecraft to less than 100 m from a pre-selected landing site on Mars.
Author
Sample Return Missions; Mars Landing; Descent; Landing Sites; Real Time Operation; Position (Location)

20070035011 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Mars Exploration Rover Instrument Positioning System
Baumgartner, Eric T.; Bonitz, Robert G.; Shiraishi, Lori R.; Melko, Joseph P.; Leger, P. Chris; March 5, 2005; 13 pp.; In English; International IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40500

During Mars Exploration Rover (MER) surface operations, the scientific data gathered by the in situ instrument suite has been invaluable with respect to the discovery of a significant water history at Meridiani Planum and the hint of water processes at work in Gusev Crater. Specifically, the ability to perform precision manipulation from a mobile platform (i.e., mobile manipulation) has been a critical part of the successful operation of Spirit and Opportunity rovers. As such, this paper describes the MER Instrument Positioning System that allows the in situ instruments to operate and collect their important science data using a robust, dexterous robotic arm combined with visual target selection and autonomous software functions.
Author
Mars Exploration; Roving Vehicles; Robot Arms; Positioning; Mars Surface; Computer Systems Programs

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20070034245 Air Force Research Lab., Edwards AFB, CA USA
Numerical Prediction of UV Radiation from Two-Phase Plumes at High Altitudes (Postprint)
Gimelshein, Natalie E; Lyons, Robert B; Reuster, James G; Gimelshein, Sergey F; Jan 2007; 15 pp.; In English
Contract(s)/Grant(s): Proj-5026
Report No.(s): AD-A469699; AFRL-PR-ED-TP-2006-455; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469699

Multi-step continuum-kinetic approach is used to model a steady state plume flow from a Star 27 motor at an altitude of 118 km. Two-way coupled Navier-Stokes equations and the DSMC method are used to predict the interaction between plume and atmospheric gases and micron-sized alumina particles from the thruster. A Monte Carlo radiation code that accounts for photon scattering on particles is used to calculate UV radiation based on the obtained flowfield solutions. Comparison of computed spectral and integral radiant intensity with available flight data is performed. Photon scattering by submicron particles in the 200 nm to 400 nm range is a significant process.
DTIC
High Altitude; Mathematical Models; Plumes; Ultraviolet Radiation

20070034276 Massachusetts Univ., Amherst, MA USA
Large Eddy Simulation Using a Transport Equation for the Subgrid-Scale Stress Tensor
Perot, Blair; Mar 22, 2007; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0023
Report No.(s): AD-A469740; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469740

The objective of this research was to demonstrate that classical transport equation (RANS) models can be applied at any mesh resolution. In particular, we show that transport equation models like the classical kappa/epsilon model also make excellent subgrid scale models for Large Eddy Simulation (LES). However, this research is not concerned with the development of a particular RANS/LES model but a general approach to turbulence modeling for any mesh resolution. To confirm the generality of the approach, a Reynolds stress transport (RST) equation model is also shown to work well as an automatically adaptive LES subgrid scale model. Unlike other hybrid modeling approaches that can address a range of mesh

scales, the demonstrated approach is self-adaptive. It will always calculate using first principals as much of the turbulence as the mesh allows, and will model the rest. The character of the model is self-adjusting and is not a function of some external input such as the geometry. The approach is easy to implement using existing CFD codes.
DTIC
Large Eddy Simulation; Simulation; Stress Tensors; Tensors

20070034322 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA
Theoretical Studies and Experimental Validation for Generating Concentration Distributions Across the Propellant Grain Upon Shear-Induced Particle Migration During Extrusion
Fair, David; Chiu, Donald; Moy, Sam; Kalyon, Dilhan M; Allende, M; Jun 2007; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W15QKN-05-D-0011
Report No.(s): AD-A469808; ARAET-TR-07010; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469808

The theory of the shear-induced particle migration is presented with numerical simulation results from multiple geometries using Poiseuille flow in a rectangular die. It appears that the functionally-grading of propellant strands can be generated upon shear-induced particle migration in propellant extrusion. The theory and the results obtained in this study with an inert simulant formulation demonstrate the utilities of the suggested methodologies and their practicality.
DTIC
Extruding; Migration; Propellant Grains; Propellants; Shear Properties

20070034460 Science Applications International Corp., Arlington, VA USA
Empirical Corrections to Dipole Model
Miller, Jonathan; Oct 2006; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W912HQ-05-P-0034
Report No.(s): AD-A469818; VA-502-06-TR; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We successfully demonstrated an empirical approach for correcting errors in the standard Dipole Model of EMI response. The Dipole Model is accurate for small targets at relatively deep burial depths but it breaks down for larger targets at shallower depths because of the interaction between the target body and the spatially non-uniform primary field. Our approach was to calculate this interaction numerically for a large set of specific target-sensor geometries using the exe code developed in 2004 by Fridon Shubitidze and Irma Shamatava for a SERDP project, and then find empirical correction factors which adjust Dipole Model predictions to match the calculated results. The correction factors were assembled into a large look-up table, from which arbitrary target-sensor geometries can be queried through multi-linear interpolation. This approach is sensor-specific and target specific, but the results will indicate the seriousness of the corrections required, and it was originally thought that the results are likely to carry over to other geometries and scales.
DTIC
Correction; Electromagnetic Interference; Errors

20070034465 Naval Research Lab., Washington, DC USA
A Generalized FFT for Many Simultaneous Receive Beams
Coleman, Jeffrey O; Jun 29, 2007; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469827; NRL/MR/5320--07-9029; XB-NRL/FR/5320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is well known that when the identical elements of a planar receive array are laid out in horizontal rows and vertical columns, a fast Fourier transform or FFT can be used to efficiently realize simultaneous beams laid out in rows and columns in the direction cosines associated with the azimuth and elevation directions. Here a more general formulation and an associated design discipline is developed. Identical elements are laid out on an arbitrary planar lattice -- it could be square, rectangular, diamond, or triangular and might display tremendous symmetry or vary little -- and the beams in direction-cosine space are laid out on an arbitrary superlattice of the dual of the element-layout lattice. The generality of these two arbitrary lattice can yield significant cost reductions for large, many-beam arrays and arises from, first, formulating the desired beam outputs using a discrete Fourier transform or DFT generalized to use an integer-matrix size parameter, and second, efficiently realizing the required real-time computations with the generalized FFT based on a matrix factorization of that size parameter that is developed here. This generalized FFT includes as special cases the usual 1D and 2D FFTs in radix-2 and mixed-radix

forms but offers many more possibilities as well. The approach cannot outperform but does match, when the matrix size parameter factors well, the N log N computational efficiency of the usual FFT. Examples illustrate a design discipline for the two lattices that involves jointly determining element spacing, steering range and beam-layout geometry, grating-lobe behavior, and FFT factorability and therefore computational efficiency.
DTIC
Beam Steering; Fast Fourier Transformations

20070034557 Colorado School of Mines, Golden, CO USA
Image Enhancement in a Quantum Environment
Coffey, Mark; May 2007; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-1-0298; Proj-NBGQ
Report No.(s): AD-A469994; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This program investigated the ability to perform image enhancement, based upon diffusion processing, on a purely quantum or hybrid classical-quantum (type-II) computer. Given that image processing based upon solving partial differential equations has become more prevalent and developed in recent years and given that the fundamental equation of non-relativistic quantum mechanics, the Schrodinger equation, may be viewed as diffusion in imaginary time, quantum information may provide practical speedups for image processing tasks. This research investigated which diffusion and related Schrodinger equations may be simulated using quantum lattice gas algorithms (QLGAs), which are attractive because of their ability to simulate non-linear phenomena. Extension of QLGAs to perform selective image smoothing in support of image enhancement has been developed and demonstrated for multi-dimensional as well as anisotropic diffusion algorithms.
DTIC
Diffusion; Image Enhancement; Image Processing; Quantum Theory

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070034320 Air Force Research Lab., Edwards AFB, CA USA
Thrust Efficiency, Energy Efficiency, and the Role of VDF in Hall Thruster Performance Analysis (Postprint)
Larson, C W; Hargus, William A; Brown, Daniel L; May 29, 2007; 19 pp.; In English
Contract(s)/Grant(s): Proj-33SP0708
Report No.(s): AD-A469806; AFRL-PR-ED-TP-2007-316; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469806

A rocket power efficiency equation was written to explicitly account for the effect of the velocity distribution function (VDF) of the propellant jet on the conversion of anode electrical energy to jet kinetic energy. This enabled a mathematically rigorous distinction to be made between thrust efficiency and energy efficiency. In this approach anode thrust efficiency, the commonly reported figure of merit for Hall thrusters, is the product of three utilization efficiencies: (1) propellant utilization efficiency, (2) voltage utilization efficiency, and (3) current utilization efficiency, which are less than unity under all real operating conditions. Unit propellant utilization is characterized by 100 percent ionization to a single ionic species whose thrust vectors are all directed along the same thrust axis. Anode voltage utilization efficiency is unity when ion species are created at the anode and accelerated through the entire anode potential. Current utilization efficiency is the fraction of cathode electron flow utilized in neutralization of accelerated positive ions. It can never be unity because a portion of the electron flow must be recycled back to the anode to provide energy to ionize neutral propellant. The architecture of the efficiency analysis is such that energy efficiency becomes naturally expressed as a product of voltage and current utilization efficiencies, and is rigorously separated from propellant utilization efficiency. Thus, thrust efficiency is the product of propellant utilization efficiency and energy efficiency. The methodology is applied to analysis of data from systematic low and high power (0.2 to 50 kW) Hall thruster performance studies published in the open literature. The cited data includes measurement of thrust, propellant mass flow rate, anode voltage, and anode current coupled with various electrical and optical
DTIC
Distribution Functions; Electron Energy; Energy Conservation; Hall Thrusters; Reliability Analysis; Thrust

20070034323 Temple Univ., Philadelphia, PA USA
Two Methods for Estimating Soviet Military Production
Kushnirsky, Fyodor I; Jan 1992; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469809; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469809

This paper is concerned with Soviet military production, the largest component of military expenditure. The well-known approaches to the problem are based either on direct estimation of physical output and prices of military goods or on some type of aggregate residual estimation. Direct estimation has been used by U.S. intelligence sources; residual estimation is used by those who lack the technical means of gathering intelligence. The methods in this paper fall into the category of the residual approach. The approach could generally be pursued in the broader framework of the GNP accounts or in the narrower framework of the machine-building and metalworking (MBMW) complex. In both cases, the estimated activities of civilian production are subtracted from the overall output values, with the difference identified with military production. The paper offers two methods for estimating Soviet military production. The first, which the author calls a direct residual approach, is designed along the traditional lines of estimating civilian MBMW activities. But, unlike the previous attempts, it uses reliable information on outputs of Soviet civilian MBMW ministries. The second method, which he calls a verifiable residual approach, uses Soviet statistics generated during the mandatory certification of goods quality. These statistics allow the computation of the output of military goods combined with certain civilian goods that are identified below. The estimation of military production is then reduced to estimating the size of those 'impurities' in the combined output. The method is in principle verifiable since the required information is open and exists in Soviet statistics, even though it may not be easily accessible.
DTIC
Defense Industry; Estimates; Estimating; Procurement; U.S.S.R.

20070035008 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Probabilistic Risk Assessment for Concurrent, Conceptual Design of Space Missions
Meshkat, Leila; September 1, 2005; 10 pp.; In English; American Institute of Aeronautics and Astronautics (AIAA), 1 Sep. 2005, Long Beach, CA, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40503

NASA is expanding its capability to perform PRA. This capability gives insight into the links of a suggested design and drives the refinement of the design by identifying optimal areas for investments. Clearly, it is more viable and less expensive to refine a design at the time that it is being conceived. Hence the utility of conducting PRA at the conceptual design phase. Concurrent engineering teams greatly reduce the design time and costs. However, there is currently no standardized means for building probabilistic risk models to assess risks associated with a design produced by such teams. The capability to produce a consistent and valid risk metric associated with such designs would greatly enhance the value of such design teams. This paper explains the experimental results obtained to date from building probabilistic risk models for sample studies conducted at the concurrent engineering design team at the Jet Propulsion Laboratory (TeamX).
Author
Space Missions; Probability Theory; Standardization; Concurrent Engineering; Risk; Assessments

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070034223 Michigan State Univ., East Lansing, MI USA
Component-Based Analysis of Fault-Tolerant Real-Time Programs
Bonakdarpour, Borzoo; Kulkarni, Sandeep S; Arora, Anish; Jan 2007; 26 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0744; OSURS01-C-1901
Report No.(s): AD-A469650; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469650

Abstract We focus on decomposition of fault-tolerant real-time programs that are designed from their fault-intolerant versions. Towards this end, motivated by the concepts of state predicate detection and state predicate correction for untimed systems, we identify three types of components, namely, detectors, weak delta-correctors, and strong delta-correctors. We also consider different levels of fault-tolerance, namely, soft-failsafe, hard-failsafe, nonmasking, soft-masking, and hard-masking,

depending upon the satisfaction of safety, liveness, and timing constraints in the presence of faults. We show that depending upon the level of tolerance, fault-tolerant real-time programs contain one or more detectors and/or weak/strong-delta correctors.
DTIC
Computer Systems Design; Detectors; Fault Tolerance; Real Time Operation

20070034232 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optimization of Rated Officer Staff Assignments
Wylie, Alexander M; Jun 2007; 45 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469679; AFIT/IOA/ENS/07-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469679

The USA Air Force matches an average of 1,400 rated officers to staff assignments each fiscal year. The primary consideration in this matching is the Rated Staff Allocation Plan, which details Air Force rated officer entitlements across the Department of Defense. The Operations Staff Assignment Branch, located at Headquarters, Air Force Personnel Center, is responsible for the assignment process. There is currently no method in place to assess or maximize the utility of the assignments made. This research details the development of an assignment matching tool that uses network flow optimization. If the tool is implemented by the Operations Staff Assignment Branch in future assignment cycles, it will make the assignment process more efficient and provide a quantitative assessment of utility that is optimized.
DTIC
Armed Forces (United States); Military Personnel; Optimization; Personnel; Software Development Tools

20070034236 Naval Research Lab., Washington, DC USA
Achieving Cross-Domain Collaboration in Heterogeneous Environments
Macklin, Thomas; Jenket, Phyllis; Dec 1, 2005; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469686; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469686

No abstract available
Heterogeneity

20070034261 Princeton Univ., NJ USA
Enhancement of Combustion and Flame Stabilization Using Transient Non-Equilibrium Plasma
Ju, Yiguang; Ombrello, Timothy; Fridman, Alexander; Gutsol, Alexander; Gangoli, Shailesh; Mar 31, 2007; 138 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0038; Proj-2308
Report No.(s): AD-A469722; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469722

The effect of non-equilibrium plasma on both partially premixed and non-premixed flames was investigated through the development of a newly integrated magnetic gliding arc (MGA) system. The lifted jet diffusion flame experiments showed a significant enhancement of the flame stabilization with plasma discharge in the air co-flow. The counterflow experiments also demonstrated that the extinction limits were extended dramatically. Laser diagnostics of flame temperature and OH distribution using planar Rayleigh scattering and planar laser-induced fluorescence revealed that the plasma-flame interaction at low air temperature was dominated by thermal effects due to rapid radical quenching. Counterflow ignition experiments for CH4-air and H2-air non-premixed flames demonstrated clearly that the MGA significantly decreased the ignition temperatures via kinetic enhancement by the NOx, catalytic effect. Numerical modeling showed that there were two ignition regimes for plasma enhanced ignition, kinetic at low strain rates and thermal at high strain rates. Comparison between experiment and simulation were in good agreement and also suggested the possibility of enhancement by ions, excited species or other mechanisms. Theoretical analysis of minimum ignition energy in a quiescent mixture showed that the production of small hydrocarbon fuel fragments by plasma discharge also led to a significant decrease of ignition energy due to radiation and transport coupling.
DTIC
Augmentation; Combustion; Flames; Plasmas (Physics)

20070034262 Minnesota Univ., Minneapolis, MN USA
Direct Numerical Simulation of the Influence of Plasmas on Turbulent Flows
Mahesh, Krishnan; Dec 31, 2006; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0064
Report No.(s): AD-A469724; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469724

This work uses direct numerical simulation to study the thermal effect of a region of plasma on quiescent air. The simulations solve the compressible ideal gas Navier-Stokes equations using Fourier spectral methods. A shock capturing scheme is incorporated to account for the strong shock waves. Also, a logarithmic formulation for the continuity equation is developed to handle low densities at the core of the plasma.
DTIC
Direct Numerical Simulation; Mathematical Models; Navier-Stokes Equation; Plasmas (Physics); Shock Waves; Temperature Effects; Turbulent Flow

20070034300 Defence Research and Development Canada, Dartmouth, Nova Scotia Canada
Assessing the Land Command and Control Information Exchange Data Model using Naval Tactical Contact Data
Isenor, Anthony W; Dec 1, 2005; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469776; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469776

No abstract available
Command and Control; Prototypes; Sonar

20070034301 GMV S.A., Madrid, Spain
The Utility of Open Source Software in Military Systems
Esperon, Agustin I; Munoz, Jose P; Tanneau, Jean M; Dec 1, 2005; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469777; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469777

No abstract available
Commercial Off-the-Shelf Products; Computer Programs; Open Source Licensing (Computers); Software Development Tools; Software Engineering

20070034306 Army Research Lab., Adelphi, MD USA
Differential Global Positioning System (DGPS) Operation and Post-Processing Method for the Synchronous Impulse Reconstruction (SIRE) Radar
Koenig, Francois; Wong, David; Jun 2007; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469783; ARL-TN-0281; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469783

This report provides a description of the differential global positioning system (DGPS) operation, setup procedure, and post-processing procedure to obtain centimeter accuracy of GPS data for the synchronous impulse reconstruction radar. This highly accurate position information will allow proper focusing of the radar image and will maintain image quality on a moving platform.
DTIC
Accuracy; Global Positioning System; Impulses

20070034474 General Accounting Office, Washington, DC USA
Military Operations. Actions Needed to Improve DOD's Stability Operations Approach and Enhance Interagency Planning
St Laurent, Janet A; Repasky, Robert L; Burke, T; Faherty, Stephen; Ditto, Susan; Lake, Ron L; Lenane, Kate; Carver, Jonathan; Rambus, Maria-Alaina; Banks, Christopher; May 2007; 61 pp.; In English
Report No.(s): AD-A469866; GAO-07-836; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DOD components have developed guidance to facilitate the integration of UAS into combat operations; however, further steps are needed to fully coordinate the deployment of these assets. For example, DOD developed a Multi-Service Tactics, Techniques, and Procedures for the Tactical Employment of Unmanned Aircraft Systems and a Joint Concept of Operations

for Unmanned Aircraft Systems.5 This guidance represents an important first step for the use of UAS in combat operations and DOD officials acknowledge these documents will continue to evolve as DOD learns more about the capabilities of UAS and other ISR assets and their application in combat operations. However, the guidance does not address, on a DOD-wide basis, the issue of advance coordination, which CENTCOM has recognized is a critical factor in integrating UAS into combat operations by enabling efficient deployment and utilization of assets and by allowing the combatant commander time to plan to support incoming assets. In the absence of such guidance, CENTCOM has established procedures for the services to coordinate system requirements prior to ISR assets arriving into CENTCOM s theater of operations. These procedures apply only to CENTCOM s theater of operations. However, we found that CENTCOM s procedures for advance coordination were not always followed because the services indicated that they were not aware of the requirement. According to CENTCOM officials, they distributed these procedures to each of CENTCOM s service components, such as Central Command Air Forces and U.S. Naval Forces Central Command, but were not aware if they were distributed further, and the service officials we interviewed were not aware of the requirement. As a result of this lack of advance coordination, CENTCOM is not always aware, on a timely basis, of assets entering theater, which can potentially exacerbate existing operational challenges such as limited interoperability and communications bandwidth.
DTIC
Military Operations; Stability; Tactics; Telecommunication

20070034502 Massachusetts Inst. of Tech., Cambridge, MA USA
Trust-Based Design of Human-Guided Algorithms
Thomer, Joseph L; Jun 2007; 230 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469915; No Copyright; Avail.: Defense Technical Information Center (DTIC)

By combining the strengths of human and computers, Human Machine Collaborative Decision Making has been shown to generate higher quality solutions in less time than conventional computerized methods. Human-guided algorithms (HGAs) harness the power of sophisticated algorithms and computers to provide flexibility to the human decision maker to model correctly and dynamically the problem and steer the algorithm to solutions that match his/her objectives. HGAs are designed to make the power of Operations Research accessible to problem domain experts and decision makers, and incorporate their expert knowledge. In order to appropriately utilize algorithms during a planner's decision making, HGA operators must appropriately trust the HGA and the final solution. Through the use of trust-based design (TBD), it was hypothesized that users of the HGA will gain better insight into the solution process, improve their calibration of trust, and generate superior solutions. The application of TBD requires the consideration of algorithms, solution steering methods, and displays required to best match human and computer complimentary strengths and to generate solutions that can be appropriately trusted. Abstract hierarchy, Ecological Interface Design, and various trust models are used to ensure that the HGA operators' evaluation of trust can be correctly calibrated. A human-subject evaluation was used to test the effectiveness of the TBD design approach for HGAs. An HGA was designed and developed using the described TBD approach. The participants were presented with the task of using the HGA to develop a routing plan for military aircraft. The results showed that TBD had a significant effect on trust, HGA performance, and the quality of final solutions. Another finding was that, HGA operators must be provided with additional trust related information to improve their understanding in order to calibrate properly their trust in the system.
DTIC
Algorithms; Decision Making; Man Machine Systems; Operations Research

20070034514 Naval Postgraduate School, Monterey, CA USA
An Integer Linear Program to Combine Container Handling and Yard Crane Deployment
Akel, Kamil; Jun 2007; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469932; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The number of containers handled by container terminals has increased significantly over the last fifty years and has stimulated researchers to improve storage yard operations. Container handling and crane deployment are two major yard operations that can impact the performance of a whole container terminal. This thesis establishes an Integer Linear Program (ILP) to combine container handling and yard crane deployment for Rubber Tired Gantry Cranes (RTG). Using real world data, we test the ILP for two different yard sizes. We find the resulting ILPs difficult to solve directly. In order to decrease the computation time, we apply a cascade method that solves the problem as a sequence of restricted subproblems. Each subproblem is restricted to a sequence of containers and the output of each subproblem provides an input to the next subproblem. This method provides better solutions than the solution that we get by solving the problem directly. The cascade

method also decreases the computation time significantly. The results demonstrate the ability to combine container handling and yard crane deployment in a single model and they verify that the cascade method works well with the ILP.
DTIC
Cargo; Cranes; Deployment; Integers; Linear Programming; Materials Handling; Optimization

20070034516 Naval Postgraduate School, Monterey, CA USA
Modeling Insurgency Attrition and Population Influence in Irregular Warfare
Howell, Jeffrey M; Jun 2007; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469937; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The author develops a model that is a combination of Lanchester and Deitchman attrition models and population epidemic models. His fundamental premise is that a combination of these two types of models can yield important insights into the key relationships between an insurgency and the contested population. The two models are a base model with constant parameters, and more a advanced model with opportunistic and idealistic recruitment, various levels of government effort against the insurgency. and different ways of modeling population support. He finds, much like the real world, that initial conditions and policy decisions have a strong impact on the outcome of the conflict. Opposing factions that tailor their tactics to the situation (a government focusing on securing the population in a security-minded public) have a much greater chance of success. He also demonstrates the importance of good intelligence. Based on different attrition, recruitment, and transition rules, he studies the relationships between dynamic population flow and insurgency success or failure. The goal of the work is to provide an analytical framework for these situations, and to analyze the effect of different initial conditions and interactions on the success or failure of an insurgency. The models developed herein are descriptive, not predictive, and are designed to give decision makers an insight into a complex insurgency process.
DTIC
Populations; Warfare

20070034521 Tennessee Univ. Space Inst., Tullahoma, TN USA
Advancements in Theoretical Models of Confined Vortex Flowfields
Batterson, Joshua W; Maicke, Brian A; Majdalani, Joseph; Mar 29, 2007; 67 pp.; In English
Contract(s)/Grant(s): FA8650-05-C-2612; Proj-5033
Report No.(s): AD-A469945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this article, we review some of the theoretical solutions used to describe swirl dominated flows in both unidirectional and bidirectional flow orientations. This short survey starts with the Rankine vortex and culminates in the presentation of a compressible solution of the bidirectional vortex. After classifying representative swirl motions as external or internal depending on physical boundary conditions, their commonalities are identified along with their relevance to either geophysical or industrial applications. We also identify the key similarity parameters that control the problem, including the inflow parameter, Kilo, and the vortex Reynolds number, V. The latter combines the mean flow Reynolds number and the product of the swirl number and chamber aspect ratio. In this study, the core and sidewall boundary layers are quantified as function of V. The compressible solution is also obtained assuming a Rayleigh-Janzen expansion in the inflow Mach number squared.
DTIC
Confinement; Flow Distribution; Fluid Dynamics; Mathematical Models; Vortices

20070034564 Lockheed Martin Advanced Technology Labs., Cherry Hill, NJ USA
Software Wind Tunnel (SWiT)
Buskens, Richard W; Lardieri, Patrick J; Watson, Bennett C; Lautenschlager, Jennifer; Schmidt, Douglas C; May 2007; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0205; Proj-SSTT
Report No.(s): AD-A470006; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Technology transition is a serious problem plaguing the DoD today. This report summarizes the activities undergone and results developed by the Lockheed Martin Software Wind Tunnel (SWiT) team to develop a concept of operations (CONOPS) and system architecture to address AFRL's Systems and Software Test Track objectives of providing an open collaborative research and development environment to demonstrate, evaluate and document the ability of novel tools, methods, techniques and run-time technologies to yield affordable and more predictable production of software intensive systems.
DTIC
Architecture (Computers); Computer Programming; Computer Systems Programs; Defense Program; Requirements; Software Engineering; Technology Assessment; Wind Tunnels

20070034756 Gini Univ. Services, Inc., Halifax, Canada
Dynamic Architecture: Structuring for Change
Gentleman, W M; Dec 1, 2005; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469772; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469772
No abstract available
Computer Techniques; Applications Programs (Computers)

20070034757 Duke Univ., Durham, NC USA
A Study of Uncertainties in Nonlinear Aeroelastic Systems
Dowell, Earl H; Attar, Peter; Thomas, Jeffrey; Sep 2006; 55 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0071; 313-6041
Report No.(s): AD-A469723; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469723
A principal goal of the Air Force research program is to develop accurate, reliable and efficient computational models so that laboratory and flight tests may be decreased and/or the results of such tests may be more effective in reducing design and production costs of new Air Force systems. Key challenges in achieving this goal are the uncertainties that exist in computational models. These uncertainties may be a result of the limitations of the mathematical model in representing physical reality, the numerical uncertainties that arise in obtaining (computational) solutions to these models, and/or the uncertainties in the parameters that enter into such models. Examples of each of these uncertainties have been studied for nonlinear aeroelastic systems and the computational results compared with experiment. New highly computationally efficient methods have been developed.
DTIC
Aeroelasticity; Dynamic Characteristics

20070034846 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Managing Risk for Cassini During Mission Operations and Data Analysis (MOandDA)
Witkowski, Mona M.; March 19, 2002; 7 pp.; In English; IEEE Aerospace Conference, 9-16 Mar. 2002, Big Sky, MT, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40399
A Risk Management Process has been tailored for Cassini that not only satisfies the requirements of NASA and JPL, but also allows the Program to proactively identify and assess risks that threaten mission objectives. Cassini Risk Management is a team effort that involves both management and engineering staff. The process is managed and facilitated by the Mission Assurance Manager (MAM), but requires regular interactions with Program Staff and team members to instill the risk management philosophy into the day to day mission operations. While Risk Management is well defined for projects in the development phase, it is a relatively new concept for Mission Operations. The Cassini team has embraced this process and has begun using it in an effective, proactive manner, to ensure mission success. It is hoped that the Cassini Risk Management Process will form the basis by which risk management is conducted during MO&DA on future projects. proactive in identifying, assessing and mitigating risks before they become problems. Cost ehtiveness is achieved by: Comprehensively identifying risks Rapidly assessing which risks require the expenditure of pruject cewums Taking early actions to mitigate these risks Iterating the process frequently, to be responsive to the dynamic internal and external environments The Cassini Program has successfully implemented a Risk Management Process for mission operations, The initial SRL has been developed and input into he online tool. The Risk Management webbased system has been rolled out for use by the flight team and risk owners we working proactive in identifying, assessing and mitigating risks before they become problems. Cost ehtiveness is achieved by: Comprehensively identifying risks Rapidly assessing which risks require the expenditure of pruject cewums Taking early actions to mitigate these risks Iterating the process frequently, to be responsive to the dynamic internal and external environments The Cassini Program has successfully implemented a Risk Management Process for mission operations, The initial SRL has been developed and input into he online tool. The Risk Management webbased system has been rolled out for use by the flight team and risk owners we working put into place will become visible and will be illusmted in future papers.
Author
Risk; Management Systems; Cassini Mission

20070034909 Klein Associates, Inc., Fairborn, OH USA

FOCUS: A Model of Sensemaking

Sieck, Winston R; Klein, Gary; Peluso, Deborah A; Smith, Jennifer L; Harris-Thompson, Danyele; Gade, Paul A; May 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 1435-01-01-CT-31161; Proj-B74F

Report No.(s): AD-A469770; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469770

Sensemaking is a relatively new concept that has largely been associated with Weick (1995) and his work in organizational behavior. Sensemaking refers to the set of processes involved in trying to improve one's understanding of a situation, often in response to surprise. The primary purpose of the current project was to unpack and develop the concept of sensemaking, principally by developing and testing a cognitive model of the processes involved. The resulting Data/Frame model posits a highly interactive relationship between data inputs and mental representations or 'frames' for interpreting data. The Data/Frame model also proposes six key sensemaking activities for handling frames in light of (anomalous) data: Elaborating, Questioning, Comparing, Preserving, Reframing, and Seeking. A secondary aim was to provide recommendations for training and other applications of the model that would be of direct benefit to the warfighter. To that end, several specific links to applied issues in domains such as information operations, intelligence analysis and combat systems design for UAV control have been developed and pursued. At this juncture, the concept of sensemaking and the Data/Frame model appear to be supported by the data, and also quite useful for military applications.

DTIC

Cognition; Education; Mental Performance; Military Technology; Situational Awareness; Tasks

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*.

20070034284 West Virginia Univ., Morgantown, WV USA

Electromagnetic Control of High Heat-Flux Spray Impingement Boiling Under Microgravity Conditions

Gray, Donald D; Kuhlman, John M; Glaspell, Shannon L; Hunnell, C A; Kreitzer, Paul J; Mehra, Deepak; Youssef, Rageey M; Mar 2007; 111 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-1-0276

Report No.(s): AD-A469754; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469754

The primary goal of this project was to discover how to most effectively use electromagnetic forces to enhance spray impingement boiling in microgravity (%g). This project was closely coordinated with the non-electromagnetic spray impingement boiling heat transfer experiments conducted by Dr. Kirk L. Yerkes of the Air Force Research Laboratory (AFRL). The West Virginia University (WVU) investigation of electrical body forces to enhance and control spray impingement boiling extended the AFRL research. The computational phase of the WVU project was based on the commercial multiphysics code CFD-ACE+, which was successfully modified to incorporate the Coulomb and electric Kelvin forces. WVU's ground-based experiments demonstrated for the first time that modest increases in heat transfer coefficient and Nusselt number can be achieved in spray impingement boiling by using electrical forces, thus confirming the fundamental hypothesis of this research. Further increases in heat transfer performance are likely to result from a better understanding of the relevant microphysics and better electrode designs. Experimental results have been used to estimate the time scales for various phenomena that occur in spray impingement boiling, which could lead to improved electrode designs.

DTIC

Boiling; Cooling; Electromagnets; Heat Flux; Heat Transfer; Impingement; Microgravity; Sprayers; Temperature Control

20070034447 Department of the Navy, Washington, DC USA

An Inverse Method to Calculate Material Properties Using an Insertion Loss Test

Hull, Andrew J, Inventor; Jun 27, 2007; 48 pp.; In English; Original contains color illustrations

Report No.(s): AD-D020291; No Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADD020291

A method for calculating material properties of a material includes conducting two insertion loss tests of the material

having a single thickness and a double thickness. These tests are conducted at a zero wavenumber. Utilizing these insertion loss tests, a dilatational wavespeed is computed. The method continues by calculating a shear wavespeed by performing three insertion loss tests of the material at single, double and triple thicknesses. These tests are conducted at a non-zero wavenumber. A shear wavespeed can be calculated from the dilatational wavespeed and these insertion loss tests. Lame constants, Young's modulus, Poisson's ratio, and the shear modulus for the material of interest can then be calculated using the dilatational and shear wavespeeds.
DTIC
Insertion Loss; Patent Applications

20070034490 Environmental Security Technology Certification Program, Arlington, VA USA
Enhanced UXO Discrimination Using Frequency-Domain Electromagnetic Induction
Nelson, H H; Steinhurst, D A; Barrow, B; Bell, T; Khadar, N; SanFilipo, B; Won, I J; Jun 27, 2007; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W74RDV10093316
Report No.(s): AD-A469893; NRL/MR/6110--07-9058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Chemistry Division of the Naval Research Laboratory has developed the Multi-sensor Towed Array Detection System for use in unexploded ordnance detection and discrimination. With support from the Environmental Security Technology Certification Program, we have developed a frequency-domain electromagnetic induction sensor array to extend the discrimination capabilities of the MTADS. We have demonstrated the system at the Standardized UXO Demonstration sites at Aberdeen Proving Ground, MD and Yuma Proving Ground, AZ. At each of the sites, we surveyed the Calibration Lanes, the Blind Test Grid, and as much of the Open Field Area as possible. In this report, we describe the sensors demonstrated, show examples of the data collected, describe our analysis methodologies, and report the detection and discrimination results as scored by management of the test sites and analysts from the Institute for Defense Analyses.
DTIC
Ammunition; Explosives Detection; Magnetic Induction

20070035001 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Electron Spin Dephasing and Decoherence by Interaction with Nuclear Spins in Self-Assembled Quantum Dots
Lee, Seungwon; vonAllmen, Paul; Oyafuso, Fabiano; Klimeck, Gerhard; Whale, K. Birgitta; January 5, 2004; 6 pp.; In English; Winter International Symposium on Information and Communication Technologies, 5-8 Jan. 2004, Cancun, Mexico; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40470

Electron spin dephasing and decoherence by its interaction with nuclear spins in self-assembled quantum dots are investigated in the framework of the empirical tight-binding model. Electron spin dephasing in an ensemble of dots is induced by the inhomogeneous precession frequencies of the electron among dots, while electron spin decoherence in a single dot arises from the inhomogeneous precession frequencies of nuclear spins in the dot. For In(x)Ga(1-x) As self-assembled dots containing ~30000 nuclei, the dephasing and decoherence times are predicted to be on the order of 100 ps and 1 (micro)s.
Author
Electron Spin; Nuclear Spin; Quantum Dots

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*.

20070034238 Defence Science and Technology Organisation, Victoria, Australia
Cracking-Induced Mistuning in Bladed Disks
Hou, Jian; Oct 1, 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469690; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469690

No abstract available
Cracks; Fatigue Life; Tuning; Vibration

20070034239 Imperial Coll. of Science and Technology, London, UK
Effects of Mistuning on the Forced Response of Bladed Discs with Friction Dampers
Petrov, E P; Ewins, D J; Oct 1, 2005; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469691; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469691
No abstract available
Finite Element Method; Friction; Tuning

20070034450 Naval Undersea Warfare Center, Newport, RI USA
Method and Apparatus for Improved Active Sonar Using Singular Value Decomposition Filtering
Nuttall, Albert H, Inventor; Jun 26, 2007; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-D020295; No Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADD020295
Current signal processing methods are inefficient because they suffer from energy spreading losses due to multiple propagation paths, target extension, moving boundaries, moving source and receiver (i.e. Doppler effects), and variations in the speed of sound. The invented method utilizes wide band, long duration pulses (i.e., large time-bandwidth product) to achieve high resolution waveform ranging and Doppler accuracy by recombination of energy spreading losses, using linear and higher-order kernel estimates based on a Volterra-Hermite polynomial expansion. The Volterra-Hermite basis expansion uses combinations of independent filter outputs derived from an eigenvalue decomposition of the covariance matrix of the excitation input, a Gaussian-distributed random white process.
DTIC
Decomposition; Patent Applications; Signal Processing; Sonar

20070034835 NASA Langley Research Center, Hampton, VA, USA
Effect of Three-Dimensional Shear-Layer Structures on Slat Cove Unsteadiness
Choudhari Meelan M.; Khorrami, Mehdi R.; [2007]; 41 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: Other Sources
Numerical simulations are used to investigate the local and global dynamics of large-scale, three-dimensional vorticity structures within the free shear layer originating from the slat cusp of a multi-element airfoil configuration. Results indicate that accounting for the local three-dimensionality of flow fluctuations leads to considerable improvement in the accuracy of the unsteady, near-field solution. Analysis of simulation data suggests the likely significance of turbulent fluctuations near the reattachment region in the generation of broadband slat noise. The computed acoustic characteristics (in terms of the frequency spectrum and spatial distribution) within short distances from the slat resemble the previously reported, subscale measurements of slat noise.
Author
Computational Fluid Dynamics; Vortices; Shear Layers; Leading Edge Slats; Aircraft Noise; Aeroacoustics; Computerized Simulation

20070034836 NASA Glenn Research Center, Cleveland, OH, USA
Effect of Temperature on Jet Velocity Spectra
Bridges, James E.; Wernet, Mark P.; October 2007; 24 pp.; In English; 13th AIAA/CEAS/28th AIAA Aeroacoustics Conference, 21-23 May 2007, Rome, Italy; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.04.02
Report No.(s): NASA/TM-2007-214993; AIAA Paper-2007-3628; E-16149; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034836
Statistical jet noise prediction codes that accurately predict spectral directivity for both cold and hot jets are highly sought both in industry and academia. Their formulation, whether based upon manipulations of the Navier-Stokes equations or upon heuristic arguments, require substantial experimental observation of jet turbulence statistics. Unfortunately, the statistics of most interest involve the space-time correlation of flow quantities, especially velocity. Until the last 10 years, all turbulence statistics were made with single-point probes, such as hotwires or laser Doppler anemometry. Particle image velocimetry (PIV) brought many new insights with its ability to measure velocity fields over large regions of jets simultaneously; however, it could not measure velocity at rates higher than a few fields per second, making it unsuitable for obtaining temporal spectra and correlations. The development of time-resolved PIV, herein called TR-PIV, has removed this limitation, enabling

measurement of velocity fields at high resolution in both space and time. In this paper, ground-breaking results from the application of TR-PIV to single-flow hot jets are used to explore the impact of heat on turbulent statistics of interest to jet noise models. First, a brief summary of validation studies is reported, undertaken to show that the new technique produces the same trusted results as hotwire at cold, low-speed jets. Second, velocity spectra from cold and hot jets are compared to see the effect of heat on the spectra. It is seen that heated jets possess 10 percent more turbulence intensity compared to the unheated jets with the same velocity. The spectral shapes, when normalized using Strouhal scaling, are insensitive to temperature if the stream-wise location is normalized relative to the potential core length. Similarly, second order velocity correlations, of interest in modeling of jet noise sources, are also insensitive to temperature as well.
Author
Temperature Effects; Jet Aircraft Noise; Velocity Distribution; Jet Flow; Power Spectra

20070034912 Naval Research Lab., Bay Saint Louis, MS USA
Ambient Noise Measurements in and Around the Gulfport Mississippi Harbor and its Potential Influence on Marine Mammals
Stanic, Steve; Brown, Robert A; Kennedy, Edgar T; Malley, Dexter A; Solangi, Mobashir A; Jun 21, 2007; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-71-M297-X4
Report No.(s): AD-A469878; NRL/MR/7184--07-9049; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A pilot program designed to measure ambient noise and record dolphin echolocation signatures at the entrance to the Gulfport harbor was carried out from May 2005 to July 2005. This non-invasive study used a passive acoustic monitoring system. These results showed that during the month of May, dolphin echo ranging clicks were easily identified by their broadband spectra and in many cases correlated with visual observations of dolphin activity in the area. Signatures of large and small ships entering and leaving the harbor area were also recorded. The animals did not appear to be affected by the noise generated by the small boats. However, when several large container ships entered and left the Gulfport harbor, there was little evidence of any dolphin echolocation signals and no dolphin were observed in the immediate area. Their absence may be due to the high levels of broadband noise radiated from these ships. These long-term observations also show that, even after sunset, dolphin echolocation signals were recorded indicating that the animals are continuing to be active during the nighttime hours. DTIC
Ambience; Harbors; Marine Mammals; Noise (Sound); Noise Measurement; Noise Pollution; Underwater Acoustics

20070034924 NASA Glenn Research Center, Cleveland, OH, USA
The Attenuation of a Detonation Wave by an Aircraft Engine Axial Turbine Stage
VanZante, Dale; Envia, Edmane; Turner, Mark G.; September 2007; 19 pp.; In English; 18th ISABE Conference (ISABE 2007), 2-7 Sep. 2007, Beijing, China; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.03.01
Report No.(s): NASA/TM-2007-214972; ISABE-2007-1260; E-16138; Copyright; Avail.: CASI: A03, Hardcopy

A Constant Volume Combustion Cycle Engine concept consisting of a Pulse Detonation Combustor (PDC) followed by a conventional axial turbine was simulated numerically to determine the attenuation and reflection of a notional PDC pulse by the turbine. The multi-stage, time-accurate, turbomachinery solver TURBO was used to perform the calculation. The solution domain consisted of one notional detonation tube coupled to 5 vane passages and 8 rotor passages representing 1/8th of the annulus. The detonation tube was implemented as an initial value problem with the thermodynamic state of the tube contents, when the detonation wave is about to exit, provided by a 1D code. Pressure time history data from the numerical simulation was compared to experimental data from a similar configuration to verify that the simulation is giving reasonable results. Analysis of the pressure data showed a spectrally averaged attenuation of about 15 dB across the turbine stage. An evaluation of turbine performance is also presented.
Author
Engine Design; Axial Flow Turbines; Detonation Waves; Turbomachinery; Combustion Chambers

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*.

20070034271 Notre Dame Univ., IN USA
Charged Particle Ejection from Nanolayered Heterostructures
Jacobs, Dennis C; Jun 11, 2007; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0004
Report No.(s): AD-A469735; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469735

This project explored specific strategies to augment the plasma density surrounding hypersonic vehicles through novel Metal-Insulator-Metal (MIM) nanostructures. Solid-state devices based on the MIM architecture emit hot electrons when a voltage bias is applied across the metal electrodes. The performance of a variety of MIM devices was studied as a function of the fabrication characteristics. The energy distribution of the emitted electrons was acquired to gain insight into the hot electron transport mechanism within these unique devices.
DTIC
Charged Particles; Ejection; Hypersonic Vehicles; Nanostructures (Devices)

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20070034515 Naval Postgraduate School, Monterey, CA USA
Evaluating Russian Dual-Use Nuclear Exports
Bitterman, Blaine S; Jun 2007; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469934; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Non-proliferation is a major concern of the international community, the USA, and Russia. This thesis examines Russia's role in the nonproliferation regime through 2004. Russia has continually said it is committed to non-proliferation; however, some of its actions contradict its rhetoric. Although Russia's violation of international agreements on nonproliferation is minimal, it is important to understand why Russia transfers nuclear technology. This thesis uses two case studies - Russian nuclear sales to Iran and India - to determine why Russia's actions fail to meet its rhetorical standards.
DTIC
International Trade; Russian Federation

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*.

20070034162 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Interferometry from Space
Carpenter, Kenneth; [2007]; 7 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.:
CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034162

Space-based interferometric observatories will be challenging projects, equal at least to that of building the Great Observatories (the Hubble Space Telescope (HST), Spitzer Space Telescope (SST), Chandra X-ray Observatory, and the Gamma Ray Observatory), if not the Pyramids of Eygpt - but they represent the next logical step in examining our Universe at substantially higher angular resolution. Increasing our resolving power by factors of 100 or more (as is needed to make meaningful improvements in this observational arena) over existing facilities such as HST and SST requires mirror diameters (100's to 1000's of meters) much larger than can be supported by single or segmented mirrors - and thus the design and

construction of sparse aperture, inteferometric arrays such as those described herein will be required. But just imagine the rewards of being able to see, for the first time, the surfaces of other stars, the location and type of extrasolar planets and even pictures of those same planets, the inner workings of Active Galactic Nuclei, the close-in details of supernovae explosions, black hole event horizons, and the infrared universe at the same resolution of the UV-optical Hubble Deep Fields. As a slight variation on the 'Star Trek: Enterprise' theme song might say, it'll be a 'long road, getting from here to there', but it will one well-worth taking.
Derived from text
Observatories; Astronomical Interferometry; Spaceborne Astronomy; Spaceborne Telescopes; Astronomical Satellites; Interferometers

20070034290 Oregon Univ., Eugene, OR USA
Phycoerythrin Signatures in the Littoral Zone
Wood, A M; Jun 29, 2007; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-99-1-0177
Report No.(s): AD-A469760; WOM-235100; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469760

Phycoerythrin (PE) refers to a family of highly fluorescent photosynthetic pigments found in some marine phytoplankton. In subtropical and temperate waters, PE-producing organisms are common enough that a spectral signature for PE can be obtained from bulk seawater, regardless of the concentration or type of other colored materials in the water. This project had two goals: to determine if the PE spectral signature of a water mass carries oceanographically useful information and to determine the biological mechanism by which the PE spectral signature changes in a water mass. The project showed that the nutrient status and color of oceanic waters can be inferred from PE spectral signature and that there is a distinctive PE spectral signature associated with turbid coastal water. We discovered several new types of PE-containing marine picocyanobacteria, described a totally new biochemical mechanism by which PE-containing phytoplankton can adapt to changes in the spectral quality of available light, and showed that lateral gene transfer is a key mechanism of evolution for PE and other genes in picocyanobacteria.
DTIC
Fluorescence; Regions; Signatures

20070034311 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Raman Fiber Lasers and Amplifiers Based on Multimode Graded-Index Fibers and Their Application to Beam Cleanup
Terry, NAthan B; Jun 2007; 218 pp.; In English; Original contains color illustrations
Report No.(s): AD-A469788; AFIT/DS/ENP/07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469788

Raman fiber lasers (RFLs) and Raman fiber amplifiers (RFAs) in multimode fibers were explored. The RFL based on a graded-index fiber was shown to be very efficient relative to RFLs based on singlemode fibers. Several configurations of the RFL were examined; the beam quality of the Stokes beam depended on the reflectivity of the output coupler and the Stokes power. When used as a beam combiner, the RFL was a highly efficient brightness converter. RFL configurations which used dichroic mirrors were shown to be potentially useful for RFLs based on very large fibers. The forward- and backward-seeded geometries of an RFA based on a graded-index fiber were examined. The beam quality of the output was observed to depend on the beam quality of the input. A numerical model explains this behavior in terms of mode competition and explains why beam cleanup occurs in graded-index fibers but not in step-index fibers. The spectrum of the forward-seeded geometry was superior to the spectrum of the backward-seeded geometry. The RFA was used as a beam combiner.
DTIC
Cleaning; Fiber Lasers; Lasers; Raman Lasers

20070034454 Washington Univ., Seattle, WA USA
Marine Mammals Monitoring for Northwest Fisheries: 2005 Field Year
Nystuen, Jeffrey A; Jul 2007; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00024-02-D-6602
Report No.(s): AD-A469811; APL-UW-TM-2-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A field program to monitor marine mammals during winter months in the coastal waters of Washington State has been

established using Passive Aquatic Listeners (PALs). Upgrades to existing instruments and new operating software were utilized during the field year 2005. Two offshore moorings at Cape Flattery and one mooring in Haro Strait, deployed synergistically with a visual observation program, were successful. Data demonstrate quantitative acoustic classification of the marine environment. The new software feature, recorded sound bites, assists in the interpretation of the sound field. Specific sound bites containing whale vocalizations were collected and then identified by outside experts. Transient killer whale and Southern Resident (SR) killer whale vocalizations were detected at Cape Flattery. Co-detection of SR killer whales with the visual observation program (D. Bain) confirm the potential for reliable detection of sound-producing marine mammals, in particular, SR killer whales, using passive acoustic monitoring with PALs.
DTIC
Acoustics; Animals; Mammals; Marine Biology; Marine Environments; Marine Mammals; Visual Perception; Whales

20070034775 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Design and Field-of-View Calibration of 114-660-GHz Optics of the Earth Observing System Microwave Limb Sounder
Cofield, Richard E.; Stek, Paul C.; IEEE Transactions on Geoscience and Remote Sensing; May 5, 2006; Volume 44, Issue 5, pp. 1166-1181; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40299; http://dx.doi.org/10.1109/TGRS.2006.873234

This paper describes the optics design and field-of view (FOV) calibration for five radiometers covering 114-660 GHz which share a common antenna in the Microwave Limb Sounder instrument on the National Aeronautics and Space Administration's Aura satellite. Details of near-field pattern measurements are presented. Estimated systematic scaling uncertainties (3/spl sigma/) on calibrated limb emissions, due to FOV calibration uncertainties, are below 0.4%. 3/spl sigma/ uncertainties in beamwidth and relative pointing of radiometer boresights are 0.006A(deg) and 0.003A(deg) , respectively. The uncertainty in modeled instrument response, due to the scan dependence of FOV patterns, is less than +/- 0.24 K equivalent blackbody temperature. Refinements to the calibration using in-flight data are presented.
Author
Field of View; Earth Observing System (EOS); Radiometers; Calibrating; Boresights; Near Fields

20070034954 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Coherent Detector Arrays for Continuum and Spectral Line Applications
Gaier, Todd C.; September 7, 2006; 33 pp.; In English; Future Instrumentation Workshop for the Green Bank Telescope, Green Bank West Virginia, Spetember 7-9, 2006, 7-9 Sep. 2006, Green Bank, West Virginia, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40257

This viewgraph presentation reviews the requirements for improved coherent detector arrays for use in continuum and spectral line applications. With detectors approaching fundamental limits, large arrays offer the only path to sensitivity improvement. Monolithic Microwave Integrated Circuit (MMIC) technology offers a straightforward path to massive focal plane millimeter wave arrays: The technology will readily support continuum imagers, polarimeters and spectral line receivers from 30-110 GHz. Science programs, particularly large field blind surveys will benefit from simultaneous observations of hundreds or thousands of pixels 1000 element array is competitive with a cost less than $2M.
CASI
Integrated Circuits; Microwave Circuits; Coherent Light; Multispectral Linear Arrays

20070035005 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Ultimate Whispering Gallery Mode Resonator and Nontrivial Relationship between Spectrum and Shape
Maleki, Lute; Grudinin, Ivan; Savchenkov, Anatoliy A.; Matsko, Andrey B.; Strekalov, Dmitry; Mohageg, Makan; Ilchenko, Vladimir S.; May 21, 2006; 2 pp.; In English; The Conference on Lasers and Electro-Optics (CLEO), 23-25 May 2006, Long Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40467

Using a similarity between morphologies of an optical planar waveguide and a whispering gallery resonator, we theoretically propose and experimentally demonstrate a one dimensional ring-like macroscopic object characterized with high finesse and small mode volume.
Author
Optical Waveguides; Whispering Gallery Modes; Resonators; Spectra

20070035007 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Adaptive Nulling: A New Enabling Technology for Interferometric Exoplanet

Lay, Oliver P.; Jeganathan, Muthu; Peters, Robert; August 3, 2003; 10 pp.; In English; The International Society for Optical Engineering (SPIE), International Symposium on Optical Science and Technology, 3-8 Aug. 2003, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40464

Deep, stable nulling of starlight requires careful control of the amplitudes and phases of the beams that are being combined. The detection of earth-like planets using the interferometer architectures currently being considered for the Terrestrial Planet Finder mission require that the E-field amplitudes are balanced at the level of approx. 0.1%, and the phases are controlled at the level of 1 mrad (corresponding to approx.1.5 nm for a wavelength of 10 microns). These conditions must be met simultaneously at all wavelengths across the science band, and for both polarization states, imposing unrealistic tolerances on the symmetry between the optical beamtrains. We introduce the concept of a compensator that is inserted into the beamtrain, which can adaptively correct for the mismatches across the spectrum, enabling deep nulls with realistic, imperfect optics. The design presented uses a deformable mirror to adjust the amplitude and phase of each beam as an arbitrary function of wavelength and polarization. A proof-of-concept experiment will be conducted at visible/near-IR wavelengths, followed by a system operating in the Mid-IR band.

Author

Near Infrared Radiation; Infrared Spectra; Interferometry; Extrasolar Planets; Terrestrial Planets; Infrared Radiation

20070035013 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Off-Axis Four-Quadrant Phase Mask (FQPM) Coronagraph for Palomar: High-Contrast Near Bright Stars Imager

Haguenauer, Pierre; Serabyn, Eugene; Bloemhof, Eric E.; Troy, Mitchell; Wallace, James K.; Koresko, Chris D.; Mennesson, Bertrand; July 31, 2005; 9 pp.; In English; SPIE Optics and Photonics : Techniques and Instrumentation for Detection of Exoplanets II, 31 Jul. - 4 Aug. 2005, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40496

Direct detection of planets around nearby stars requires the development of high-contrast imaging techniques because of the high difference between their respective fluxes. This led us to test a new coronagraphic approach based on the use of phase mask instead of dark occulting ones. Combined with high-level wavefront correction on an unobscured off-axis section of a large telescope, this method allows imaging very close to the star. Calculations indicate that for a given ground-based on-axis telescope, use of such an off-axis coronagraph provides a near-neighbor detection capability superior to that of a traditional coronagraph utilizing the full telescope aperture. Setting up a laboratory experiment working in near infrared allowed us to demonstrate the principle of the method, and a rejection of 2000:1 has already been achieved.

Author

Coronagraphs; Imaging Techniques; Quadrants; Planets; Near Infrared Radiation; Detection

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20070034277 Michigan Univ., Ann Arbor, MI USA

The Effects of Cathode Configuration on Hall Thruster Cluster Plume Properties (POSTPRINT)

Beal, Brian E; Gallimore, Alec D; Hargus, Jr , William A; Jul 2005; 21 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0051; Proj-1011

Report No.(s): AD-A469742; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469742

Clusters of Hall thrusters may be used to produce electric propulsion systems capable of operating at power levels in excess of the current state of the art. One of the key factors to be considered in determining the optimum cluster architecture is the configuration of the electron-emitting cathode(s). This work presents experimentally determined plume properties and discharge current characteristics obtained with multiple thrusters coupled to a single cathode. Spatially resolved plasma density, electron temperature, and plasma potential data are presented during both single thruster and cluster operation. Measurements taken in this configuration are compared to previously published data obtained with each thruster coupled to

its own independent cathode. Critical plasma parameters in the cluster plume are shown to be strongly influenced by the location of the hollow cathode.
DTIC
Cathodes; Hall Thrusters; Plasma Jets; Plumes

20070034475 Engineering Research and Consulting, Inc., Edwards AFB, CA USA
Experimental and Numerical Examination of the BHT-200 Hall Thruster Plume (Postprint)
Nakles, Michael R; Brieda, Lubos; Reed, Garrett; Hargus, William A; Spicer, Randy L; Jun 6, 2007; 19 pp.; In English
Contract(s)/Grant(s): Proj-33SP
Report No.(s): AD-A469868; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The plume of a Busek BHT-200 xenon Hall thruster has been characterized through measurements from various plasma electrostatic probes. Ion current flux, plasma potential, plasma density, and electron temperatures were measured in the near-field of the plume to 60 cm downstream of the exit plane. These experimentally derived measurements were compared to simulations of the thruster/vacuum chamber environment using the plasma plume code DRACO. The goals of this study were to gain understanding of the effect of the vacuum facility on the thruster plume and to determine the fidelity of the DRACO numerical simulation.
DTIC
Hall Thrusters; Plumes

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*.

20070034317 Army Research Lab., Aberdeen Proving Ground, MD USA
Simulating Photonic Band Gaps in Crystals
Kodan, Daniel H; Chung, Peter W; Jun 2007; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7UH7
Report No.(s): AD-A469800; ARL-TR-4167; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469800

This report summarizes the progress and results for a Student Temporary Employment Program Internship from July 2006 through June 2007. The report presents an introduction to the concept of photonic crystals through quantitative calculations of band gaps with the use of an open source code. Photonics is the science and technology of generating, controlling, and detecting photons, particularly in the visible light and near infrared spectrum. The first part of the report provides a detailed introduction to the principle of photonics from an engineering perspective and discusses possible concepts and applications for the future. Sample calculations for phonon dispersion curves are then presented with the use of simplified models of crystals to demonstrate universal principles of vibrational behavior to understand the properties of crystals. To this end, a MATLAB(1) program was written to generate dispersion relations for two types of reduced dimensional lattices. The second part of the report demonstrates the implementation of a photonic band gap model. The calculations were performed with the use of the Massachusetts Institute of Technology photonic band gap code (MPB). The code was compiled and built on the computers at the U.S. Army Research Laboratory's Major Shared Resource Center, and results verifying the installation are shown. The report concludes with appendices detailing MATLAB code for the phonon calculations, input decks for MPB, and an ancillary literature review of ferroelectric fatigue in crystals, which was a another topic of interest early in the internship.
DTIC
Crystals; Energy Gaps (Solid State); Simulation

20070034945 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Design and Fabrication Highlights Enabling a 2mm, 128 Element Bolometer Array for GISMO
Allen, Christine A.; Benford, Dominic J.; Miller, Timothy M.; Staguhn, Johannes G.; Wollack, Edward J.; Moseley, S. Harvey; July 22, 2007; 1 pp.; In English; 12th International Workshop on Low Temperature Detectors, 22-27 July 2007, Paris, France; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The design and fabrication of a background limited, 128 pixel Transition Edge Sensor (TES) bolometer array for the Goddard IRAM Super-conducting 2-mm Observer (GISMO) is presented.
Derived from text
Fabrication; Bolometers; Arrays; SOI (Semiconductors)

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*.

20070034511 Army Research Lab., Aberdeen Proving Ground, MD USA
Reactive Gas Phase Compression Due to Shock-Induced Cavity Collapse in Energetic Materials
Tran, Linhbao; Jun 2007; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH80
Report No.(s): AD-A469925; ARL-RP-179; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A mesoscale simulation is carried out to examine shock-initiation due to gas phase reaction at site of cylindrical pore within an HMX crystal. The focus here is to investigate viscoplastic heating with gas pore compression that leads to chemical reactions within the gas phase. Systems of conservation laws for both solid and gas phases are solved along with species conservation from a reduced set of chemical kinetic model. Mass, momentum, and energy transfer between phases are applied explicitly at the solid-gas interface using physical boundary conditions, thus avoiding empiricism of mixture multiphase formulation. These transfer processes are critical in the Mach stem formation around the collapsing reacting gas pore.
DTIC
Cavities; Collapse; Crystals; Equations of State; Explosives; HMX; Reactivity; Vapor Phases; Voids

20070034763 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Record Low NEP in the Hot-Electron Titanium Nanobolometers
Karasik, Boris S.; Olaya, David; Wei, Jian; Pereverzev, Sergey; Gershenson, Michael E.; Kawamura, Jonathan H.; McGrath, William R.; Sergeev, Andrei V.; August 27, 2006; 5 pp.; In English; Applied Superconduvity Conference, 27 Aug. - 1 Sep. 2006, Seattle, WA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04GD55G; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40353

We are developing hot-electron superconducting transition-edge sensors (TES) capable of counting THz photons and operating at T = 0.3K. We fabricated superconducting Ti nanosensors with Nb contacts with a volume of approx. 3x10(exp -3) cu microns on planar Si substrate and have measured the thermal conductance due to the weak electron-phonon coupling in the material G = 4x10(exp -14) W/K at 0.3 K. The corresponding phonon-noise NEP = 3x10(exp -19) W/Hz(sup 1/2). Detection of single optical photons (1550nm and 670nm wavelength) has been demonstrated for larger devices and yielded the thermal time constants of 30 microsec at 145 mK and of 25 microsec at 190 mK. This Hot-Electron Direct Detector (HEDD) is expected to have a sufficient energy resolution for detecting individual photons with (nu) > 1 THz where NEP approx. 3x10(exp -20) W/Hz(sup 1/2) is needed for spectroscopy in space.
Author
Bolometers; Superconductivity; Thermal Conductivity; Hot Electrons; Photons; Titanium

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*.

20070034166 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cassini-Huygens Outreach: It Takes a Village to Reach the World
McConnell, Shannon; September 20, 2006; 12 pp.; In English; European Planetary Science Congress, 18-22 September 2006, Berlin, Germany; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40271

The viewgraph presentation includes a Cassini-Huygens outreach overview, including discussions of educational initiatives, the Saturn observation campaign, solar system ambassadors, products for diverse communities, Cassini's web presence, and the Cassini raw image gallery,
Derived from text
Cassini Mission; Huygens Probe; Public Relations; Education

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20070034735 NASA Johnson Space Center, Houston, TX, USA
Formulation of NASA's Constellation Program
Rhatigan, Jennifer L.; Hanley, Jeffrey M.; Geyer, Mark S.; October 2007; 26 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/SP-2007-563; IAC-07-B3.1.06; S-1020; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034735

NASA has recently formed the Constellation Program to achieve the objectives of maintaining American presence in low Earth orbit, returning to the moon for purposes of establishing an outpost, and laying the foundation to explore Mars and beyond in the first half of the 21st century. The Constellation Program's heritage rests on the successes and lessons learned from NASA's previous human spaceflight programs: Mercury, Gemini, Apollo, Space Shuttle and International Space Station (ISS). This paper describes the rationale behind the formulation of the Constellation Program, including organizational structure, and workforce structure, as well as the approaches to requirements generation, budget formulation, operational philosophies, and procurement strategies.
Author
Space Exploration; Manned Space Flight; Project Planning; Mission Planning; Project Management; Constellation Program

20070034787 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Unmanned Surface and Underwater Vehicles
Bremer, R. H.; Cleophas, P. L. H.; Fitski, H. J.; Keus, D.; July 03, 2007; 2 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 015.35069
Report No.(s): TD2006-0 142; TNO-DV 2006 A455; Copyright; Avail.: Other Sources

The introduction of unmanned vehicles may have serious consequences for naval operations. Therefore, in the future the Royal Netherlands Navy needs to have sufficient knowledge to be able to make sound decisions with respect to procurement and employment of such vehicles. In an earlier study research had already been carried out into unmanned aerial vehicles. In this project it was examined which defence capabilities can be carried out with unmanned surface and underwater vehicles. First an inventory of current and future unmanned vehicles and a subdivision into three categories were made. Next it was tried to project the listed vehicles on the capability list of the Royal Netherlands Navy. This appeared to be difficult, because for this study the capabilities were not detailed enough. Therefore, these capabilities were further subdivided into 'subcapabilities', so next the suitability of the listed vehicles for those subcapabilities could be investigated.
Author
Procurement; Underwater Vehicles; Unmanned Ground Vehicles; Surface Vehicles

20070035000 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
JPL's Approach for Helping Flight Project Managers Meet Today's Management Challenges
Leising, Charles J.; March 8, 2004; 6 pp.; In English; Institute of Electrical and Electronics Engineers (IEEE) Aerospace Conference, 8-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations
Report No.(s): IEEEAC 1359, Version 1; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40479

All across NASA project managers are facing tough new challenges. NASA has imposed increased oversight and the number of projects at Centers such as JPL has exploded from a handful of large projects to a much greater number of smaller ones. Experienced personnel are retiring at increasing rates and younger, less experienced managers are being rapidly promoted up the ladder. Budgets are capped, competition among NASA Centers and Federally Funded Research and Development Centers (FFRDCs) has increased significantly and there is no longer any tolerance to cost overruns. On top of all this, implementation schedules have been reduced by 25 to 50% to reduce run-out costs, making it even more difficult to define requirements, validate heritage assumptions and make accurate cost estimates during the early phases of the life-cycle.JPL's executive management, under the leadership of the Associate Director for Flight Projects and Mission Success, have attempted to meet these challenges by improving operations in five areas: (1) increased standardization, where it is judged to have significant benefit; (2) better balance and more effective partnering between projects and the line

management; (3) increased infrastructure support; (4) improved management training; and (5) more effective review and oversight.
Author
Project Management; Cost Estimates; Schedules; Education; Leadership; Cost Reduction; Standardization

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*.

20070034217 Army War Coll., Carlisle Barracks, PA USA
Prediction Markets: Another Tool in the Intelligence Kitbag
Weigle, Brett D; Feb 20, 2007; 22 pp.; In English
Report No.(s): AD-A469632; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469632

Prediction markets (or information markets) are an efficient mechanism to aggregate information from diverse sources to develop the probability of an event. Such markets have accurately forecast presidential elections, Hollywood Academy Award winners and marketing campaigns in corporations, to name a few examples. The U.S. Intelligence Community does not lack for data in the global war on terrorism. However, the 9/11 Commission Report highlights the difficulty of pooling information gathered by multiple collectors and fusing it into a coherent, comprehensive analysis to be used by strategic leaders. This paper explores the viability of prediction markets to support intelligence analysis by coalescing data from multiple sources into a glimpse of the future.
DTIC
Intelligence; Market Research; Multisensor Fusion

20070034233 Army War Coll., Carlisle Barracks, PA USA
Winning the Peace: Building a Strategic Level Lessons Learned Program
French, Daniel L; Mar 9, 2007; 26 pp.; In English
Report No.(s): AD-A469680; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469680

The U.S. military has developed a robust, comprehensive system to capture, analyze, and disseminate tactical-level and operational-level lessons learned from training events and ongoing conflict operations. Together with Joint Forces Command, the Services are working to expand their lessons learned efforts at the operational level and to incorporate the Theater Strategic arena. These efforts remain focused on warfighting issues -- Major Combat Operations. No comparable system exists at the strategic level to address post-conflict issues. Over the last three decades, U.S. Armed Forces have regularly been involved in conflicts where 'winning the peace' has taken on greater significance. Post-conflict operations often dominate the military planning process as well as the interests and energies of the U.S. National Command Authority, the Department of State, and other government and nongovernment agencies. Many of these agencies have developed lessons learned programs with a peacekeeping, stability operations focus. However, there is no single agency or process that has taken on the challenge of monitoring all these efforts with the goal of sorting, analyzing, and globally sharing key operational and strategic lessons learned. The author proposes an approach to achieving interagency and military cooperation on the collection, analysis, and sharing of strategic-level lessons learned through the implementation of a Strategic Lessons Learned Program (SLLP). The author also recommends that the Center for Strategic Lessons Learned (CSLL) be integrated into the organizational structure of the Peacekeeping and Stability Operations Institute (PKSOI), either within the proposed Operational Integration Section or as an independent section or directorate. The CSLL would sponsor independent lessons learned collection efforts as well as collaborating with existing Service, JFCOM, or other agency planned collection efforts to meet strategic lessons learned requirements.
DTIC
Information Management; Organizations; United States

20070034235 New Mexico State Univ., Las Cruces, NM USA

A Model for Predicting Late Prehistoric Architectural Sites at the Pinon Canyon Maneuver Site in Southeastern Colorado

Owens, Mark; Jan 2007; 58 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): P6115010068

Report No.(s): AD-A469685; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469685

During several years of archeological inventory projects, over 100 distinct locations with Late Prehistoric stage architecture have been identified. The present report builds a model for the prediction of hypothetical habitation locations that will provide a basic tool for future archeological inventories in southeastern Colorado/or other areas where hunter-gatherer groups display sedentary tendencies. Using GIS spatial analysis tools, the model is able to predict the location of defensive sites and complex sites with a high degree of accuracy.

DTIC

Archaeology; Canyons; Colorado; Geographic Information Systems; Mathematical Models

20070034243 Thales Research and Technology, Orsay, France

Use of Software COTS within C4ISR Systems: Contribution of Information Sharing to Enhanced Risk Management, the eCots Approach

Mielnik, Jean-Christophe; Lauriere, Stephane; Dec 1, 2005; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469695

No abstract available

Commercial Off-the-Shelf Products; Computer Programs; Data Bases; Directories; Industries; Risk

20070034250 Southampton Univ., UK

Will the Semantic Web Deliver Information Interoperability?

Shadbolt, Nigel; Dec 1, 2005; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469707

No abstract available

Internets; Interoperability; Semantics

20070034252 Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

Improve Interoperability by Formalizing the Natural Language Parts of Military Messages

Hecking, Matthias; Dec 1, 2005; 43 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469711; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469711

No abstract available

Command and Control; Interoperability; Message Processing; Messages; Natural Language (Computers)

20070034255 Army Research Lab., Aberdeen Proving Ground, MD USA

Implementation of an Enterprise Identifier Seed Server for Joint and Coalition Systems

Chamberlain, Sam; Dec 1, 2005; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469715; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469715

No abstract available

Information Systems; Interoperability; Military Operations; Seeds

20070034256 Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

Towards a Higher Level of Interoperability: Ontology Components for Command and Control Systems

Schade, Ulrich; Dec 1, 2005; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA469716

No abstract available

Command and Control; Interoperability

20070034452 Defence Research Establishment Valcartier, Valcartier, Quebec Canada

Data Replication in Low Bandwidth Military Environments -State of the Art Review

Gibb, Allan; Chamberlain, Sam; Jun 2000; 10 pp.; In English

Report No.(s): AD-A468345; X5-TTCP/C3I; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Modern armies are undergoing a revolution in the way information is managed on the battlefield. Voice-based command, control, and communication systems are being complemented by, and in some cases replaced by (in whole or in part) digital command, control and communication systems. Digital systems offer the promise of increased battlefield awareness through a more systematic and automated distribution of relevant data than is possible with a voice-based communication system. To deliver on this promise, the communication backbone must be capable of distributing digital data among participating command and control nodes with no error and a timeliness appropriate to the operational scenario. To maintain information superiority, important information must be passed quickly enough to permit the friendly commander to stay within, and act within, the decision cycle of the enemy commander. On the tactical battlefield, the low data throughput and unreliable connectivity of the wireless communication links make it difficult to replicate enough data in a timely way to satisfy this objective. This paper reviews the state of the art of data replication mechanisms within a low bandwidth wireless military environment as revealed at a workshop sponsored by The Technical Cooperation Program (TTCP), Command, Control, Communications, and Intelligence (C3I) Group, Technical Panel 10 (TP-10) that was held at Fort Leavenworth, Kansas in April 1999.

DTIC

Bandwidth; Command and Control; Data Acquisition; Digital Systems; Telecommunication; Wireless Communication

20070034471 Jackson (Henry M.) Foundation, Rockville, MD USA

Children's Hospice

Naulty, Cheryl M; Jan 2005; 145 pp.; In English

Contract(s)/Grant(s): W81XWH-04-C-0064

Report No.(s): AD-A469842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this program is to develop and recommend a model of care that enhances the quality of life for Department of Defense (DoD) children with life-threatening conditions and their families. The authors' strategy is to maximize current benefits and coordinate medical care with existing community resources and services, tailored to support the family's specified needs and requirements. The first year of work focused on a feasibility study to gather data on the intent, interpretation, and implementation of the benefit; status of service delivery; available resources through the Military Health System, contract providers, community and other government agencies; and to conduct an assessment of needs of families. A distinct research protocol was designed to use individual interviews and focus groups to determine family and provider needs. The benefits likely to be used by military families and their children were analyzed. A data assessment collection tool has been designed to capture descriptors regarding community resources. The plan is to web enable the database to provide maximum availability and accessibility to the various potential users. An existing education curriculum for providers, Initiative for Pediatric Palliative Care, developed by the Education Development Center, was selected as one that best aligns with the CHI PACC (trademark) model.

DTIC

Children; Data Acquisition; Diseases; Management Systems; Medical Services; Military Personnel; User Requirements

20070034505 Naval Postgraduate School, Monterey, CA USA

The Makara of Hizballah: Deception in the 2006 Summer War

Acosta, David A; Jun 2007; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A469918; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information, while always a critical element of warfare, is quickly becoming decisive in present day conflicts. While the

use of this information can take many forms, one area where the discussion of information's impact on conflict has been delinquent is in the art of deception. Hizballah and Israel serve as the perfect backdrop to examine the effects of deception in current conflicts. While Israel has always maintained a hard power advantage through its military might and prowess, Hizballah looked for other ways to level the playing field. The use of information in supporting deception, which has been a key enabler for the weaker side, became one of the answers to redressing the military balance. This paper will demonstrate that Hizballah, fighting an asymmetric conflict with Israel, used deception very effectively in their defense of southern Lebanon during the 2006 Summer War; this use of deception significantly offset many of Israel's hard power advantages. It will also show that Hizballah's use of information technologies greatly enhanced their ability to wield deception. Finally, this paper will address the interrelation of various information activities and the need to maintain consolidation of these activities for planning and execution on the modern battlefield.
DTIC
Deception; Summer; Warfare

20070034555 Vanderbilt Univ., Nashville, TN USA
Tool Integration Framework for Bio-Informatics
Neema, Sandeep; Apr 2007; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-2-0097; DARPA ORDER-T713; Proj-BIOC
Report No.(s): AD-A469991; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Experience in developing tool integration solutions for engineer domains indicates that the key ingredient for robust tool integration is semantically precise definition of interchange format. The project described in this report developed a robust, scalable, extensible, and standards-based tool integration framework for systems biology applications. Model-based techniques were developed and applied to formally and precisely define the interchange formats using metamodels and semantic well-formedness rules. These interchange formats were used for integrating diverse systems biology computational tools. The report describes the tool integration framework, interchange formats, and applications to representative systems biology workflows.
DTIC
Application Programming Interface; Networks; Software Development Tools

20070034558 Rensselaer Polytechnic Inst., Troy, NY USA
Harnessing Multiple Representations for Autonomous Full-Spectrum Political, Military, Economic, Social, Information and Infrastructure (PMESII) Reasoning
Cassimatis, Nicholas L; May 2007; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-2-0015; Proj-230S
Report No.(s): AD-A469995; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Assessing the effects of various actions on particular varieties of battlespace entities has been impeded by the absence of a representative computational model of the governing dynamics between so-called Political, Military, Economic, Social, Information, and Infrastructure (PMESII) elements in the theater of operations. Associated with each of these categories are formalisms suitable for computational implementation. Currently, we are lacking a way to describe the nonlinear dependence of each category on the others. We have proposed that the formal systems used to describe each of these categories can be described within an abstracted, yet common representational framework and therefore heterogeneous reasoning across the PMESII spectrum may be within our grasp. The Polyscheme architecture (Cassimatis 2002) was utilized to perform this integration, and to demonstrate that non-trivial reasoning about PMESII elements and their complex network of relationships may be computationally realizable.
DTIC
Autonomy; Cognition; Economics; Mathematical Models; Spectra

20070034560 Tufts Univ., Medford, MA USA
Automatic Detection of Covert Channels in Networks
Brodley, C E; May 2007; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-2-0015; Proj-4519
Report No.(s): AD-A469998; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A covert channel is a mechanism that can be used to violate a security policy by allowing information to leak to an unauthorized process. Two types of covert channels exist; storage and timing channels. A storage channel involves the direct

or indirect writing of a storage location by one process and the direct or indirect reading of the storage by another process. A timing channel involves a sender process that signals information to another by modulating its own use of systems resources in such a way that this manipulation affects the real response time observed by the second process. In this research, we focused on the analysis and detection of covert timing channels in the TCP/IP protocol suite.
DTIC
Buffer Storage; Detection; Protocol (Computers); Security

20070034759 Defense Technical Information Center, Fort Belvoir, VA USA
Defense Technical Information Center Strategic Plan 2007-2012
Jun 2007; 39 pp.; In English
Report No.(s): AD-A469665; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469665

The Defense Technical Information Center (DTIC) serves as a vital link in information transfer among Department of Defense (DoD) personnel, contractors and potential contractors as well as other U.S. Government agencies and their contractors. Since our inception at the end of World War II, we have fulfilled this mission by providing authenticated content and state-of-the-art information tools. However, no organization remains preeminent resting on past accomplishments. To continue to serve as a vital link, we must possess a clear vision of our goals and an innovative culture, able to respond rapidly to our customers needs in the fast-paced world of information exploitation. This Strategic Plan serves as DTIC's road map to the future and guides us in establishing the annual goals we need to meet along the way. It helps us measure how far we have come towards achieving our goals and to recognize where we need to adjust our direction in order to reach our planned destination. As the Executive Authority of this agency, I fully endorse this five year Strategic Plan and confirm my commitment to providing leadership to ensure its successful implementation.
DTIC
Planning; Technology Transfer

20070034760 Army War Coll., Carlisle Barracks, PA USA
Understanding NETCOM and Its Role in the 21st Century
Washer, Thomas F; Mar 30, 2007; 24 pp.; In English
Report No.(s): AD-A469647; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469647

In October of 2002, the Army combined two Army level signal support organizations to create the Network Enterprise Technology Command/9th Army Signal Command (NETCOM/9th ASC). The creation of NETCOM/9th ASC is critical to the Army's efforts in the accomplishment of network centric/information dominance goals that directly support transformation efforts. This project examines the reasons why NETCOM/9th ASC was created, reviews its unique organizational structure and mission, and outlines its role in the Army's overarching transformation in the 21st century. Although the research reveals that NETCOM/9th ASC's strategic plans and objectives are nested to support the Army's transformation efforts, the lack of Army senior leader familiarity with this organization could put at risk some of the programs that support the implementation of its strategic plans. Recommendations are offered to address the organization's identity crisis as well as possible resource shortfalls. More importantly, the facts discovered during the research will provide senior/strategic leaders with a broad understanding of this organization and how it impacts Army operations and transformational efforts from the Business Mission Area to the Warfighting Mission Area.
DTIC
Organizations; Military Operations; Identities

20070034774 Defence Science Technology Lab., Farnborough, UK
Information Interoperability for Coalition Operations - Status and Prospects
White, Ian; Lasschuyt, Eddie; Wunder, Michael; Dorion, Eric; Bares, Michael; Metzger, Rick; Dec 1, 2005; 40 pp.; In English
Report No.(s): AD-A469713; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA469713

No abstract available
Interoperability; Information Transfer

20070034868 Navy Personnel Research Studies and Technology, Millington, TN USA
2006 Navy Quality of Life Survey
Wilcove, Gerry L; Schultz, Rosemary A; Patrissi, Geoffrey A; Jul 2007; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A470014; NPRST-AB-07-6; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 2006 Navy Quality of Life (QOL) Survey focused on QOL issues and concerns among active duty Navy personnel. It was designed to be action oriented so that the Navy could address areas of concern to personnal. A stratified random sample was drawn; 5,317 surveys were completed; and responses were weighted to the population. A number of positive results were obtained. For example, enlisted personnel reported that overall satisfaction with shipboard life improved from 2002. And personnel, as a group, believed that standard of living/income had also improved. An area of concern was the finding that only half of enlisted believed they were well prepared if asked to deploy in support of the Global War on Terrorism. An additional concern was the finding that personnel were apprehensive about the impact of future policy changes on their jobs and careers. to address that concern, it is recommended that the Navy develop more effective communication strategies.
DTIC
Military Personnel; Navy; Social Factors; Surveys

20070034881 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Using Knowledge-Based Systems to Support Learning of Organizational Knowledge: A Case Study
Cooper, Lynne P.; Nash, Rebecca L.; Phan, Tu-Anh T.; Bailey, Teresa R.; January 5, 2003; 10 pp.; In English; Hawaii International Conference on System Sciences (HICSS-36), 6-9 Jan. 2003, Big Island, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40415

This paper describes the deployment of a knowledge system to support learning of organizational knowledge at the Jet Propulsion Laboratory (JPL), a US national research laboratory whose mission is planetary exploration and to 'do what no one has done before.' Data collected over 19 weeks of operation were used to assess system performance with respect to design considerations, participation, effectiveness of communication mechanisms, and individual-based learning. These results are discussed in the context of organizational learning research and implications for practice.
Author
Expert Systems; Knowledge Based Systems; Organizations; Deployment

20070034883 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
NASA's Secured Advanced Federated Environment
Chow, Edward; Korsmeyer, David; Paterson, Pat; Liu, Joseph; Stewart, Helen; Burchell, Scott; Chang, Pat; Spence, Matt Chew; Viernes, Conan; Goforth, Andy; Billik, Shoshana; Wheeler, Bob; June 9, 2003; 12 pp.; In English; Twelfth IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, 9-11 Jun. 2003, Linz, Austria; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40418

In 1999, a NASA-wide team initially set out to create a collaborative environment to enable NASA's scientists and engineers to share information and tools across NASA locations and with world-wide partners. This paper describes the team's development process and solutions in resolving conflicting security issues of building a complex intra/inter-enterprise collaborative system. Based on the federated, hierarchical, compartmentalized principles, the Secured Advanced Federated Environment (SAFE) developed by the team is becoming a foundational element for building a collaborative infrastructure for NASA. This paper also introduces the concept of a Micro Security Domain which can achieve the balance between the need to collaborate and the need to enforce enterprise and local security rules. SAFE'S federated security concepts enables networks to be formed around the functional/security requirements. With the SAFE technologies and approaches, security will not be an afterthought of the enterprise network design.
Author
Security; Functional Design Specifications; Resolution; Position (Location)

20070034955 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Enhancing DSN Operations Efficiency with the Discrepancy Reporting Management System (DRMS)
Chatillon, Mark; Lin, James; Cooper, Tonja M.; July 2003; 7 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40431

The DRMS is the Discrepancy Reporting Management System used by the Deep Space Network (DSN). It uses a web

interface and is a management tool designed to track and manage: data outage incidents during spacecraft tracks against equipment and software known as DRs (discrepancy Reports), to record 'out of pass' incident logs against equipment and software in a Station Log, to record instances where equipment has be restarted or reset as Reset records, and to electronically record equipment readiness status across the DSN. Tracking and managing these items increases DSN operational efficiency by providing: the ability to establish the operational history of equipment items, data on the quality of service provided to the DSN customers, the ability to measure service performance, early insight into processes, procedures and interfaces that may need updating or changing, and the capability to trace a data outage to a software or hardware change. The items listed above help the DSN to focus resources on areas of most need.
Author
Deep Space Network; Management Systems; Spacecraft Equipment

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*.

20070034204 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Future Mission Trends and their Implications for the Deep Space Network
Abraham, Douglas S.; September 19, 2006; 12 pp.; In English; IAA Space 2nd Space Architecture Symposium, 19-21 Sep. 2006, San Jose, CA, USA; Original contains color and black and white illustrations
Report No.(s): AIAA Paper-2006-7247; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40273

This viewgraph presentation discusses the direction of future missions and it's significance to the Deep Space Network. The topics include: 1) The Deep Space Network (DSN); 2) Past Missions Driving DSN Evolution; 3) The Changing Mission Paradigm; 4) Assessing Future Mission Needs; 5) Link Support Trends; 6) Downlink Rate Trends; 7) Uplink Rate Trends; 8) End-to-End Link Difficulty Trends; 9) Summary: Future Mission Trend Drivers; and 10) Conclusion: Implications for the DSN.
CASI
Deep Space Network; Trends; Space Missions; Manned Space Flight; Communication Satellites

20070034764 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
DSN Antenna Array Architectures Based on Future NASA Mission Needs
MacNeal, Bruce E.; Abraham, Douglas S.; Cesarone, Robert J.; March 3, 2007; 8 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): IEEAC Paper #1386, Version 4; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40339

A flexible method of parametric, full life-cycle cost analysis has been combined with data on NASA's future communication needs to estimate the required number and operational dates of new antennas for the Deep Space Network (DSN). The requirements were derived from a subset of missions in the Integrated Mission Set database of NASA's Space Communications Architecture Working Group. Assuming that no new antennas are 'constructed', the simulation shows that the DSN is unlikely to meet more than 20% of mission requirements by 2030. Minimum full life-cycle costs result when antennas in the diameter range, 18m-34m, are constructed. Architectures using a mixture of antenna diameters produce a slightly lower full life-cycle cost.
Author
Antenna Arrays; Cost Analysis; Data Transmission; Space Communication; Life Cycle Costs

20070034789 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Space-Based Voice over IP Networks
Nguyen, Sam P.; Okino, Clayton; Walsh, William; Clare, Loren; March 3, 2007; 10 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color illustrations
Report No.(s): IEEEAC Paper #1526, Version 1; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40328

In human space exploration missions (e.g. a return to the Moon and for future missions to Mars), there will be a need to

provide voice communications services. In this work we focus on the performance of Voice over IP (VoIP) techniques applied to space networks, where long range latencies, simplex links, and significant bit error rates occur. Link layer and network layer overhead issues are examined. Finally, we provide some discussion on issues related to voice conferencing in the space network environment.
Author
Voice Communication; Space Exploration; Aerospace Environments; Bit Error Rate

20070034852 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Heritage Adoption Lessons Learned, Active Mirror Telescope Cover Deployment and Latch Mechanism
Wincentsen, James E.; May 17, 2006; 10 pp.; In English; 38th Aerospace Mechanisms Symposium, 17-19 May 2006, Williamsburg, VA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40447

The Active Mirror Telescope (AMT) task adopted the Cover Deployment and Latch Mechanism (CDLM) design as used on the Galaxy Evolution Explorer (GALEX) project. The three separate mechanisms that comprise the CDLM will be discussed in this paper in addition to a focus on heritage adoption lessons learned and specific examples. These lessons learned will be valuable to any project considering the use of heritage designs.
Author
Telescopes; Mirrors; Deployment; Latches

20070034962 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Model Checking Artificial Intelligence Based Planners: Even the Best Laid Plans Must Be Verified
Smith, Margaret H.; Holzmann, Gerard J.; Cucullu, Gordon C., III; Smith, Benjamin D.; March 5, 2005; 13 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40493

Automated planning systems (APS) are gaining acceptance for use on NASA missions as evidenced by APS flown On missions such as Orbiter and Deep Space 1 both of which were commanded by onboard planning systems. The planning system takes high level goals and expands them onboard into a detailed of action fiat the spacecraft executes. The system must be verified to ensure that the automatically generated plans achieve the goals as expected and do not generate actions that would harm the spacecraft or mission. These systems are typically tested using empirical methods. Formal methods, such as model checking, offer exhaustive or measurable test coverage which leads to much greater confidence in correctness. This paper describes a formal method based on the SPIN model checker. This method guarantees that possible plans meet certain desirable properties. We express the input model in Promela, the language of SPIN and express the properties of desirable plans formally.
Author
NASA Programs; Deep Space 1 Mission; Artificial Intelligence; Planning

20070034968 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Unequal-Arm Interferometry and Ranging in Space
Tinto, Massimo; May 30, 2005; 24 pp.; In English; Center of Applied Space Technology and Microgravity (ZARM) Lasers, Clocks, And Drag-Free : Technologies for Future Exploration in Space and Tests of Gravity, Bremen, Germany, May 30, 30 May - 1 Jun. 2005, Bremen, Germany; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40473

Space-borne interferometric gravitational wave detectors, sensitive in the low-frequency (millihertz) band, will fly in the next decade. In these detectors the spacecraft-to-spacecraft light-traveltimes will necessarily be unequal, time-varying, and (due to aberration) have different time delays on up- and down-links. By using knowledge of the inter-spacecraft light-travel-times and their time evolution it is possible to cancel in post-processing the otherwise dominant laser phase noise and obtain a variety of interferometric data combinations sensitive to gravitational radiation. This technique, which has been named Time-Delay Interferometry (TDI), can be implemented with constellations of three or more formation-flying spacecraft that coherently track each other. As an example application we consider the Laser Interferometer Space Antenna (LISA) mission and show that TDI combinations can be synthesized by properly time-shifting and linearly combining the phase measurements performed on board the three spacecraft. Since TDI exactly suppresses the laser noises when the delays coincide with the light-travel-times, we then show that TDI can also be used for estimating the time-delays needed for its

implementation. This is done by performing a post-processing non-linear minimization procedure, which provides an effective, powerful, and simple way for making measurements of the inter-spacecraft light-travel-times. This processing technique, named Time-Delay Interferometric Ranging (TDIR), is highly accurate in estimating the time-delays and allows TDI to be successfully implemented without the need of a dedicated ranging subsystem.
Author
Interferometry; Time Lag; Low Frequencies; Gravitational Waves; Space Missions; Rangefinding

20070034970 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Virtual Mission Operation Framework (VMOF)
Lee, Meemong; Weidner, Richard J.; March 8, 2004; 11 pp.; In English; The Institute of Electrical and Electronics Engineers (IEEE) Aerospace Conference, 8-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations
Report No.(s): IEEEAC 1136, Version 1; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40471

The Virtual Mission Operation Framework (VMOF) is one of the project lifecycle engineering process improvement efforts initiated by the institutional technology infrastructure program at JPL. The VMOF is composed of three frameworks: a model integration framework, a simulation framework, and a visualization framework. The model integration framework interfaces with spacecraft system design, mission design, and structure design. The simulation framework interfaces with the operation scenario design, environmental phenomena science, and science payload system design. The visualization framework interfaces with the flight system testbed, the ground system, and the science analysis. The three frameworks of the VMOF collaborate to create a comprehensive virtual mission operation that enables a 'validation-in-the-loop' system design process and lifecycle-continuous science-return validation.This paper discusses the technical approaches for each framework implementation, challenges and approaches involved in streamlining mission information access, and on-going activities toward enabling Model-Based Engineering Design in a collaborative distributed environment.
Author
Mission Planning; Space Missions; Systems Engineering; Simulation; Spacecraft Design

20070034997 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Addition of a Low Altitude Tethys Flyby to the Nominal Cassini Tour
Buffington, Brent; Strange, Nathan; Ionasescu, Rodica; August 7, 2005; 4 pp.; In English; AAS/AIAA Astrodynamics Specialist Conference, 7-11 Aug. 2005, Lake Tahoe, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40432

Of the eight Saturnian icy satellites, all but Mimas and Tethys have low altitude targeted flybys during the 4-year nominal Cassini spacecraft tour. In November 2004, the existence of a potential low-altitude Tethys flyby was discovered; this low-altitude Tethys flyby, added to the nominal tour in March 2005, corresponds to a 1500 km nontargeted periapsis altitude on September 24, 2005 and requires a Av cost of 8 mls. This paper details the methods used to determine the Tethys non-targeted flyby altitude, driven by navigational requirements and operational constraints, in addition to several trajectory modifications implemented to reduce total Av costs, and in some cases, simultaneous increases in scientific return.
Author
Cassini Mission; Icy Satellites; Flyby Missions; Tethys; Navigation; Microwave Landing Systems

20070034998 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Atmospheric Electron-Induced X-Ray Spectrometer (AEXS) Development
Wilcox, Jaroslava Z.; Urgiles, Eduardo; Toda, Risaku; George, Thomas; Douglas, Susanne; Crisp, Joy; April 24, 2005; 4 pp.; In English; European Geosciences Union General Assembly, 24-29 Apr. 2005, Vienna, Austria; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40433

This paper describes the progress in the development of the so-called Atmospheric Electron X-ray Spectrometer (AEXS) instrument in our laboratory at JPL. The AEXS is a novel miniature instrument concept based on the excitation of characteristic X-Ray Fluorescence (XRF) and luminescence spectra using a focused electron beam, for non-destructive evaluation of surfaces of samples in situ, in planetary ambient atmosphere. In situ operation is obtained through the use of a thin electron transmissive membrane to isolate the vacuum within the AEXS electron source from the outside ambient atmosphere. By using a focused electron beam, the impinging electrons on samples in the external atmosphere excite XRF

spectra from the irradiated spots with high-to-medium spatial resolution. The XRF spectra are analyzed using an energy-dispersive detector to determine surface elemental composition. The use of high- intensity electron beam results in rapid spectrum acquisition (several minutes), and consequently low energy consumption (several tens of Joules) per acquired XRF spectrum in comparison to similar portable instruments.
Author
X Ray Spectrometers; Electron Spectroscopy; X Ray Fluorescence; Planetary Atmospheres; Nondestructive Tests; Dispersing

20070035003 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Deep Space 1: Testing New Technologies for Future Small Bodies Missions
Rayman, Marc D.; October 1, 2001; 15 pp.; In English; International Astronomical Federation (IAF), International Astronautical Congress, 1-5 Oct. 2001, Toulouse, France; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40468

Launched on October 24, 1998, Deep Space 1 (DS1) was the first mission of NASA's New Millennium Program, chartered to validate in space high-risk, new technologies important for future space science programs. The advanced technology payload that was tested on DS1 comprises solar electric propulsion, solar concentrator arrays, autonomous on-board navigation and other autonomous systems, several telecommunications and microelectronics devices, and two low-mass integrated science instrument packages. The mission met or exceeded all of its success criteria. The 12 technologies were rigorously exercised so that subsequent flight projects would not have to incur the cost and risk of being the fist users of these new capabilities. Examples of the benefits to future small body missions from DS1's technologies will be described.
Author
Deep Space 1 Mission; Space Programs; Solar Electric Propulsion; Solar Collectors; Telecommunication; Payloads; Microelectronics; Instrument Packages

20070035053 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Access to Space for Technology Validation Missions: A Practical Guide
Herrell, Linda M.; March 3, 2007; 8 pp.; In English; IEEE Aerospace Conference, 3-10 Mar. 2007, Big Sky, MT, USA; Original contains color illustrations
Report No.(s): IEEEAC Paper #1175, Version 2; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40322

Space technology experiments and validation missions share a common dilemma with the aerospace industry in general: the high cost of access to space. Whether the experiment is a so-called university cubesat, a university measurement experiment, or a NASA New Millennium Program (NMP) technology validation mission, the access to space option can be scaled appropriately for the particular constraints. A cubesat might fly as one of a number of cubesats that negotiate a flight on an experimental vehicle. A university experiment might do the same. A NASA flight validation might partner with an Air Force experimental mission.
Author
Space Technology Experiments; Space Missions; Costs; Spaceborne Experiments; Aerospace Engineering; Cost Effectiveness

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20070034150 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Computing Spacetimes: From Cosmology to Black Holes
Centrell, Joan; June 07, 2007; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Numerical relativity, the solution of the Einstein equations on a computer, is one of the most challenging and exciting areas of physics. Richard Matzner has played a key role in this subject from its birth, roughly 3 decades ago, to the present. This talk will present some of the highlights of Richard's work in numerical relativity.
Author
Black Holes (Astronomy); Cosmology; Einstein Equations; Relativity; Numerical Analysis

20070034203 California Univ., San Diego, La Jolla, CA, USA

INTEGRAL and XMM-Newton Observations of the X-Ray Pulsar IGR J16320-4751/AX J1691.9-4752

Rodriquez, J.; Bodaghee, A.; Kaaret, P.; Tomsick, J. A.; Kuulkers, E.; Malaguti, G.; Petrucci, P.-O.; Cabanac, C.; Chernyakova, M.; Corbel, S.; Deluit, S.; DiCocco, G.; Ebisawa, K.; Goldwurm, A.; Henri, G.; Lebrun, F.; Paizis, A.; Walter, R.; Foschini, L.; Monthly Notices of the Royal Astronomical Society; September 14, 2006; ISSN 0035-8711; Volume 366, pp. 274-282; In English

Contract(s)/Grant(s): NNG04GQ05G; Copyright; Avail.: Other Sources

We report on observations of the X-ray pulsar IGR J16320-4751 (also known as AX J1631.9-4752) performed simultaneously with International Gamma-Ray Astrophysics Laboratory (INTEGRAL) and XMM-Newton. We refine the source position and identify the most likely infrared counterpart. Our simultaneous coverage allows us to confirm the presence of X-ray pulsations at approximately 1300 s, that we detect above 20 keV with INTEGRAL for the first time. The pulse fraction is consistent with being constant with energy, which is compatible with a model of polar accretion by a pulsar. We study the spectral properties of IGR J16320-4751 during two major periods occurring during the simultaneous coverage with both satellites, namely a flare and a non-flare period. We detect the presence of a narrow 6.4 keV iron line in both periods. The presence of such a feature is typical of supergiant wind accretors such as Vela X-1 or GX 301-2. We inspect the spectral variations with respect to the pulse phase during the non-flare period, and show that the pulse is solely due to variations of the X-ray flux emitted by the source and not due to variations of the spectral parameters. Our results are therefore compatible with the source being a pulsar in a High Mass X-ray Binary. We detect a soft excess appearing in the spectra as a blackbody with a temperature of approximately 0.07 keV. We discuss the origin of the X-ray emission in IGR J16320-4751: while the hard X-rays are likely the result of Compton emission produced in the close vicinity of the pulsar, based on energy argument we suggest that the soft excess is likely the emission by a collisionally energized cloud in which the compact object is embedded.

Author

Pulsars; Supergiant Stars; Spectral Counterparts (Astronomy); X Ray Astronomy; X Ray Stars

20070034206 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Astrometeric Science with ESA PlanetQuest

Shao, Michael; Unwin, Stephen; August 23, 2006; 16 pp.; In English; IAU General Assembly Joint Discussion 16, 23 Aug. 2006, Prague, Czech Republic; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40277

This viewgraph presentation reviews Astrometry with the Space Interferometry Mission (ESA) PlanetQuest. The topics include: 1) ESA PlanetQuest - the World's First Long- Baseline Optical Interferometer in Space; 2) National Academy of Sciences / NRC endorses ESA PlanetQuest; 3) ESA Planet Search; 4) Planetary System Architectures & Diversity; 5) ESA Search for 1~10 M(sub Earth) Planets Around Nearby Stars; 6) Deep Search of 120 nearby stars; 7) Planets around Young Stars; 8) ESA PlanetQuest Science Team; 9) Dark Halo of our Galaxy; 10) Dynamics of Galaxy Groups within 5 Mpc; 11) Probing Active Galactic Nuclei with Astrometry; 12) Snapshot Observing Mode: Astrometry for the masses; 13) ESA Technology Development is Complete; and 14) ESA Hardware, Tested for Flight.

CASI

Astrometry; Interferometry; NASA Space Programs; Spacecraft Instruments; Technology Utilization; Planetary Systems

20070034207 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Precision Astrometry with ESA PlanetQuest: Science and Mission Update

Shao, Michael; Unwin, Stephen; August 21, 2006; 22 pp.; In English; IAU General Assembly Joint Discussion 16, 23 Aug. 2006, Prague, Czech Republic; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/40279

This viewgraph presentation gives a science and mission update of precision Astrometry with the Space Interferometry Mission (ESA) PlanetQuest. The topics include: 1) ESA PlanetQuest - the World s First Long- Baseline Optical Interferometer in Space; 2) National Academy of Sciences / NRC endorses ESA PlanetQuest; 3) Astrometry with an Interferometer; 4) Overall Configuration (deployed); 5) ESA Planet Finding Capabilities; 6) Planet detection with ESA - minimum masses; 7) Searching for Terrestrial Planets with SIM; 8) Planets around Young Stars; 9) ESA PlanetQuest Science Team; 10) ESA Astrophysics; 11) SIM's Reach Extends Across our Entire Galaxy to do Precision Astrophysics; 12) Dynamics of Galaxy Groups within 5 Mpc; 13) Galactic tidal tails; 14) Dark Halo of our Galaxy; 15) Probing Active Galactic Nuclei with Astrometry; 16) Sample tile for relative astrometry; 17) Astrometric signatures of AGN; 18) Snapshot Observing Mode:

Astrometry for the masses; and 19) ESA Technology Development is Complete.
CASI
Astrometry; Space Missions; NASA Space Programs; Spacecraft Instruments; Optical Measuring Instruments; Planetary Systems; Precision; Astronomical Interferometry; Astrophysics; Interferometry

20070034753 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Planetary Moon Cycler Trajectories
Russell, Ryan P.; Strange, Nathan J.; January 28, 2007; 20 pp.; In English; AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - 1 Feb. 2007, Sedona, AZ, USA; Original contains color illustrations
Report No.(s): AAS 07-118; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40318

Free-return cycler trajectories repeatedly shuttle a spacecraft between two bodies using little or no fuel. Here, the cycler architecture is proposed as a complementary and alternative method for designing planetary moon tours. Previously applied enumerative cycler search and optimization techniques are generalized and specifically implemented in the Jovian and Saturnian moon systems. In addition, the algorithms are tested for general use to find non-Earth heliocentric cyclers. Overall, hundreds of ideal model ballistic cycler geometries are found and several representative cases are documented and discussed. Many of the ideal model solutions are found to remain ballistic in a zero radius sphere of influence patched conic ephemeris model, and preliminary work in a high-fidelity fully integrated model demonstrates near-ballistic cycles for several example cases.
Author
Trajectories; Saturn (Planet); Cycles; Moon; Algorithms

20070034780 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Near-Earth Asteroid 2005 CR37: Radar Images and Photometry of a Candidate Contact Binary
Benner, Lance A. M.; Nolan, Michael C.; Ostro, Steven J.; Giorgini, Jon D.; Pray, Donald P.; Harris, Alan W.; Magri, Christopher; Margot, Jean-Luc; Icarus; March 13, 2006; ISSN 0019-1035; Volume 182, pp. 474-481; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NSF AST-02-05974; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40302; http://dx.doi.org/10.1016/j.icarus.2006.01.016

Arecibo (2380 MHz, 13 cm) radar observations of 2005 CR37 provide detailed images of a candidate contact binary: a 1.8-km-long, extremely bifurcated object. Although the asteroid's two lobes are round, there are regions of modest topographic relief, such as an elevated, 200-m-wide facet, that suggest that the lobes are geologically more complex than either coherent fragments or homogeneous rubble piles. Since January 1999, about 9% of NEAs larger than approx.200 m imaged by radar can be described as candidate contact binaries.
Author
Asteroids; Photometry; Radar Imagery; Radar Tracking

20070034782 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Image of Fomalhaut Dust Ring at 350 Microns: The Relative Column Density Map Shows Pericenter-Apocenter Asymmetry
Marsh, K. A.; Velusamy, T.; Dowell, C. D.; Grogan, K.; Beichman, C. A.; The Astrophysical Journal Letters; January 12, 2005; Volume 620, pp. L47-L50; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NSF AST-02-29008; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40305

We have imaged the circumstellar disk of Fomalhaut at 350 mm wavelength, using SHARC II (Submillimeter High Angular Resolution Camera II) at the Caltech Submillimeter Observatory. The spatial resolution of the raw images (9') has been enhanced by a factor of 3 using the HiRes deconvolution procedure. We find that at this wavelength and signal-to-noise ratio (approx.12), the observed morphology is that of a simple inclined ring (i approx. 70 deg), with little or no other apparent structure--this is the first observation that shows clearly the ring morphology of the disk. We have combined our 350 mm data with Spitzer Space Telescope images at 24, 70, and 160 mm in order to estimate the two-dimensional spatial variation of relative column density ('tau map') using our DISKFIT procedure. The tau map is based on the following physical assumptions: (1) the wavelength variation of opacity is the same throughout the disk, (2) the radial variation of dust temperature is dictated by the energy balance of individual grains in the stellar radiation field, and (3) the vertical scale height

of the disk follows a power-law radial variation. The results confirm the ringlike morphology but also show that the geometric center is displaced from the star by about 8 AU and that the ring has an apocentric enhancement of approximately 14% in integrated column density. If we interpret the displacement in terms of elliptical orbital motion due to gravitational perturbation by an unseen planet, then the implied forced eccentricity is ~0.06; dynamical modeling then predicts an apocentric density enhancement consistent with that inferred from the tau map.
Author
Space Infrared Telescope Facility; Submillimeter Waves; Signal to Noise Ratios; High Resolution; Spatial Resolution; Morphology; Dust

20070034813 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Gravitational Waves from Black Hole Mergers
Centrella, Joan; [2007]; 1 pp.; In English; Space Telescope Science institute Spring Conference on Black Hole, 23 Apr. 2007, Baltimore, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

The final merger of two black holes is expected to be the strongest gravitational wave source for ground-based interferometers such as LIGO, VIRGO, and GEO600, as well as the space-based interferometer LISA. Observing these sources with gravitational wave detectors requires that we know the radiation waveforms they emit. Since these mergers take place in regions of extreme gravity, 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 black hole mergers 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. Within the past few years, however, this situation has changed dramatically, with a series of remarkable breakthroughs. This talk will focus on new simulations that are revealing the dynamics and waveforms of binary black hole mergers, and their applications in gravitational wave detection, data analysis, and astrophysics.
Author
Black Holes (Astronomy); Gravitational Waves; LISA (Observatory); Simulation; Astrophysics

20070034818 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SWIFT Observations of a Far UV Luminosity Component in SS433
Cannizzo, J. K.; Boyd, P. T.; Dolan, J. F.; February 07, 2007; 4 pp.; In English
Contract(s)/Grant(s): NNG06EO90A; Copyright; Avail.: CASI: A01, Hardcopy

SS433 is a binary system showing relativistic Doppler shifts in its two sets of emission lines. The origin of its UV continuum is not well established. We observed SS433 to determine the emission mechanism responsible for its far UV spectrum. The source was observed at several different phases of both its 13 d orbital period and 162.5 d precession period using the UVOT and XRT detector systems on Swift. The far UV spectrum down to 1880 Angstrom lies significantly above the spectral flux distribution predicted by extrapolating the reddened blackbody continuum that fits the spectrum above 3500 Angstroms. The intensity of the far UV flux varies over a period of days and the variability is correlated with the variability of the soft X-ray flux from the source. An emission mechanism in addition to those previously detected in the optical and X-ray regions must exist in the far UV spectrum of SS433.
Author
Luminosity; Far Ultraviolet Radiation; Swift Observatory; X Ray Binaries; Ultraviolet Spectra

20070034820 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Properties of X-Ray Flashes and X-Ray-Rich GRBs Observed by Swift
Sakamoto, T.; Yamazaki, R.; Cummings, J.; Krimm, H.; Parsons, A.; Hullinger, D.; Barbier, L.; Fenimore, E.; Markwardt, C.; Tueller, J.; Sato, G.; Barthelmy, S.; Gehrels, N.; Palmer, D.; May 27, 2007; 1 pp.; In English; American Astronomical Society 210th Hawaii Meeting, 27-31 May 2007, Honolulu, HI, USA
Contract(s)/Grant(s): NCC5-637; Copyright; Avail.: Other Sources; Abstract Only

We describe and discuss the spectral and temporal characteristics of the prompt emission and X-ray afterglow emission of X-ray flashes (XRFs) detected and observed by Swift between December 2005 and September 2006. We compare these characteristics to a sample of X-ray rich gamma-ray bursts (XRRs) and conventional classical gamma-ray bursts (C-GRBs)observed during the same period. We confirm the correlation between Epeak and fluence noted by others and find further evidence that XRFs and C-GRBs form a continuum. We also confirmed that our known redshift samples are consistent with the correlation between the peak energy (Epeak) and the isotropic radiated energy (Eiso), so called the Epeak-Eiso

relation. The spectral properties of X-ray afterglows are similar to those of gamma-ray burst afterglows, but the temporal properties of the two classes are quite different. We found that the light curves of C-GRBs afterglow show a break to steeper indices (shallow-to-steep break) at much earlier times than do XRF afterglows. Moreover, the overall luminosity of X-ray afterglows of XRFs are systematically smaller by a factor of two or more compared with that of C-GRBs. These distinct differences in the X-ray afterglow between XRFs and C-GRBs are key to understanding not only a mysterious shallow-to-steep phase in the X-ray afterglow but also the unique nature of XRFs.
Author
Gamma Ray Bursts; X Rays; Afterglows; Swift Observatory

20070034844 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Near-Earth Asteroid Tracking with the Maui Space Surveillance System (NEAT/MSSS)
Helin, Eleanor F.; Pravdo, Steven H.; Lawrence, Kenneth J.; Hicks, Michael D.; September 10, 2001; 9 pp.; In English; Air Force Maui Optical and Supercomputing Site (AMOS) Technical Conference, 10-14 Sep. 2001, Mau, HI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40397

Over the last year the Jet Propulsion Laboratory's (JPL) Near-Earth Asteroid Tracking (NEAT) program has made significant progress and now consists of two simultaneously-operating, autonomous search systems on the 1.2-m (48') telescopes: on the Maui Space Surveillance System (NEAT/MSSS) and NEAT/Palomar on the Palomar Observatory's Oschin telescope. This paper will focus exclusively on the NEAT/MSSS system. NEAT/MSSS is operated as a partnership between NASA/JPL and the USA Air Force Research Laboratory (AFRL), utilizing the AFRL 1.2-m telescope on the 3000-m summit of Haleakala, Maui, The USAF Space Command (SPCMD) contributed financial support to build and install the 'NEAT focal reducer' on the MSSS 1.2-m telescope giving it a large field of view (2.5 square degrees), suitable for the near-earth object (NEO),both asteroids and comets, survey. This work was completed in February 2000. AFRL has made a commitment to NEAT/MSSS that allows NEAT to operate full time with the understanding that AFRL participate as partners in NEAT/MSSS and have use of the NEAT camera system for high priority satellite observations during bright time (parts of 12 nights each month). Currently, NEAT has discovered 42 NEAs including 12 larger than 1-km, 5 Potentially Hazardous Asteroids (PHAs), 6 comets, and nearly 25,000 asteroid detections since March 2000.
Author
Near Earth Objects; Satellite Observation; Asteroids; Field of View; Telescopes; Autonomy

20070034871 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Keck Interferometer Nuller: System Architecture and Laboratory Performance
Serabyn, E.; Booth, A.; Colavita, M. M.; Creech-Eakman, M.; Crawford, S.; Garcia, J.; Johnson, R.; Hovland, E.; Koresko, C.; Ligon, R.; Martin, S. R.; Mennesson, B.; Moore, J.; Palmer, D.; Paine, C.; Shao, M.; Swain, M.; Smythe, R.; Vasisht, G.; June 21, 2004; 10 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40426

The first high-dynamic-range interferometric mode planned to come on line at the Keck Observatory is mid-infrared nulling. This observational mode, which is based on the cancellation of the on-axis starlight arriving at the win Keck telescopes, will be used to examine nearby stellar systems for the presence of circumstellar exozodiacal emission. This paper describes the system level layout of the Keck Interferometer Nuller (KIN), as well as the final performance levels demonstrated in the laboratory integration and test phase at the Jet Propulsion Laboratory prior to shipment of the nuller hardware to the Keck Observatory in mid-June 2004. On-sky testing and observation with the mid-infrared nuller are slated to begin in August 2004.
Author
Infrared Telescopes; Astronomical Interferometry; Astronomical Observatories; Stellar Systems; Stellar Envelopes

20070034940 NASA Marshall Space Flight Center, Huntsville, AL, USA
Updates to the MSFC Meteoroid Stream Model
Moser, D. E.; Cooke, W. J.; June 11, 2007; 1 pp.; In English; Meteoroids 2007, 11-15 Jun. 2007, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034940

The Marshall Space Flight Center (MSFC) Meteoroid Stream Model simulates particle ejection and subsequent evolution

from comets in order to provide meteor shower forecasts to spacecraft operators for hazard mitigation and planning purposes. The model, previously detailed, has recently been updated; the changes include the implementation of the RADAU integrator, an improved planetary treatment, and the inclusion of general relativistic effects in the force function. The results of these updates are investigated with respect to various meteoroid streams and the outcome presented.
Author
Forecasting; Meteoroids; Meteoroid Hazards; Meteoroid Showers; Mathematical Models

20070034941 NASA Marshall Space Flight Center, Huntsville, AL, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Prelude to and Aftermath of the Giant Flare of 2004 December 27: Persistent and Pulsed X-ray Properties of SGR 1806-20 from 1993 to 2005
Woods, Peter M.; Kouveliotou, Chryssa; Finger, Mark H.; Gogus, Ersin; Wilson, Colleen A.; Patel, Sandeep K.; Hurley, Kevin; Swank, Jean H.; Astrophysical Journal; January 2007; Volume 654, pp. 470-486; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04GO50G; NAG5-9350; NAG5-11451; NAG5-13080; Copyright; Avail.: Other Sources

We report on the evolution of key spectral and temporal parameters of SGR 1806-20 prior to and following the highly energetic giant flare of 2004 December 27. Using RXTE, we track the pulse frequency of the SGR and find that the spin-down rate varied erratically in the months before and after the flare. Contrary to the giant flare in SGR 1900+14, we find no evidence for a discrete jump in spin frequency at the time of the December 27th flare (Absolute value of (Delta * upsilon/upsilon) < 5 10 (exp -6)). In the months surrounding the flare, we find a strong correlation between pulsed flux and torque consistent with the model for magnetar magnetosphere electrodynamics proposed. As with the flare in SGR 1900+14, the pulse morphology of SGR 1806-20 changes drastically following the flare. Using Chandra and other publicly available imaging X-ray detector observations, we construct a spectral history of SGR 1806-20 from 1993 to 2005. The usual magnetar persistent emission spectral model of a power law plus a blackbody provides an excellent fit to the data. We confirm the earlier finding of increasing spectral hardness of SGR 1806-20 between 1993 and 2004. However, our results indicate significant differences in the temporal evolution of the spectral hardening. Rather than a direct correlation between torque and spectral hardness, we find evidence for a sudden torque change that preceded a gradual hardening of the energy spectrum on a timescale of years. Interestingly, the spectral hardness, spin-down rate, phase-averaged flux, and pulsed flux of SGR 1806-20 all peak months before the flare epoch.
Author
Magnetars; Pulsars; X Ray Astronomy; Soft Gamma Repeaters; Gamma Ray Bursts; Hardness

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070034202 California Univ., San Diego, La Jolla, CA, USA
Black Hole Spectral States and Physical Connections
Tomsick, John A.; Advances in Space Research; December 13, 2005; ISSN 0273-1177; Volume 38, pp. 2805-2809; In English
Contract(s)/Grant(s): NAG5-13055; NNG04GA49G; NAG5-12703; NNG04GP08G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.asr.2005.12.027

The dramatic changes seen in the X-ray spectral and timing properties of accreting black hole candidates (BHCs) provide important clues about the accretion and jet formation processes that occur in these systems. Dividing the different source behaviors into spectral states provides a framework for studying BHCs. To date, there have been three main classification schemes with Luminosity-based, Component-based, or Transition-based criteria. The canonical, Luminosity-based criteria and physical models that are based on this concept do not provide clear explanations for several phenomena, including hysteresis of spectral states and the presence of jets. I discuss the re-definitions of states, focusing on an application of the Component-based states to more than 400 RXTE observations of the recurrent BHC 4U 1630-47. We compare the X-ray properties for the recent 2002-2004 outburst to those of an earlier (1998) outburst, during which radio jets were observed. The results suggest a connection between hysteresis of states and major jet ejections, and it is possible that both of these are related to the evolution of the inner radius of the optically thick accretion disk.
Author
Accretion Disks; Black Holes (Astronomy); Spectra; X Ray Astronomy; Hysteresis

20070034822 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evidence for a Broad Relativistic Iron Line from the Neutron Star LMXB Ser X-1
Bhattacharyya, Sudip; Strohmayer, Tod E.; [2007]; 13 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

We report on an analysis of XMM-Newton data from the neutron star low mass X-ray binary (LMXB) Serpens X-1 (Ser X-1). Spectral analysis of EPIC PN data indicates that the previously known broad iron Ka emission line in this source has a significantly skewed structure with a moderately extended red wing. The asymmetric shape of the line is well described with the laor and diskline models in XSPEC, which strongly supports an inner accretion disk origin of the line. To our knowledge this is the first strong evidence for a relativistic line in a neutron star LMXB. This finding suggests that the broad lines seen in other neutron star LMXBs likely originate from the inner disk as well. Detailed study of such lines opens up a new way to probe neutron star parameters and their strong gravitational fields. The laor model describes the line from Ser X-1 somewhat better than diskline, and suggests that the inner accretion disk radius is less than 6GM/c(exp 2). This is consistent with the weak magnetic fields of LMXBs, and may point towards a high compactness and rapid spin of the neutron star. Finally, the inferred source inclination angle in the approximate range 50-60 deg is consistent with the lack of dipping from Ser X-1. Author

Neutron Stars; X Ray Binaries; Spectrum Analysis; Iron; Accretion Disks

20070034823 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Science Drivers for Multiwavelength Investigations Using the New Gamma-Ray Observatories and Missions
Thompson, Dave; August 09, 2007; 8 pp.; In English; Second Multiwavelength Workshop for Next Generation Gamma-Ray Experiments, 9-10 Aug. 2007, Chicago, IL, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034823

This viewgraph presentation discusses the need for multiwavelength research in terms of types of observation facilities, advances in communication, astrophysics vs. astronomy, and maximizing the scientific return from new gamma-ray facilities. CASI

Spectrum Analysis; Wavelengths; Gamma Ray Astronomy

20070034890 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stellar Imager
Carpenter, Kenneth; February 27, 2007; 6 pp.; In English; Original contains black and white illustrations; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034890

The Stellar Imager (SI) is one of NASA's 'Vision Missions' - concepts for future, space-based, strategic missions that could enormously increase our capabilities for observing the Cosmos. SI is designed as a UV/Optical Interferometer which will enable 0.1 milli-arcsecond (mas) spectral imaging of stellar surfaces and, via asteroseismology, stellar interiors and of the Universe in general. The ultra-sharp images of the Stellar Imager will revolutionize our view of many dynamic astrophysical processes by transforming point sources into extended sources, and snapshots into evolving views. SI, with a characteristic angular resolution of 0.1 milli-arcseconds at 2000 Angstroms, represents an advance in image detail of several hundred times over that provided by the Hubble Space Telescope. The Stellar Imager will zoom in on what today-with few exceptions - we only know as point sources, revealing processes never before seen, thus providing a tool as fundamental to astrophysics as the microscope is to the study of life on Earth. SI's science focuses on the role of magnetism in the Universe, particularly on magnetic activity on the surfaces of stars like the Sun. It's prime goal is to enable long-term forecasting of solar activity and the space weather that it drives, in support of the Living With a Star program in the Exploration Era. SI will also revolutionize our understanding of the formation of planetary systems, of the habitability and climatology of distant planets, and of many magneto-hydrodynamically controlled processes in the Universe. Stellar Imager is included as a 'Flagship and Landmark Discovery Mission' in the 2005 Sun Solar System Connection (SSSC) Roadmap and as a candidate for a 'Pathways to Life Observatory' in the Exploration of the Universe Division (EUD) Roadmap (May, 2005) and as such is a candidate mission for the 2025-2030 timeframe. An artist's drawing of the current 'baseline' concept for SI is presented.
Author

Imaging Techniques; Astrophysics; Interferometers; Fizeau Effect; Asteroseismology; Ultraviolet Radiation; Stellar Activity; Sun

20070034989 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cassini Observations of Saturn's Dawn-Magnetotail Region and their Relation to Models of Saturn's Aurora: Preliminary Results

Sittler, E. C.; Blanc, M. F.; Richardson, J. D.; Rymer, A.; Thomsen, M.; Cooper, J. F.; Simpson, D.; Khurana, K. K.; Dougherty, M.; [2006]; 1 pp.; In English; Fall 2006 AGU Meeting, 11-15 Dec. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Using Cassini plasma and magnetic field observations from the dawn meridian of Saturn s outer magnetosphere to Saturn s magnetotail region, we investigate the applicability of the centrifugal instability model by Sittler et al. [2006] for Saturn s auroral response to the solar wind, versus the reconnection model of Saturn s aurora by Cowley et al. [2005]. We use Cassini Plasma Spectrometer (CAPS) Ion Mass Spectrometer (IMS) and Electron Plasma Spectrometer (ELS) observations to characterize the plasma environment. ELS and magnetometer observations are used to map out the morphology of the outer magnetosphere from dawn to midnight local time. IMS observations are used to measure plasma flow velocities from which one can infer rotation versus convective flows. IMS composition measurements are used to trace the source of plasma from the inner magnetosphere (protons, H2 and water group ions) versus an external solar wind source (protons and Heff ions). A critical parameter for both models is the strength of the convection electric field with respect to the rotational electric field for the large scale magnetosphere. Is there a significant return flow from the magnetotail? Pitch angle distributions also play an important role as a discriminator. If the magnetosphere tends to conserve angular momentum as suggested by Sittler et al. [2006], then we expect to see an anti-correlation between rotational flow component and radial flow velocities. All will be investigated.

Author

Magnetohydrodynamic Flow; Auroras; Saturn (Planet); Magnetic Fields; Planetary Magnetotails; Solar Wind; Mass Spectrometers; Morphology; Convective Flow

20070034990 NASA Goddard Space Flight Center, Greenbelt, MD, USA

System Engineering the Space Infrared Interferometric Telescope (SPIRIT)

Hyde, Tristram T.; Leisawitz, David T.; Rinehart, Stephen; August 24, 2007; 2 pp.; In English; SPIE International Symposium on Optics and Photonics. UV Optical/IR Space Telescopes: Innovation Technologies and Concepts III, 24-27 Aug. 2007, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Space Infrared Interferometric Telescope (SPIRIT) recently studied as a candidate Origins Probe mission with funding support from NASA s Astrophysics Division. SPIRIT will have three primary science objectives: a. learn how planetary systems form from protostellar disks, and how they acquire their chemical organization; b. measure the resonant structures in exozodiacal debris disks to find and characterize extrasolar planets; and c. learn how high-redshift galaxies formed and merged to form the present-day population of galaxies. SPIRIT will accomplish these objectives through infrared observations with a two aperture interferometric instrument. This paper shows many of the systems level trades that went into the chosen design for instrument and spacecraft details. The error budget for several key performance values allocates tolerances to all contributing factors, and a performance model of the spacecraft plus instrument system demonstrates meeting those allocations with margin. Observational parameters along with spacecraft pointing and communication downlink parameters are traded against instrument detector, thermal, structural, and control bandwidth parameters.

Author

Spaceborne Telescopes; Systems Engineering; Planetary Systems; Infrared Astronomy; Astrophysics; Performance Prediction

20070034991 Ohio Univ., Athens, OH, USA

Cosmological Effects of Powerful AGN Outbursts in Galaxy Clusters: Insights from an XMM-Newton Observation of MS 0735+7421

Gitti, M.; McNamara, B. R.; Nulsen, P. E. J.; Wise, M. W.; The Astrophysical Journal; May 10, 2007; Volume 660, Part 1, pp. 1118-1136; In English

Contract(s)/Grant(s): NNG05GK87G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1086/512800

We report on the results of an analysis o f XMM-Newton observations o f MS 0735+7421, the galaxy cluster that hosts the most energetic AGN outburst currently known. .The previous chandra image shows twin giant x-ray cavities (approx.200 kpc diameter) filled with radio emission and surrounded by a weak shock front. XMM data are consistent with these findings. The total energy in cavities and shock (1E62 erg(approx.100 kpc), to heat the gas within 1 Mpc by approx.1/4 kev per particle. The cluster exhibits an upward departure (factor approx.2) from the mean L-T relation. The boost in emissivity produced by the ICM compression in the bright shells due to the cavity expansion may contribute to explain the high luminosity and high

central gas mass fraction that we measure. The scaled temperature and metallicity profiles are in general agreement with those observed in re1axed clusters. Also, the quantities we measure are consistent with the observed M-T relation. We conclude that violent outbursts such as the one in MS 0735+7421 do not cause dramatic scaling relations (other than the L-T relation). However, if they are relatively common they may play a role in creating the global cluster properties.
Author
Cosmology; Galactic Clusters; Shock Fronts; Emissivity; Luminosity; Radio Emission

20070034999 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Scattering and Absorption by Nonspherical Particles in Planetary Atmospheres
West, Robert A.; May 16, 2005; 4 pp.; In English; IAA 8th Conference on Electromagnetic and Light Scattering by Nonspherical Particles, 16-20 May 2005, Salobrena, Spain; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40434

The atmospheres of Mars, the giant planets, and Titan all support populations of nonspherical particles. Analyses of observations of these atmospheres therefore rely on an understanding of the optical properties of nonspherical particles. We can glean information on particle size and composition from the wavelength dependence of the optical depth and from the shape of the forward peak of the scattering phase function. Additional information comes from polarization measurements which have been especially fruitful for Titan's haze. The Mars atmosphere contains mineral dust particles with effective radii near 1.6 micro meters, and water ice particles with radii between about 1 and 4 micro meters. The uppermost tropospheric hazes in Jupiter and Saturn are composed of ice crystals of ammonia, water and possibly traces of ammonium hydrosulfide, Methane ice and hydrogen sulfide ice are present in the atmospheres of Uranus and Neptune. Size estimation for these hazes in the giant planets is difficult, and even the expected spectral signatures are elusive, Titan's haze is both forward scattering and strongly polarized - a combination which points toward a fractal aggregate struc1.ure of 10 - 100 or more organic monomers whose radius is about 0.06 micro meters. Polar stratospheric hazes on Jupiter and Saturn also display this characteristic.
Author
Planetary Atmospheres; Forward Scattering; Mars Atmosphere; Gas Giant Planets; Titan; Optical Properties; Haze; Scattering Functions

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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*.

20070034367 Brown Univ., Providence, RI, USA
Experimental and Petrological Constraints on Lunar Differentiation from the Apollo 15 Green Picritic Glasses
Elkins-Tanton, Linda T.; Chatterjee, Nilanjan; Grove, Timothy L.; Meteoritics and Planetary Science; 2003; Volume 38, Nr. 4, pp. 515-527; In English
Contract(s)/Grant(s): NAG5-13051; Copyright; Avail.: Other Sources

Phase equilibrium experiments on the most magnesian Apollo 15C green picritic glass composition indicate a multiple saturation point with olivine and orthopyroxene at 1520 C and 1.3 GPa (about 260 km depth in the moon). This composition has the highest Mg# of any lunar picritic glass and the shallowest multiple saturation point. Experiments on an Apollo 15A composition indicate a multiple saturation point with olivine and orthopyroxene at 1520 C and 2.2 GPa (about 440 km depth in the moon). The importance of the distinctive compositional trends of the Apollo 15 groups A, B, and C picritic glasses merits the reanalysis of NASA slide 15426,72 with modern electron microprobe techniques. We confirm the compositional trends reported by Delano (1979, 1986) in the major element oxides SiO2, TiO2, Al2O3, Cr2O3, FeO, MnO, MgO, and CaO, and we also obtained data for the trace elements P2O5, K2O, Na2O, NiO, S, Cu, Cl, Zn, and F. Petrogenetic modeling demonstrates that the Apollo 15 A-B-C glass trends could not have been formed by fractional crystallization or any continuous assimilation/fractional crystallization (AFC) process. The B and C glass compositional trends could not have been formed by batch or incremental melting of an olivine + orthopyroxene source or any other homogeneous source, though the A glasses may have been formed by congruent melting over a small pressure range at depth. The B compositional trend is well modeled by starting with an intermediate A composition and assimilating a shallower, melted cumulate, and the C compositional trend is well modeled by a second assimilation event. The assimilation process envisioned is one in which heat and mass transfer

were separated in space and time. In an initial intrusive event, a picritic magma crystallized and provided heat to melt magma ocean cumulates. In a later replenishment event, the picritic magma incrementally mixed with the melted cumulate (creating the compositional trends in the green glass data set), ascended to the lunar surface, and erupted as a fire fountain. A barometer created from multiple saturation points provides a depth estimate of other glasses in the A-B-C trend and of the depths of assimilation. This barometer demonstrates that the Apollo 15 A-B-C trend originated over a depth range of approx.460 km to approx.260 km within the moon.
Author
Petrology; Apollo 15 Flight; Lunar Geology; Glass; Magnesium; Spaceborne Experiments; Lunar Surface

20070034381 Brown Univ., Providence, RI, USA
Magmatic Processes That Produced Lunar Fire Fountains
Elkins-Tanton, Linda T.; Chatterjee, Nilanjan; Grove, Timothy L.; Geophysical Research Letters; May 22, 2003; ISSN 0094-8276; Volume 30, No. 10; 4 pp.; In English
Contract(s)/Grant(s): NAG5-13051; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2003GL017082

Reanalysis of the Apollo 15 A, B, and C green glass beads from slide 15426,72, led to the discovery of patchy, highly vesicular glass rims adhering to beads. These rims are high in S and Ni and low in MgO, but otherwise compositionally similar to the green glasses. We find that these rims represent a unique melt composition that places constraints on lunar magmatic processes. Combining the compositional data for the vesicular glass rims with new minor element data for the green glass beads leads us to hypothesize that the vesicular rim fluid originated near the green glass source, at about 2.2 GPa. These findings support the theory of a heterogeneous lunar mantle, and suggest that sulfur did not drive the eruption from depth, but that degassing volatiles into the vacuum did drive the final fire fountain eruption.
Author
Magma; Lunar Geology; Geophysics; Fires; Lunar Mantle

20070034435 Massachusetts Inst. of Tech., Cambridge, MA, USA
Sulfur Saturation Limits in Silicate Melts and their Implications for Core Formation Scenarios for Terrestrial Planets
Holzheid, Astrid; Grove, Timothy L.; American Mineralogist; [2002]; ISSN 0003-004X; Volume 87, pp. 227-237; In English
Contract(s)/Grant(s): NAG5-13051; NAG5-4768; Copyright; Avail.: Other Sources

This study explores the controls of temperature, pressure, and silicate melt composition on S solubility in silicate liquids. The solubility of S in FeO-containing silicate melts in equilibrium with metal sulfide increases significantly with increasing temperature but decreases with increasing pressure. The silicate melt structure also exercises a control on S solubility. Increasing the degree of polymerization of the silicate melt structure lowers the S solubility in the silicate liquid. The new set of experimental data is used to expand the model of Mavrogenes and O'Neill(1999) for S solubility in silicate liquids by incorporating the influence of the silicate melt structure. The expected S solubility in the ascending magma is calculated using the expanded model. Because the negative pressure dependence of S solubility is more influential than the positive temperature dependence, decompression and adiabatic ascent of a formerly S-saturated silicate magma will lead to S undersaturation. A primitive magma that is S-saturated in its source region will, therefore, become S-undersaturated as it ascends to shallower depth. In order to precipitate magmatic sulfides, the magma must first cool and undergo fractional crystallization to reach S saturation. The S content in a metallic liquid that is in equilibrium with a magma ocean that contains approx. 200 ppm S (i.e., Earth's bulk mantle S content) ranges from 5.5 to 12 wt% S. This range of S values encompasses the amount of S (9 to 12 wt%) that would be present in the outer core if S is the light element. Thus, the Earth's proto-mantle could be in equilibrium (in terms of the preserved S abundance) with a core-forming metallic phase.
Author
Melts (Crystal Growth); Silicates; Sulfur; Terrestrial Planets; Saturation; Iron Oxides; Solubility

20070034443 Massachusetts Inst. of Tech., Cambridge, MA, USA
Experimental Constraints on Ureilite Petrogenesis
Singletary, Steven; Grove, Timothy L.; Geochimica et Cosmochimica Acta; 2006; ISSN 0016-1016; Volume 70, Issue 5, pp. 1291-1308; In English
Contract(s)/Grant(s): NAG5-13051; NAG5-9525; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.gca.2005.10.034

This experimental study explores the petrogenesis of ureilites by a partial melting/smelting process. Experiments have

been performed over temperature (1150-1280 C), pressure (5-12.5 MPa), and low oxygen fugacity (graphite-CO gas) conditions appropriate for a hypothetical ureilite parent body approximately 200 km in size. Experimental and modeling results indicate that a partial melting/smelting model of ureilite petrogenesis can explain many of the unique characteristics displayed by this meteorite group. Compositional information preserved in the pigeonite-olivine ureilites was used to estimate the composition of melts in equilibrium with the ureilites. The results of 20 experiments saturated with olivine, pyroxene, metal, and liquid with appropriate ureilite compositions are used to calibrate the phase coefficients and pressure-temperature dependence of the smelting reaction. The calibrated coefficients are used to model the behavior of a hypothetical residue that is experiencing fractional smelting. The residue is initially olivine-rich and smelting progressively depletes the olivine content and enriches the pyroxene and metal contents of the residues. The modeled residue composition at 1260 C best reproduces the trend of ureilite bulk compositions. The model results also indicate that as a ureilite residue undergoes isothermal decompression smelting over a range of temperatures, Ca/Al values and Cr203 contents are enriched at lower temperatures (below about 1240 C) and tend to decrease at higher temperatures. Therefore, fractional smelting can account for the high Ca/A1 and Cr203 wt% values observed in ureilites. We propose that ureilites were generated from an olivine-rich, cpx-bearing residue. Smelting began when the residue was partially melted and contained liquid, olivine, and carbon. These residues experienced varying degrees of fractional smelting to produce the compositional variability observed within the pigeonite-bearing ureilites. Variations in mineral composition, modal proportions, and isotopic signatures are best described by heterogeneous accretion of the ureilite parent body followed by minimal and variable degrees of igneous processing.
Author
Minerals; Petrogenesis; Ureilites; Meteoritic Composition; Olivine

20070034483 Massachusetts Inst. of Tech., Cambridge, MA, USA
The Effect of Metal Composition on Fe-Ni Partition Behavior between Olivine and FeNi-Metal, FeNi-Carbide, FeNi-Sulfide at Elevated Pressure
Holzheid, Astrid; Grove, Timothy L.; Chemical Geology; [2005]; ISSN 0009-2541; Volume 221, Issues 3-4, pp. 207-224; In English
Contract(s)/Grant(s): NAG5-13051; NAG5-9525; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1016/j.chemgeo.2005.05.005

Metal-olivine Fe-Ni exchange distribution coefficients were determined at 1500 C over the pressure range of 1 to 9 GPa for solid and liquid alloy compositions. The metal alloy composition was varied with respect to the Fe/Ni ratio and the amount of dissolved carbon and sulfur. The Fe/Ni ratio of the metal phase exercises an important control on the abundance of Ni in the olivine. The Ni abundance in the olivine decreases as the Fe/Ni ratio of the coexisting metal increases. The presence of carbon (up to approx. 3.5 wt.%) and sulfur (up to approx. 7.5 wt.%) in solution in the liquid Fe-Ni-metal phase has a minor effect on the partitioning of Fe and Ni between metal and olivine phases. No pressure dependence of the Fe-Ni-metal-olivine exchange behavior in carbon- and sulfur-free and carbon- and sulfur-containing systems was found within the investigated pressure range. To match the Ni abundance in terrestrial mantle olivine, assuming an equilibrium metal-olivine distribution, a sub-chondritic Fe/Ni-metal ratio that is a factor of 17 to 27 lower than the Fe/Ni ratios in estimated Earth core compositions would be required, implying higher Fe concentrations in the core forming metal phase. A simple metal-olivine equilibrium distribution does not seem to be feasible to explain the Ni abundances in the Earth's mantle. An equilibrium between metal and olivine does not exercise a control on the problem of Ni overabundance in the Earth's mantle. The experimental results do not contradict the presence of a magma ocean at the time of terrestrial core formation, if olivine was present in only minor amounts at the time of metal segregation.
Author
Liquid Metals; Olivine; Iron; Nickel; Liquid Alloys; Composition (Property); Earth Core; Sulfides; Carbides; Chemical Composition; Pressure Dependence

20070034695 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cassini-Huygens Mars Exploration Rover
Liepack, Otfrid G.; October 9, 2006; 65 pp.; In English; Rottery Club, Mallorca, 9-10 Oct. 2006, Mallorca, Spain; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40280

A viewgraph presentation on the Cassini-Huygens Mars Exploration Rover is shown. The contents include: 1) Deep Space Network (DSN); 2) Saturn Cassini-Huygens; 3) Mars Exploration Rover; and 4) References.
CASI
Mars Exploration; Mars Roving Vehicles; Cassini Mission; NASA Space Programs; Deep Space Network; Huygens Probe; Mars (Planet)

20070034696 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Communications Network
Edwards, Chad; Burleigh, Scott C.; August 10, 2006; 28 pp.; In English; SCAWG Networking Technology Workshop, 10 Aug. 2006, Reston, VA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40282

This viewgraph presentation discusses the need for a relay network at Mars and investments needed for a Mars relay network.

CASI

Communication Networks; Mars (Planet); Space Missions; NASA Space Programs; Mars Roving Vehicles; Radio Relay Systems

20070034732 Harvard Univ., Cambridge, MA, USA
Effect of Shock on the Magnetic Properties of Pyrrhotite, the Martian Crust, and Meteorites
Louzad, Karin L.; Stewart, Sarah T.; Weiss, Benjamin P.; Geophysical Research Letters; 2007; Volume 34; 1 pp.; In English
Contract(s)/Grant(s): NNX06AD14G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006GL027685

We performed planar shock recovery experiments on natural pyrrhotite at pressures up to 6.9 GPa. We find that high-field isothermal remanent magnetization in pyrrhotite is demagnetized up to 90% by shock due to preferential removal of low coercivity components of magnetization. Contrary to static experiments, we do not observe complete demagnetization. Post shock permanent changes in magnetic properties include increasing saturation isothermal remanent magnetization, bulk coercivity and lowtemperature memory, and changes in squareness of hysteresis. These changes are consistent with an increase in the volume fraction of single domain grains. The lack of magnetic anomalies over large Martian impact basins is not expected to be solely due to shock demagnetization of the crust. We find that pyrrhotite-bearing rocks and meteorites can retain records of Martian magnetic fields even if shocked to pressures approaching 7 GPa. However, some paleointensity techniques may underestimate this field.

Author

Magnetic Fields; Magnetization; Mars (Planet); Mars Surface; Pyrrhotite; Impact; Mechanical Shock; Demagnetization

20070034736 California Univ., Berkeley, CA, USA
Finding Terrestrial Planets Using External Occulters
Heap, Sara; June 04, 2007; 1 pp.; In English; Spirit of Lyot, 4-8 Jun. 2007, Berkeley, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

In order to identify a detected exoplanet as an Earth-like (habitable) planet, we must obtain its spectrum to verify that its atmosphere shows evidence of water vapor. We argue that a regular, optical telescope combined with a large occulter to block light from the star offers the most promising, cost-effective way to detect and characterize exoplanets.

Author

Extrasolar Planets; Occultation; Telescopes; Terrestrial Planets

20070034758 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Gyro Evaluation for the Mission to Jupiter
Jerebets, Sergei A.; March 3, 2007; 10 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 1642, Version 4; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40320

As an important component in NASA's New Frontiers Program, the Jupiter Polar Orbiter (Juno) mission is designed to investigate in-depth physical properties of Jupiter. It will include the giant planet's ice-rock core and atmospheric studies as well as exploration of its polar magnetosphere. It will also provide the opportunity to understand the origin of the Jovian magnetic field. Due to severe radiation environment of the Jovian system, this mission inherently presents a significant technical challenge to Attitude Control System (ACS) design since the ACS sensors must survive and function properly to reliably maneuver the spacecraft throughout the mission. Different gyro technologies and their critical performance characteristics are discussed, compared and evaluated to facilitate a choice of appropriate gyro-based inertial measurement unit to operate in a harsh Jovian environment to assure mission success.

Author

Gyroscopes; Jupiter (Planet); Planetary Magnetic Fields; Attitude Control; Control Systems Design

20070034771 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mission Design Overview for the Phoenix Mars Scout Mission
Garcia, Mark D.; Fujii, Kenneth K.; January 28, 2007; 15 pp.; In English; AAS/AIAA Space Flight Mechanics Meeting, 28 Jan. - 1 Feb. 2007, Sedona, AZ, USA; Original contains color illustrations
Report No.(s): AAS 07-247; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40351

The Phoenix mission 'follows the water' by landing in a region where NASA's Mars Odyssey orbiter has discovered evidence of ice-rich soil very near the Martian surface. For three months after landing, the fixed Lander will perform in-situ and remote sensing investigations that will characterize the chemistry of the materials at the local surface, sub-surface, and atmosphere, and will identify potential provenance of key indicator elements of significance to the biological potential of Mars, including potential organics and any accessible water ice. The Lander will employ a robotic arm to dig to the ice layer, and will analyze the acquired samples using a suite of deck-mounted, science instruments. The development of the baseline strategy to achieve the objectives of this mission involves the integration of a variety of elements into a coherent mission plan. Author

Mars Missions; Mission Planning; Soils; Ice; Mars Surface; 2001 Mars Odyssey; Remote Sensing

20070034772 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Terrain Adaptive Navigation for Mars Rovers
Matthies, Larry H.; Helmick, Daniel M.; Angelova, Anelia; Livianu, Matthew; March 3, 2007; 11 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 #1668; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40330

A navigation system for Mars rovers in very rough terrain has been designed, implemented, and tested on a research rover in Mars analog terrain. This navigation system consists of several technologies that are integrated to increase the capabilities compared to current rover navigation algorithms. These technologies include: goodness maps and terrain triage, terrain classification, remote slip prediction, path planning, high-fidelity traversability analysis (HFTA), and slip-compensated path following. The focus of this paper is not on the component technologies, but rather on the integration of these components. Results from the onboard integration of several of the key technologies described here are shown. Additionally, the results from independent demonstrations of several of these technologies are shown. Future work will include the demonstration of the entire integrated system described here.
Author

Terrain; Roving Vehicles; Mars Surface; Trajectory Planning; Navigation; Planetary Geology

20070034792 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Testing of the Mars Exploration Rovers to Survive the Extreme Thermal Environments
Man, Kin F.; Hoffman, Alan R.; February 27, 2007; 24 pp.; In English; IMAP 2nd Advanced Technology Workshop on Reliability of Advanced Packages and Devices in Extreme Cold Environments, 27-31 Feb. 2007, Arcadia, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40326

Both Rovers have celebrated 3-year anniversaries on surface of Mars: a) More than ten times design life; b) Planned and implemented rigorous assembly and system level test programs; c) Demonstrated robust thermal margins; d)Tested both in vacuum and Mars atmosphere; e) Planned and implemented thermal cycling life qualification program; f) Demonstrated survival in deep thermal diurnal cycling and seasonal temperature variations; and g) Both Rovers continue to explore and return valuable science data
Derived from text

Roving Vehicles; Mars Exploration; Thermal Cycling Tests; Atmospheric Temperature; Mars Atmosphere; Annual Variations

20070034797 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Evolution of Dust in the Early Universe with Applications to the Galaxy SDSS J1148+5251
Dwek, Eli; Galliano, Frederic; Jones, Anthony P.; February 07, 2007; 35 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Dusty hyperluminous galaxies in the early universe provide unique environments for studying the role of massive stars in the formation and destruction of dust. At redshifts above approximately 6, when the universe was less than approximately

1 Gyr old, dust could have only condensed in the explosive ejecta of Type II supernovae (SNe), since most of the progenitors of the AGB stars, the major alternative source of interstellar dust, did not have time to evolve off the main sequence. In this paper we present analytical models for the evolution of the gas, dust, and metals in high redshift galaxies, with a special application to SDSS J1148+5251 (hereafter J1148+5251), a hyperluminous quasar at z = 6.4. Ignoring accretion of interstellar matter onto grains, the main free model parameters are the dust yield in SNe, and the grain destruction efficiency by supernova remnants. We find that an average supernova must condense at least 1 solar mass of dust to account for the observed dust mass in J1148+5251. Theoretically, this large yield can only be attainable if stars are formed with a top heavy initial mass function. Observationally, it is in excess of the largest dust yield of approximately less than 0.02 solar mass found thus far in the ejecta of any SN. If future observations find this to be a typical supernova dust yield, then additional processes, such as accretion onto preexisting grains, or condensation around the AGN will need to be invoked to account for the large amount of dust in this and similar objects. The galaxy's star formation history is still uncertain, and current observations of the gas, metal, and dust contents of J1148+5251 can be reproduced by either an intensive and short burst of star formation (psi greater than or equal to 2 10(exp 3) solar mass yr(exp -1)) with a duration of less than or equal to 10(exp 8) yr, or a much lower star formation rate (psi approximately equal to 100 solar mass yr(exp -1)) occurring over the lifetime of the galaxy.
Author
Universe; Mathematical Models; Interplanetary Dust; Interstellar Matter; Active Galactic Nuclei

20070034804 Massachusetts Inst. of Tech., Cambridge, MA, USA
Early Petrologic Processes on the Ureilite Parent Body
Singletary, S. J.; Grove, T. L.; Meteoritics and Planetary Science; [2003]; Volume 38, Nr. 1, pp. 95-108; In English
Contract(s)/Grant(s): NAG5-13051; NAG5-9525; Copyright; Avail.: Other Sources

We present a petrographic and petrologic analysis of 21 olivine-pigeonite ureilites, along with new experimental results on melt compositions predicted to be in equilibrium with ureilite compositions. We conclude that these ureilites are the residues of a partial melting/smelting event. Textural evidence preserved in olivine and pigeonite record the extent of primary smelting. In pigeonite cores, we observe fine trains of iron metal inclusions that formed by the reduction of olivine to pigeonite and metal during primary smelting. Olivine cores lack metal inclusions but the outer grain boundaries are variably reduced by a late-stage reduction event. The modal proportion of pigeonite and percentage of olivine affected by late stage reduction are inversely related and provide an estimation of the degree of primary smelting during ureilite petrogenesis. In our sample suite, this correlation holds for 16 of the 21 samples examined. Olivine-pigeonite-liquid phase equilibrium constraints are used to obtain temperature estimates for the ureilite samples examined. Inferred smelting temperatures range from approximately 1150 C to just over 1300 C and span the range of estimates published for ureilites containing two or more pyroxenes. Temperature is also positively correlated with modal percent pigeonite. Smelting temperature is inversely correlated with smelting depth--the hottest olivine-pigeonite ureilites coming from the shallowest depth in the ureilite parent body. The highest temperature samples also have oxygen isotopic signatures that fall toward the refractory inclusion-rich end of the carbonaceous chondrite-anhydrous mineral (CCAM) slope 1 mixing line. These temperature-depth variations in the ureilite parent body could have been created by a heterogeneous distribution of heat producing elements, which would indicate that isotopic heterogeneities existed in the material from which the ureilite parent body was assembled.
Author
Carbonaceous Chondrites; Petrogenesis; Petrography; Pyroxenes; Ureilites; Meteorite Parent Bodies; Meteoritic Composition

20070034869 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Unstable Resonant Orbits near Earth and Their Applications in Planetary Missions
Parker, Jeffrey S.; Lo, Martin W.; August 16, 2004; 27 pp.; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40424

This paper explores the uses of planar, simple-periodic symmetrical families of orbits in mission designs in the Earth-Moon system. This classification is defined as the planar periodic orbits that pierce the x-axis in the rotating frame exactly twice per orbit where each piercing is orthogonal to the x-axis. A continuation method has been used to explore several families of this class of orbit in the Earth-Moon restricted three-body system. The invariant manifolds of the unstable orbits in each of these families are then produced and several mission designs are discussed that take advantage of these manifolds.

Focus is given to mission designs that implement resonant orbits that periodically fly by the moon.
Author
Space Missions; Earth-Moon System; Orbits

20070034951 NASA Glenn Research Center, Cleveland, OH, USA
Lunar South Pole Illumination: Review, Reassessment, and Power System Implications
Fincannon, James; November 2007; 35 pp.; In English; Fifth International Energy Conversion Engineering Conference and Exhibit (IECEC), 25-28 Jun. 2007, St. Louis, MO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 986249.01.11.20.21.03
Report No.(s): NASA/TM-2007-215025; AIAA Paper-2007-4700; E-16219; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034951

This paper reviews past analyses and research related to lunar south pole illumination and presents results of independent illumination analyses using an analytical tool and a radar digital elevation model. The analysis tool enables assessment at most locations near the lunar poles for any time and any year. Average illumination fraction, energy storage duration, solar/horizon terrain elevation profiles and illumination fraction profiles are presented for various highly illuminated sites which have been identified for manned or unmanned operations. The format of the data can be used by power system designers to develop mass optimized solar and energy storage systems. Data are presented for the worse case lunar day (a critical power planning bottleneck) as well as three lunar days during lunar south pole winter. The main site under consideration by present lunar mission planners (on the Crater Shackleton rim) is shown to have, for the worse case lunar day, a 0.71 average illumination fraction and 73 to 117 hours required for energy storage (depending on power system type). Linking other sites and including towers at either site are shown to not completely eliminate the need for energy storage.
Author
Solar Energy; Illuminating; Digital Elevation Models; Energy Storage

20070034958 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Data Management for Mars Exploration Rovers
Snyder, Joseph F.; Smyth, David E.; September 19, 2004; 13 pp.; In English; Mars Conference, 19 Sep. 2004, Ischia Island, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40490

Data Management for the Mars Exploration Rovers (MER) project is a comprehensive system addressing the needs of development, test, and operations phases of the mission. During development of flight software, including the science software, the data management system can be simulated using any POSIX file system. During testing, the on-board file system can be bit compared with files on the ground to verify proper behavior and end-to-end data flows. During mission operations, end-to-end accountability of data products is supported, from science observation concept to data products within the permanent ground repository. Automated and human-in-the-loop ground tools allow decisions regarding retransmitting, re-prioritizing, and deleting data products to be made using higher level information than is available to a protocol-stack approach such as the CCSDS File Delivery Protocol (CFDP).
Author
Data Management; Mars Exploration; Roving Vehicles; Flight Control; Computer Programs

20070034961 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Observation Planning Made Simple with Science Opportunity Analyzer (SOA)
Streiffert, Barbara A.; Polanskey, Carol A.; November 8, 2004; 12 pp.; In English; 2004 Core Technologies for Space Systems Conference, 8 Nov. 2004, Colorado Springs, CO, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40481

As NASA undertakes the exploration of the Moon and Mars as well as the rest of the Solar System while continuing to investigate Earth's oceans, winds, atmosphere, weather, etc., the ever-existing need to allow operations users to easily define their observations increases. Operation teams need to be able to determine the best time to perform an observation, as well as its duration and other parameters such as the observation target. In addition, operations teams need to be able to check the observation for validity against objectives and intent as well as spacecraft constraints such as turn rates and acceleration or pointing exclusion zones. Science Opportunity Analyzer (SOA), in development for the last six years, is a multi-mission toolset that has been built to meet those needs. The operations team can follow six simple steps and define his/her observation

without having to know the complexities of orbital mechanics, coordinate transformations, or the spacecraft itself.
Author
Earth Atmosphere; Solar System; Orbital Mechanics; Coordinate Transformations; Moon

20070034966 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Preliminary System Analysis of In Situ Resource Utilization for Mars Human Exploration
Rapp, Donald; Andringa, Jason; Easter, Robert; Smith, Jeffrey H .; Wilson, Thomas; Clark, D. Larry; Payne, Kevin; March 5, 2005; 20 pp.; In English; IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40487

We carried out a system analysis of processes for utilization of Mars resources to support human exploration of Mars by production of propellants from indigenous resources. Seven ISRU processes were analyzed to determine mass. power and propellant storage volume requirements. The major elements of each process include C02 acquisition, chemical conversion, and storage of propellants. Based on a figure of merit (the ratio of the mass of propellants that must be brought from Earth in a non-ISRU mission to the mass of the ISRU system. tanks and feedstocks that must be brought from Earth for a ISRU mission) the most attractive process (by far); is one where indigenous Mars water is accessible and this is processed via Sabatier/Electrolysis to methane and oxygen. These processes are technically relatively mature. Other processes with positive leverage involve reverse water gas shift and solid oxide electrolysis.
Author
Mars Exploration; Systems Analysis; Propellant Storage; Extraterrestrial Water; In Situ Resource Utilization

20070034985 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Home on the Moon
Sletzen, Frank, Jr.; Aerospace America; July 2007; ISSN 0740-722X; Volume 45, No. 7, pp. 28-32; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

This article outlines the first steps towards development of a base for human settlement on the Moon. After consulting other international agencies, and over 1000 people, NASA has arrived at 85 specific objectives. The most visible of these is scientific discovery, but others include economic development and international cooperation.
CASI
Moon; Lunar Bases; Lunar Exploration; Constellation Program; Space Colonies; Lunar Surface; Lunar Shelters

20070034987 Massachusetts Inst. of Tech., Cambridge, MA, USA
Paleomagnetic Analysis Using SQUID Microscopy
Weiss, Benjamin P.; Lima, Eduardo A.; Fong, Luis E.; Baudenbacher, Franz J.; Journal of Geophysical Research; September 19, 2007; Volume 112; 1 pp.; In English
Contract(s)/Grant(s): NNX06AD14G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2007JB004940

Superconducting quantum interference device (SQUID) microscopes are a new generation of instruments that map magnetic fields with unprecedented spatial resolution and moment sensitivity. Unlike standard rock magnetometers, SQUID microscopes map magnetic fields rather than measuring magnetic moments such that the sample magnetization pattern must be retrieved from source model fits to the measured field data. In this paper, we presented the first direct comparison between paleomagnetic analyses on natural samples using joint measurements from SQUID microscopy and moment magnetometry. We demonstrated that in combination with apriori geologic and petrographic data, SQUID microscopy can accurately characterize the magnetization of lunar glass spherules and Hawaiian basalt. The bulk moment magnitude and direction of these samples inferred from inversions of SQUID microscopy data match direct measurements on the same samples using moment magnetometry. In addition, these inversions provide unique constraints on the magnetization distribution within the sample. These measurements are among the most sensitive and highest resolution quantitative paleomagnetic studies of natural remanent magnetization to date. We expect that this technique will be able to extend many other standard paleomagnetic techniques to previously inaccessible microscale samples.
Author
Microscopy; Paleomagnetism; Interference; Quantum Mechanics; SQUID (Detectors)

20070035052 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
STARDUST: An Incredulous Dream to Incredible Return
Tsou, Peter; October 19, 2006; 45 pp.; In English; Science Outreach, 19 Oct. 2006, Venice, Italy; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40317

This viewgraph presentation reviews the Stardust mission. The goal of the mission was to return to Earth a very small part of a comet for study. The success of the mission gave us a small part of a comet to use for research into questions such as the cometary origin of water and life on earth and the formation of the solar system. The slides review the challenges, the strategy, the laboratory experiments, the instrument development, the characteristics of Aerogel, the Stardust trajectory, pictures of the samples and a listing of the firsts that were accomplished during the Stardust project.
CASI
Aerogels; Comets; Stardust Mission; Comet Nuclei; Interstellar Matter

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20070034153 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SDO Asks: What's The Sun Doing Now?
Pesnell, W. D.; 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

Solar observations have tended to emphasize events like flares and CMEs, and what leads to these events. The past decade has seen an increasing emphasis on understanding the entire Sun, from the nuclear reactions at the core to the development and loss of magnetic loops in the corona. The Solar Dynamics Observatory (SDO) will return synoptic data, taken at a regular cadence and covering the entire Sun. This means you can still study events, but can also move forward to producing a quantitative model of what the Sun is doing today. The science investigations of SDO will determine how the Sun's magnetic field is generated and structured, how this stored magnetic energy is released into the heliosphere and geospace as the solar wind, energetic particles, and variations in the solar irradiance. How SDO data will transform the study of the Sun and the affect on stellar astrophysics will be discussed.
Derived from text
Solar Magnetic Field; Solar Observatories; Sun; Astrophysics; Stellar Physics

20070034791 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Solar Activity FARside Investigation (SAFARI) Science
Ruzmaikin, Alexander; Murphy, Neil; February 26, 2007; 20 pp.; In English; Dynamics and Magnetism from the Inner Core to the Corona of the Sun, 6 Feb. 2007, Saclay, France; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/40327

This presentation describes what kind of heliospheric problems can be solved with simultaneous observations of spatially separated sound signals on the Sun. It is based on previously published work.
Author
Solar Activity; Predictions; Heliosphere; Convection; Sound Waves; Space Weather

20070034886 AI Solutions, Inc., Lanham, MD, USA
Solar Dynamics Observatory High Gain Antenna Handover Planning
Hashmall, Joseph A.; Mann, Laurie; September 24, 2007; 12 pp.; In English; 20th International Symposium on Space Flight Dynamics, 24-28 Sep. 2007, Annapolis, MD, USA; Original contains color illustrations
Contract(s)/Grant(s): NNG04DA01C; Task Order 85; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20070034886

The Solar Dynamics Observatory (SDO) is planned to launch in early 2009 as a mission to study the solar variability and its impact on Earth. To best satisfy its science goal, SDO will fly in a geosynchronous orbit with an inclination of approximately 29 deg. The spacecraft attitude is designed so that the science instruments point directly at the Sun with high accuracy. One of SDO's principal requirements is to obtain long periods of uninterrupted observations. The observations have

an extremely high data volume so SDO must be in continuous contact with the ground during the observation periods. To maintain this contact, SDO is equipped with a pair of high gain antennas (HGAs) transmitting to a pair of ground antennas at the SDO ground station (SDOGS) located in White Sands, New Mexico. Either HGA can transmit to either SDOGS antenna. Neither HGA can be powered down. During a portion of each year, each of the HGA beams will intersect with the SDO body for a portion of the orbit. The original SDO antenna contact plan used each HGA for the half of each year during which its beam would not intersect the spacecraft. No data would be lost except, possibly, when switching from one antenna to another. After this plan was adopted, further analysis showed that daily handovers would be necessary for significant periods of the year. This unexpected need for extensive handovers necessitated that a handover design be developed to minimize the impact on the mission. This antenna handover design was developed and successfully tested with simulated data using the slew rate limits from preliminary jitter analysis. Subsequent analysis provided significant revision of allowed rates requiring modification of the handover plans.
Author
Antenna Design; High Gain; Solar Observatories; Solar Activity; Helioseismology; Spacecraft Antennas

20070034913 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Forecast of the Amplitude of Solar Cycle 24 Based on the Disturbed Days Precursor
Rabin, Douglas M.; March 21, 2007; 1 pp.; In English; American Astronomical Society 210th Meeting, 27-31 May 2007, Honolulu, HI, USA; No Copyright; Avail.: Other Sources; Abstract Only

R. J. Thompson (1993, Solar Physics 148, 383) exhibited a significant linear relationship between the number of geomagnetically disturbed days (those that exceed some threshold value of the Ap or nu index) in a solar cycle and the sum of the peak sunspot number in that cycle and the next cycle. Thus, the number of disturbed days during a full cycle, together with the peak sunspot number in that cycle, is a predictor of the amplitude of the next cycle. The work reported here applies Thompson's method to the current cycle. Linear relationships as described above are derived both for the pure aa record (1868-2006) and for a composite of aa (1868-1931) and Ap (1932-2006). For the composite record, the relationship between aa and Ap is determined cycle-by-cycle during the period of overlap. The method is tested for sensitivity to the adopted Ap (or equivalent aa) threshold. The highest smoothed monthly sunspot number for Cycle 24 is forecasted to be R(sub z) = 115 plus or minus 30, where the uncertainty is conservatively based on the full spread of the data around the fitted line in the sunspot number direction. In terms of smoothed monthly 10.7-cm radio flux, the forecast is F10.7 = 164 plus or minus 28.
Author
Solar Cycles; Amplitudes; Solar Physics; Geomagnetism

20070034942 Department of the Army, Hanover, NH, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA
Seasonal Evolution and Interannual Variability of the Local Solar Energy Absorbed by the Arctic Sea Ice-Ocean System
Perovich, Donald K.; Nghiem, Son V.; Markus, Thorsten; Schweiger, Axel; Journal of Geophysical Research; March 06, 2007; Volume 112; 16 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-11800; NNH04AA71I-1; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1029/2006JC003558

The melt season of the Arctic sea ice cover is greatly affected by the partitioning of the incident solar radiation between reflection to the atmosphere and absorption in the ice and ocean. This partitioning exhibits a strong seasonal cycle and significant interannual variability. Data in the period 1998, 2000-2004 were analyzed in this study. Observations made during the 1997-1998 SHEBA (Surface HEat Budget of the Arctic Ocean) field experiment showed a strong seasonal dependence of the partitioning, dominated by a five-phase albedo evolution. QuikSCAT scatterometer data from the SHEBA region in 1999-2004 were used to further investigate solar partitioning in summer. The time series of scatterometer data were used to determine the onset of melt and the beginning of freezeup. This information was combined with SSM/I-derived ice concentration, TOVS-based estimates of incident solar irradiance, and SHEBA results to estimate the amount of solar energy absorbed in the ice-ocean system for these years. The average total solar energy absorbed in the ice-ocean system from April through September was 900 MJ m(sup -2). There was considerable interannual variability, with a range of 826 to 1044 MJ m(sup -2). The total amount of solar energy absorbed by the ice and ocean was strongly related to the date of melt onset, but only weakly related to the total duration of the melt season or the onset of freezeup. The timing of melt onset is significant because the incident solar energy is large and a change at this time propagates through the entire melt season, affecting the albedo every day throughout melt and freezeup.
Author
Annual Variations; Arctic Ocean; Sea Ice; Solar Energy; Absorptance

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.

20070035020 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

Validation Assistant in Instructional Design

vanMeer, J. P.; Veldhuis, G. J.; vanEmmerik, M. L.; vanSchaik, M. G.; May 2007; 2 pp.; In Dutch
Contract(s)/Grant(s): TNO Proj. 013.14313
Report No.(s): TD2007-0900; TNO-DV 2007 A111; Copyright; Avail.: Other Sources

The purpose of this article is to introduce and demonstrate an effective tool that supports instructors in developing educational programs for training and instruction. Due to periodical job rotation within the military, instructional developers are not always experts in their field and are consequently unaware of the types of educational concepts that are available to teach with. This supportive tool has been developed over the course of several years, incorporating both theoretical and practical criteria related to selecting a suitable concept for an educational program. It aims to support instructors in selecting suitable educational concepts for their specific needs. Subsequently, it provides support in the actual concretization of the concepts. In continuance of two pilots, the tool has been tested by 29 instructors in training. This demonstrates very high potential for the use of the tool. It can be concluded that, with some refinements, it is well adapt at providing support for the development of new educational programs.
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Education; Instructors

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