National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program plays a key part in helping NASA maintain this important role.

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
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- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

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- Telephone the NASA STI Help Desk at (301) 621-0390
- Write to:
  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

Introduction

Scientific and Technical Aerospace Reports (*STAR*) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

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

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.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up to date NASA STI, visit the STI Program's website at http://www.sti.nasa.gov.

NASA STI Availability Information

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 (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability'. When CASI is indicated, the user can order this information directly from CASI using the STI Online Order Form or contact help@sti.nasa.gov or telephone the CASI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI documents and videos. When information is not available from CASI, the source of the information is indicated when known.

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National Technical Information Service (NTIS)

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** (FDLP) to ensure access by 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 http://www.access.gpo.gov/su_docs.

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

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

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Subject Term Index

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20040068290 Lawrence Livermore National Lab., Livermore, CA

Parameterization of Intermittent Turbulence in the Stable Boundary Layer

Nitao, E. N.; Lundquist, J. K.; Loosmore, G. A.; Aug. 01, 2003; In English

Report No.(s): DE2003-15004664; UCRL-LR-155053; No Copyright; Avail: National Technical Information Service (NTIS)

The atmospheric boundary layer is of special interest due to its direct impact and interaction with the surface of the earth where most human activity occurs. The daytime boundary layer is dominated by convective turbulence, and thus is modeled easily. However, sources of turbulence at night are multiple and varied, making the flow more difficult to predict. And yet it is important to predict nocturnal dynamics because of its influences on aviation, the dispersion of pollutants, and fog formation.

NTIS

Turbulence; Stability; Atmospheric Boundary Layer

20040071057 Lawrence Livermore National Lab., Livermore, CA

Aerodynamic Design of Heavy Vehicles Reporting Period September 2001 through January 15, 2002

McCallen, R.; Salari, K.; Ortega, J.; Yen-Nakafuji, D.; Jan. 25, 2002; In English

Report No.(s): DE2004-15002221; UCRL-ID-147155; No Copyright; Avail: National Technical Information Service (NTIS)

Three of the DOE Team members, Fred Browand (USC), Rose McCallen (LLNL), and Jim Ross (NASA), chaired an international conference titled The Aerodynamics of Heavy Vehicles: Trucks, Busses, and Trains. It was held at the Asilomar Conference Center in Monterey, California on December 2-5,2003. Attendees included top scientists and engineers in the field of aerodynamics from universities, government laboratories, and industry. The conference was sponsored by the United Engineering Foundation (UEF) with DOE as a major contributor. LLNL also provided support for a speaker and Freightliner, International, and Volvo heavy vehicle manufactures supported 3 separate evening socials. Work continues on establishing the publisher for the conference proceedings. Team members presented several papers at the conference and a large poster describing the goals and objectives of the DOE Project highlighting recent activities and results was constructed and displayed in the conference reception hall.

NTIS

Aerodynamic Drag; Drag Reduction; Trucks; Conferences; Computational Fluid Dynamics

20040073433 NASA Glenn Research Center, Cleveland, OH, USA

A CAD Approach to Integrating NDE With Finite Element

Abdul-Aziz, Ali; Downey, James; Ghosn, Louis J.; Baaklini, George Y.; April 2004; 30 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-728-30-06

Report No.(s): NASA/TM-2004-212904; E-14327; No Copyright; Avail: CASI; A03, Hardcopy

Nondestructive evaluation (NDE) is one of several technologies applied at NASA Glenn Research Center to determine atypical deformities, cracks, and other anomalies experienced by structural components. NDE consists of applying high-quality imaging techniques (such as x-ray imaging and computed tomography (CT)) to discover hidden manufactured flaws in a structure. Efforts are in progress to integrate NDE with the finite element (FE) computational method to perform

detailed structural analysis of a given component. This report presents the core outlines for an in-house technical procedure that incorporates this combined NDE-FE interrelation. An example is presented to demonstrate the applicability of this analytical procedure. FE analysis of a test specimen is performed, and the resulting von Mises stresses and the stress concentrations near the anomalies are observed, which indicates the fidelity of the procedure. Additional information elaborating on the steps needed to perform such an analysis is clearly presented in the form of mini step-by-step guidelines. Author

Nondestructive Tests; Computer Aided Design; Finite Element Method; Structural Analysis

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*.

20040068291 Federal Aviation Administration, Washington, DC

Temperature Distribution Within Solid Metal Cylinders Subjected to a Standard Aircraft Engine Fire

Reinhardt, J. W.; Do, D.; Fayer, J.; Apr. 2004; In English

Report No.(s): PB2004-105465; DOT/FAA/AR-04/1; No Copyright; Avail: National Technical Information Service (NTIS)

This report provides temperature data that could be used to establish the ultimate tensile strength (UTS) loss of candidate engine mount materials after been exposed to a standard flame for 5 and 15 minutes. The materials tested included 4130 steel (baseline),15-5 PH steel, titanium 6A1-4V, Inconel 718, and aluminum 7075. These materials were instrumented internally with thermocouples and exposed to the standard flame. MIL-Handbook-5H provides some data with regards to the UTS loss of these materials while heated, but additional strength tests must be conducted to account for the higher temperatures experienced by these materials while exposed to the standard fire.

NTIS

Aluminum Alloys; Temperature Distribution; Aircraft Engines

20040068293 Federal Aviation Administration, Washington, DC

Development of Airport Active Runway Vehicle Lighting

Patterson, J. W.; May 2004; 24 pp.; In English

Report No.(s): PB2004-105485; DOT/FAA/AR-TN04/9; No Copyright; Avail: CASI; A03, Hardcopy

Runway incursions are a leading cause of airport ground accidents and usually result from the presence of unauthorized ground vehicles within the active runway area. In many cases, air traffic control personnel can become confused by the numerous flashing lights and various colors of lights on vehicles operating on the airport and because of this, are unable to distinguish which vehicles are on the runway and which are on a parallel taxiway or holding short of the runway. The purpose of this evaluation was to determine the feasibility of equipping airport ground vehicles with supplemental warning beacons that would be illuminated only when the vehicle was on an active runway, thus providing a visual cue to eliminate any confusion in regards to the location of the vehicle. The objective of the research was to evaluate the various beacon features available, such as beacon colors, flash patterns, flash speeds, or beacon separation distances, to determine if there was a particular combination that would make the beacon unique enough to be used for this purpose.

NTIS

Air Traffic Controllers (Personnel); Airports; Luminaires

20040070783 Akron Univ., Akron, OH, USA

Representation of Ice Geometry by Parametric Functions: Construction of Approximating NURBS Curves and Quantification of Ice Roughness--Year 1: Approximating NURBS Curves

Dill, Loren H.; Choo, Yung K., Technical Monitor; April 2004; 70 pp.; In English

Contract(s)/Grant(s): NAG3-2848; WBS 728-41-10

Report No.(s): NASA/CR-2004-213071; E-14547; No Copyright; Avail: CASI; A04, Hardcopy

Software was developed to construct approximating NURBS curves for iced airfoil geometries. Users specify a tolerance that determines the extent to which the approximating curve follows the rough ice. The user can therefore smooth the ice geometry in a controlled manner, thereby enabling the generation of grids suitable for numerical aerodynamic simulations. Ultimately, this ability to smooth the ice geometry will permit studies of the effects of smoothing upon the aerodynamics of

iced airfoils. The software was applied to several different types of iced airfoil data collected in the Icing Research Tunnel at NASA Glenn Research Center, and in all cases was found to efficiently generate suitable approximating NURBS curves. This method is an improvement over the current "control point formulation" of Smaggice (v.1.2). In this report, we present the relevant theory of approximating NURBS curves and discuss typical results of the software.
Author
Ice Formation; Computer Programs; Approximation; Airfoils; Computational Fluid Dynamics; Curves; Spline Functions

20040073548 Army Research Lab., Aberdeen Proving Ground, MD
Navier-Stokes Predictions of the Individual Components of the Pitch-Damping Coefficient Sum
Weinacht, Paul; Apr. 2004; 44 pp.; In English
Report No.(s): AD-A422328; ARL-TR-3169; No Copyright; Avail: CASI; A03, Hardcopy

An approach for predicting the two individual aerodynamic damping coefficients that form the pitch-damping coefficient sum is presented. The coefficients are obtained using prescribed or forced motions that independently excite the two different angular rates that are associated with the two damping coefficients. A key feature of the approach is that steady flow fields are produced by the selected motions. Steady flow computational fluid dynamics approaches can be applied, allowing results to be obtained in a computationally efficient manner. Application of the technique is made to an axisymmetric projectile configuration. The predicted pitch- damping coefficient sum obtained by adding the individually determined coefficients is in excellent agreement with previous predictions of the pitch-damping coefficient sum and with experimental data. Additional validation of the approach is obtained through comparisons with prior results from numerical solutions of the nonlinear unsteady potential equation. The individual coefficients are also compared with slender body theory, and the results show similar trends though the slender body theory appears to underpredict the various coefficients.
DTIC
Aerodynamic Characteristics; Damping; Navier-Stokes Equation

20040073553 Tennessee Univ., Knoxville, TN
An Investigation of Flow Acceleration and Electromagnetic Absorption Phenomena Induced by Paraelectric and Peristaltic Electrohydrodynamic Effects of the One Atmosphere Uniform Glow Discharge Plasma
Mar. 8, 2004; 25 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0425; Proj-2308
Report No.(s): AD-A422343; CAGE-4B958; AFRL-SR-AR-TR-04-0228; No Copyright; Avail: CASI; A03, Hardcopy

We took wind tunnel data and were able to demonstrate low speed (below 5 m/ sec) flow attachment on a NACA 0015 airfoil using OAUGDP plasma actuators. We were able further to demonstrate that only one actuator was sufficient to produce re-attachment, and that this actuator should be located not at the site of the flow separation bubble, but at the leading edge of the airfoil. The plasma actuators not only re-attached the flow, but also stabilized the downstream flow, reduced vortex formation, and increased the stall angle of the airfoil. During these wind tunnel tests, we also demonstrated peristaltic flow acceleration by polyphase RF signals driving a phased sequence of OAUGDP plasma actuators, and we demonstrated the reversal ofthe peristalticaly-induced flow with the reversal of the phase of the driving RF voltage. We also developed and investigated mechanically and electrically robust paraelectric, peristaltic, and combined paraelectric and peristaltic ceramic plasma actuator panels. Among these was a three-dimensional electrohydrodynamic flow acceleration duct that functions like a Glauert wall jet. The most promising design was the combined paraelectric and peristaltic panel, and the EHD flow acceleration duct, in which peristaltic flow from phased electrodes is given an additional boost by paraclectric momentum addition, with no momentum addition counter to the dominant flow to induce turbulence in the boundary layer. At the end of the contract, the ERD duct produced exit velocities more than 9 meters/second using paraelectric effects alone. We also achieved up to 7 meters/sec by pure peristaltic acceleration. We also found that one or more plasma actuators in series could be modeled as a classical Glauert wall jet in the region outside the plasma where electrohydrodynamic effects are no longer dominant.
DTIC
Actuators; Atmospheric Effects; Electrohydrodynamics; Electromagnetic Absorption; Glow Discharges; Plasmas (Physics); Wind Tunnel Tests

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20040068139 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Air System Information Management
Filman, Robert E.; March 2004; 4 pp.; In English
Contract(s)/Grant(s): NCC2-1426; No Copyright; Avail: CASI; A01, Hardcopy

I flew to Washington last week, a trip rich in distributed information management. Buying tickets, at the gate, in flight, landing and at the baggage claim, myriad messages about my reservation, the weather, our flight plans, gates, bags and so forth flew among a variety of travel agency, airline and Federal Aviation Administration (FAA) computers and personnel. By and large, each kind of information ran on a particular application, often specialized to own data formats and communications network. I went to Washington to attend an FAA meeting on System-Wide Information Management (SWIM) for the National Airspace System (NAS) (http://www.nasarchitecture.faa.gov/Tutorials/NAS101.cfm). NAS (and its information infrastructure, SWIM) is an attempt to bring greater regularity, efficiency and uniformity to the collection of stovepipe applications now used to manage air traffic. Current systems hold information about flight plans, flight trajectories, weather, air turbulence, current and forecast weather, radar summaries, hazardous condition warnings, airport and airspace capacity constraints, temporary flight restrictions, and so forth. Information moving among these stovepipe systems is usually mediated by people (for example, air traffic controllers) or single-purpose applications. People, whose intelligence is critical for difficult tasks and unusual circumstances, are not as efficient as computers for tasks that can be automated. Better information sharing can lead to higher system capacity, more efficient utilization and safer operations. Better information sharing through greater automation is possible though not necessarily easy.
Author
National Airspace System; Information Management

20040068143 NASA Ames Research Center, Moffett Field, CA, USA
Aviation System Capacity Program Terminal Area Productivity Project: Ground and Airborne Technologies
Giulianetti, Demo J.; August 2001; 58 pp.; In English
Contract(s)/Grant(s): 712-10-92
Report No.(s): NASA/TP-2001-210917; A-0005611; No Copyright; Avail: CASI; A04, Hardcopy

Ground and airborne technologies were developed in the Terminal Area Productivity (TAP) project for increasing throughput at major airports by safely maintaining good-weather operating capacity during bad weather. Methods were demonstrated for accurately predicting vortices to prevent wake-turbulence encounters and to reduce in-trail separation requirements for aircraft approaching the same runway for landing. Technology was demonstrated that safely enabled independent simultaneous approaches in poor weather conditions to parallel runways spaced less than 3,400 ft apart. Guidance, control, and situation-awareness systems were developed to reduce congestion in airport surface operations resulting from the increased throughput, particularly during night and instrument meteorological conditions (IMC). These systems decreased runway occupancy time by safely and smoothly decelerating the aircraft, increasing taxi speed, and safely steering the aircraft off the runway. Simulations were performed in which optimal trajectories were determined by air traffic control (ATC) and communicated to flight crews by means of Center TRACON Automation System/Flight Management System (CTASFMS) automation to reduce flight delays, increase throughput, and ensure flight safety.
Author
Capacitance; Air Traffic Control; Management Systems; Flight Safety

20040070801 NASA Glenn Research Center, Cleveland, OH, USA
Update on SLD Engineering Tools Development
Miller, Dean R.; Potapczuk, Mark G.; Bond, Thomas H.; April 2004; 34 pp.; In English; FAA In-Flight Icing/Ground De-Icing International Conference, 16-20 Jun. 2003, Chicago, IL, USA
Contract(s)/Grant(s): WBS 728-41-01
Report No.(s): NASA/TM-2004-213072; E-14548; Rept-2003-01-2127; No Copyright; Avail: CASI; A03, Hardcopy

The airworthiness authorities (FAA, JAA, Transport Canada) will be releasing a draft rule in the 2006 timeframe

concerning the operation of aircraft in a Supercooled Large Droplet (SLD) environment aloft. The draft rule will require aircraft manufacturers to demonstrate that their aircraft can operate safely in an SLD environment for a period of time to facilitate a safe exit from the condition. It is anticipated that aircraft manufacturers will require a capability to demonstrate compliance with this rule via experimental means (icing tunnels or tankers) and by analytical means (ice prediction codes). Since existing icing research facilities and analytical codes were not developed to account for SLD conditions, current engineering tools are not adequate to support compliance activities in SLD conditions. Therefore, existing capabilities need to be augmented to include SLD conditions. In response to this need, NASA and its partners conceived a strategy or Roadmap for developing experimental and analytical SLD simulation tools. Following review and refinement by the airworthiness authorities and other international research partners, this technical strategy has been crystallized into a project plan to guide the SLD Engineering Tool Development effort. This paper will provide a brief overview of the latest version of the project plan and technical rationale, and provide a status of selected SLD Engineering Tool Development research tasks which are currently underway.
Author
Aircraft Icing; Supercooling; Product Development; Computerized Simulation; Drops (Liquids)

20040070815 NASA Langley Research Center, Hampton, VA, USA
Meteorology and Wake Vortex Influence on American Airlines FL-587 Accident
Proctor, Fred H.; Hamilton, David W.; Rutishauser, David K.; Switzer, George F.; April 2004; 60 pp.; In English
Contract(s)/Grant(s): 728-40-30; 137-30-10
Report No.(s): NASA/TM-2004-213018; L-18371; No Copyright; Avail: CASI; A04, Hardcopy
The atmospheric environment surrounding the crash of American Airlines Flight 587 is investigated. Examined are evidence for any unusual atmospheric conditions and the potential for encounters with aircraft wake vortices. Computer simulations are carried out with two different vortex prediction models and a Large Eddy Simulation model. Wind models are proposed for studying aircraft and pilot response to the wake vortex encounter.
Author
Meteorology; Airline Operations; Accident Investigation; Vortices; Aircraft Wakes; Civil Aviation

20040073470 NASA Glenn Research Center, Cleveland, OH, USA
In-Flight Icing Training for Pilots Using Multimedia Technology
Burke, Kevin M.; VanZante, Judith Foss; Bond, Thomas H.; April 2004; 11 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-708-20-14
Report No.(s): NASA/TM-2004-212396; AIAA Paper 2003-0019; E-13979; Copyright; Avail: CASI; A03, Hardcopy
Over the last five years, the Aircraft Icing Project of the NASA Aviation Safety Program has developed a number of in-flight icing education and training aids to support increased awareness for pilots of the hazards associated with atmospheric icing conditions. Through the development of this work, a number of new instructional design approaches and media delivery methods have been introduced to enhance the learning experience, expand user interactivity and participation, and, hopefully, increase the learner retention rates. The goal of using these multimedia techniques is to increase the effectiveness of the training materials. This paper will describe the mutlimedia technology that has been introduced and give examples of how it was used.
Author
Aircraft Icing; Multimedia; Technology Utilization; Pilot Training; In-Flight Monitoring

20040073567 Naval Postgraduate School, Monterey, CA
Deployed Virtual Consulting: The Fusion of Wearable Computing, Collaborative Technology, Augmented Reality and Intelligent Agents to Support Fleet Aviation Maintenance
Nasman, James M.; Mar. 2004; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422381; No Copyright; Avail: CASI; A04, Hardcopy
This thesis addresses the need of Naval Aviation Maintenance to streamline and more effectively manage the process of technical consultation aboard deployed aircraft carriers. The current process involves the physical transportation of an appropriate technician to the carrier to perform required maintenance and/or repairs. In light of the technology currently available this process becomes obviously obsolete, overly costly and needlessly time consuming. By implementing wireless technology in combination with advanced software allowing the virtual collaboration of parties widely separated by

geographical distance the Navy can establish a "virUal technical presence" onboard aircraft carriers wherever they may be in the world. This thesis will describe how the fusion of wearable computing, augmented reality, intelligent agents coupled with CoABS, and a modem collaborative software application can revolutionize Naval aviation maintenance as we know it. The technology is there - it only remains for the Navy to leverage it and take advantage of the significant returns that it will provide.
DTIC
Aircraft Maintenance; Computation; Computers; Deployment; Military Operations

20040073613 Naval Training Equipment Center, Orlando, FL
NTEC Training Support Developments
Jun. 1977; 32 pp.; In English
Report No.(s): AD-A422486; NAVTRADEV-P-1300-67; No Copyright; Avail: CASI; A03, Hardcopy

The Army's most sophisticated flight simulator, Device 2B31, has been accepted at Fort Rucker, Alabama. Modeled after the CH-47C medium cargo helicopter, it is designed for use in the initial transition training and subsequent proficiency training for CH-47C aviators. The simulator is currently undergoing operational testing to determine to what degree it can be used to augment or replace existing training programs. Test subjects will include 24 aviators undergoing initial transition training into the CH- 47C, and an additional 16 CH-47C qualified aviators using the simulator for proficiency training purposes. The test program began in January 1077 and will be completed in August 1977.
DTIC
Education; Flight Simulators

20040073621 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Automated Method of Predicting Clear-Air Turbulence
Belson, Brian L.; Mar. 2004; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422498; AFIT/GM/ENP/04-02; No Copyright; Avail: CASI; A06, Hardcopy

Clear-air turbulence (CAT) prediction is vitally important to military aviation and the successful completion of Department of Defense (DoD) operations such as air to air refueling and new national defensive weapon systems such as directed energy platforms. The unique mission requirements of military aircraft often require strict avoidance of turbulent regions. Traditionally, weather forecasters have found it difficult to accurately predict CAT. In order to forecast regions where CAT might occur, forecasters must first determine the location of breaking waves caused by either Kelvin-Helmholtz instabilities or topographically forced internal gravity waves (mountain waves) in the atmosphere. The USA Air Force (USAF) 15th Operational Weather Squadron (15th OWS) requested an updated method of predicting CAT and this request was ranked as one of the highest priority research needs by the HQ USAF Director of Weather, Deputy Chief of Staff for Air and Space Operations. A new method of forecasting turbulence was developed in this work and the operational model was delivered to the 15th OWS for immediate inclusion into their operations. This method combines output from the Knapp-Ellrod index and the Naval Research Laboratory s Mountain Wave Forecast Model (MWFM) onto a single chart. Displaying these tools together allows forecasters to view both causes of CAT simultaneously. Furthermore, a new visualization tool is developed that allows a forecaster to view several layers at the same time as well as a composite chart to greatly reduce the time required to produce turbulence charts by OWS forecasting centers worldwide. Tests of forecast accuracy, as determined by pilot reports (PIREPS), between charts currently produced by USAF OWSs and this new method were compared, with the new method producing far superior forecast results. This method revolutionizes
DTIC
Clear Air Turbulence; Predictions; Refueling

20040073727 Drexel Univ., Philadelphia, PA
Micromechanical Origins and Design Implications of Damage Tolerance in Ti3SiC2
Barsoum, M. W.; Kalidindi, S. R.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0435
Report No.(s): AD-A422643; ARO-40383.1-MS; No Copyright; Avail: CASI; A02, Hardcopy

The goals of the proposed work were to elucidate the microstructural and atomic origins of the mechanical properties exhibited by Ti3 SiC2 The focus is on the micro- mechanisms of inelastic deformation and their contribution to the damage tolerance exhibited by this compound. In addition to being technologically important, a basic study of the structure-property relations in this compound will be beneficial to understanding the behavior of the entire class of layered ternary carbides and

nitrides. There are over 60 of these identified to date, During this work we conducted and successfully completed an extensive investigation of the mechanical response at two different length scales macro (simple compression tests) and micro scale (nano-indentations). Additionally, we also completed extensive investigations on graphite. Our measurements revealed several unique features that are common to both of these layered materials, in comparison to other conventional ceramics. Our studies have revealed that the reversible, rate-independent, hysteretic stress-strain curves exhibited is attributable to incipient kink banding, which at higher stress levels (or temperatures) leads to irreversible deformation caused by formation of kink bands. Remarkably, the hysteretic energy dissipated in each cycle in the MAX phases can be as high as 25% of the elastic stored energy.
DTIC
Ceramics; Damage; Irreversible Processes; Micromechanics; Stress-Strain Relationships; Tolerances (Mechanics)

20040073736 Naval War Coll., Newport, RI
Redefining Fire Support Control for the Noncontiguous Battle Field
Auld, Elisabeth S.; Feb. 9, 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422653; No Copyright; Avail: CASI; A03, Hardcopy

The ultimate objective of joint military operations is to bring to bear a swift, decisive, efficient blow to the adversary. It demonstrates the speed, efficiency, and flexibility the joint fires community strives for, by linking weapons effects to the Joint Force Commander's campaign or operation objectives through component operations. Fire Support Coordination Measures (FSCMs) serve as the primary means of orchestrating joint fires on the battlefield. This paper will discuss three areas where seams exist in the joint force community: (a) deep versus close battle (b) operational definition of the Fire Support Coordination Line (FSCL) and (c) application of the FSCL on a noncontiguous/ nonlinear battlefield. Potential solutions are (a) use of a common grid reference system (b) use of a Joint Effects Coordination Line (JECL) and (c) establishment of a Joint Fires Element (JFE).
DTIC
Fire Control; Fires; Military Operations

20040073794 Woods Hole Oceanographic Inst., MA
Adaptive Oceanographic Sampling in a Coastal Environmental Using Autonomous Gliding Vehicles
Fratantoni, David M.; May 13, 2004; 4 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0340
Report No.(s): AD-A422781; No Copyright; Avail: CASI; A01, Hardcopy

Our long-term goal is to develop an efficient, relocatable, infrastructure-free ocean observing system composed of high-endurance, low-cost autonomous vehicles with near-global range and modular sensor payload. Particular emphasis is placed on the development of adaptive sampling strategies and the intelligent control of large glider fleets operating within the framework of an autonomous oceanographic sampling network.
DTIC
Autonomous Navigation; Autonomy; Coasts; Gliding; Oceanography; Sampling

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*.

20040073764 Design Interactive, Inc., Oviedo, FL
Spatial Navigation Transfer Evaluation Toolkit
Milham, Laura; Hale, Kelly; Stanney, Kay M.; Jan. 20, 2004; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-C-0194
Report No.(s): AD-A422698; No Copyright; Avail: CASI; A03, Hardcopy

The training transfer study focused on a group of student navigators at HS-l0 (San Diego, California) preparing for their first operational rotary wing tactical overland flight, aimed at developing and utilizing terrain association skills. In order to assess the training transfer effectiveness of the VEHELO, a set of outcome and process metrics for a spatial terrain association task was specified. As VS training effectiveness has been found to be dependent on individual difference variables such as

spatial ability (Waller, 1999), several additional standardized metrics were utilized to assess process measures, including spatial ability (Ekstrom, French, & Harman, 1976), navigation skill (Hegarty, Richardson, Montello, Lovelace, & Subbiah, 2002) , workload (Hart & Staveland, 1988) , self-efficacy (Scott, 2000) and simulator sickness (Kennedy, Lane, Serbaum, & Lilienthal, 1993). To assess terrain association skill, a test was developed in which participants were asked to correlate out- the-window views with topographical maps and vice versa.
DTIC
Air Navigation; Education; Navigation; Space Perception; Spatial Distribution

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*.

20040068163 NASA Langley Research Center, Hampton, VA, USA
Wind Tunnel to Atmospheric Mapping for Static Aeroelastic Scaling
Heeg, Jennifer; Spain, Charles V.; Rivera, J. A.; [2004]; 12 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-20-31
Report No.(s): AIAA Paper 2004-2044; No Copyright; Avail: CASI; A03, Hardcopy

Wind tunnel to Atmospheric Mapping (WAM) is a methodology for scaling and testing a static aeroelastic wind tunnel model. The WAM procedure employs scaling laws to define a wind tunnel model and wind tunnel test points such that the static aeroelastic flight test data and wind tunnel data will be correlated throughout the test envelopes. This methodology extends the notion that a single test condition - combination of Mach number and dynamic pressure - can be matched by wind tunnel data. The primary requirements for affecting this extension are matching flight Mach numbers, maintaining a constant dynamic pressure scale factor and setting the dynamic pressure scale factor in accordance with the stiffness scale factor. The scaling is enabled by capabilities of the NASA Langley Transonic Dynamics Tunnel (TDT) and by relaxation of scaling requirements present in the dynamic problem that are not critical to the static aeroelastic problem. The methodology is exercised in two example scaling problems: an arbitrarily scaled wing and a practical application to the scaling of the Active Aeroelastic Wing flight vehicle for testing in the TDT.
Author
Wind Tunnel Models; Atmospheric Models; Aeroelasticity; Wind Tunnel Tests

20040068182 NASA Ames Research Center, Moffett Field, CA, USA
CAD-Based Aerodynamic Design of Complex Configurations using a Cartesian Method
Nemec, Marian; Aftosmis, Michael J.; Pulliam, Thomas H.; December 15, 2003; 13 pp.; In English; 42nd AIAA Aerospace Sciences Conference, 5-8 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2004-0113; No Copyright; Avail: CASI; A03, Hardcopy

A modular framework for aerodynamic optimization of complex geometries is developed. By working directly with a parametric CAD system, complex-geometry models are modified nnd tessellated in an automatic fashion. The use of a component-based Cartesian method significantly reduces the demands on the CAD system, and also provides for robust and efficient flowfield analysis. The optimization is controlled using either a genetic or quasi-Newton algorithm. Parallel efficiency of the framework is maintained even when subject to limited CAD resources by dynamically re-allocating the processors of the flow solver. Overall, the resulting framework can explore designs incorporating large shape modifications and changes in topology.
Author
Computer Aided Design; Aerodynamic Configurations; Optimization; Mathematical Models; Cartesian Coordinates; Automatic Control

20040068309, Boeing Co., Wichita, KS, USA
Bonded Repair of Aircraft Composite Sandwich Structures
Tomblin, J. S.; Salah, L.; Welch, J. M.; Borgman, M. D.; Feb. 2004; In English
Report No.(s): PB2004-105463; No Copyright; Avail: National Technical Information Service (NTIS)

With the increasing use of fiber-reinforced composite sandwich structures in aircraft components, it has become necessary to develop repair methods that will restore the components original design strength without compromising its structural integrity. One of the main concerns is whether large repairs are always necessary to restore strength or whether smaller, less intrusive repairs can be implemented instead. Cure temperature can also become an issue if the repair patch requires curing at 350 degrees F. Residual thermal stresses due to the bonding of the patch to the parent structure may induce further damage to the component. With these concerns in mind, the main objective of this study was to evaluate the effectiveness of scarf repairs applied to sandwich structures, given several bonding repair variables.
NTIS
Aircraft Maintenance; Composite Materials; Sandwich Structures

20040070828 NASA Langley Research Center, Hampton, VA, USA
Aircraft Wake Vortex Measurements at Denver International Airport
Dougherty, Robert P.; Wang, Frank Y.; Booth, Earl R.; Watts, Michael E.; Fenichel, Neil; D'Errico, Robert E.; 2004; 13 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 23-137-30-10
Report No.(s): AIAA Paper 2004-2880; Copyright; Avail: CASI; A03, Hardcopy

Airport capacity is constrained, in part, by spacing requirements associated with the wake vortex hazard. NASA's Wake Vortex Avoidance Project has a goal to establish the feasibility of reducing this spacing while maintaining safety. Passive acoustic phased array sensors, if shown to have operational potential, may aid in this effort by detecting and tracking the vortices. During August/September 2003, NASA and the USDOT sponsored a wake acoustics test at the Denver International Airport. The central instrument of the test was a large microphone phased array. This paper describes the test in general terms and gives an overview of the array hardware. It outlines one of the analysis techniques that is being applied to the data and gives sample results. The technique is able to clearly resolve the wake vortices of landing aircraft and measure their separation, height, and sinking rate. These observations permit an indirect estimate of the vortex circulation. The array also provides visualization of the vortex evolution, including the Crow instability.
Author
Aircraft Wakes; Airports; Vortex Avoidance; Vortices; Aeroacoustics

20040070893 NASA Langley Research Center, Hampton, VA, USA
Development of an LS-DYNA Model of an ATR42-300 Aircraft for Crash Simulation
Jackson, Karen E.; Fasanella, Edwin L.; [2004]; 15 pp.; In English; ICrash 2004 - International Crashworthiness Conference, 14-16 Jul. 2004, San Francisco, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the development of an LS-DYNA simulation of a vertical drop test of an ATR42-300 twin-turboprop high-wing commuter-class airplane. A 30-ft/s drop test of this aircraft was performed onto a concrete impact surface at the FAA Technical Center on July 30, 2003. The purpose of the test was to evaluate the structural response of a commuter-class aircraft when subjected to a severe, but survivable, impact. The aircraft was configured with crew and passenger seats, anthropomorphic test dummies, forward and aft luggage, instrumentation, and onboard data acquisition systems. The wings were filled with approximately 8,700 lb. of water to represent the fuel and the aircraft weighed a total of 33,200 lb. The model, which consisted of 57,643 nodes and 62,979 elements, was developed from direct measurements of the airframe geometry, over a period of approximately 8 months. The seats, dummies, luggage, fuel, and other ballast were represented using concentrated masses. Comparisons were made of the structural deformation and failure behavior of the airframe, as well as selected acceleration time history responses.
Author
Drop Tests; Commuter Aircraft; Dynamic Response; Structural Failure

20040071039 Federal Aviation Administration, Washington, DC
Continued Evaluation and Spectrum Development of a Health and Usage Monitoring System
Michael, J.; Collingwood, G.; Augustine, M.; Cronkhite, J.; May 2004; 64 pp.; In English
Report No.(s): PB2004-105483; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the results of a research project to evaluate structural usage monitoring and damage tolerance methodology using data collected on a Bell Model412 helicopter that was equipped with a health and usage monitoring system (HUMS). The helicopter was operated by Petroleum Helicopters Inc., from its base in Morgan City (UMMC). The usage

spectrum data from the UMMC were compared to certification data and to data from previous HUMS studies. The previous HUMS studies included the Atlanta short haul mission (ASHM), which was considered severe usage because it involved many short maneuvering flights to provide pickup and delivery services at the Olympics, and the Gulf Coast mission (GCM), which was considered mild usage because it primarily involved long cruise flights. The results of the different missions showed that usage monitoring could provide benefits in extending retirement times or inspection intervals compared to those set during certification, especially if high- and low-altitude effects are considered. In addition to usage monitoring evaluations, simplified mini-HUMS approaches were reviewed that could potentially provide low-cost HUMS with high paybacks. Also, guidelines were developed for HUMS certification and qualification and for the integration of HUMS into the operator's maintenance program. These guidelines are also discussed in the report. Finally, the usage data that were collected were used to perform fatigue-life calculations and theoretical redesigns fo four selected rotor system components known as principal structural elements to meet damage tolerance requirements.
NTIS
Systems Health Monitoring; Evaluation; Fatigue Life

20040071061 Federal Aviation Administration, Washington, DC
Engineering Studies of Cleaning and Drying Processes in Preparation for Fluorescent Penetrant Inspection
Jan. 2004; In English
Report No.(s): PB2004-102558; DOT/FAA/AR-03/73; No Copyright; Avail: National Technical Information Service (NTIS)

Fluorescent penetrant inspection (FPI) plays a crucial role in the overall inspection strategy for commercial jet engines. While over 90% of the metallic components that are used in jet engines will receive at least one fluorescent penetrant inspection as part of production qualification, FPI also plays a critical role in in-service maintenance and overhaul for the commercial aircraft industry. In-service inspection brings with it unique challenges brought about by service-induced conditions and materials used as part of the maintenance process. For FPI to provide effective crack detection, the defect must be clean, dry, and open to the surface. There are several methods approved for part cleaning and drying in preparation for FPI. The purpose of this program was to compare approved drying methods and to evaluate the effectiveness of a variety of cleaning methods on a range of typical contaminants. Quantitative methods to assess the changes in FPI indication response were developed and used to characterize low-cycle fatigue cracks grown in titanium and nickel samples.
NTIS
Aircraft Industry; Jet Engines; Cleaning

20040071064 Federal Aviation Administration, Washington, DC
Effects of Surface Preparation on the Long-Term Durability of Adhesively Bonded Composite Joints
Jan. 2004; In English
Report No.(s): PB2004-102557; DOT/FAA/AR-03/53; No Copyright; Avail: National Technical Information Service (NTIS)

The long-term durability of adhesively bonded composite joints is critical to modern aircraft structures, which are increasingly using bonding as an alternative to mechanical fastening. The effects of surface preparation for the adherends are critical to initial strength, long-term durability, fracture toughness, and failure modes of bonded joints. In this study, several potential factors are evaluated, with focus on the following: 1. Effects of possible chemical contamination from release fabrics, release films, and peel plies during adherend cure. 2. Chemical and mechanical effects of abrasion on the fracture toughness and failure mode. 3. Characterization of paste and film adhesives using mechanical test methods. There are several standard test methods to evaluate specimen fracture, but the majority concentrate on bonded metals and interlaminar composite fracture. Testing is concentrated on mode I tests. A custom double cantilever beam specimen was devised and used, and two forms of a wedge crack test (traveling and static) were also used. Additionally, mode II single lap shear tests were run to compare to the mode I tests. Nondestructive testing included X-ray photography of crack fronts, energy dispersive spectroscopy and X-ray photoelectron spectroscopy surface chemistry analyses, and scanning electron microscope imaging of prepared surfaces. All mode I test methods tended to be in agreement in the ranking of different surface preparation methods. Test results showed that release agents deposited on adherend surfaces during their cure cycle prevented proper adhesion. While mechanical abrasion did improve their fracture toughness and lower their contamination greatly, the test values did not reach the levels of samples that were not contaminated before bonding; therefore, the interfacial modes of failure did not always change to desirable modes.
NTIS
Adhesive Bonding; Joints (Junctions); Aircraft Engines; Mechanical Properties; Surface Properties; Composite Materials

20040071101 Texas Univ., Austin, TX, USA

Parameterized Consideration Set Model for Airport Choice: An Application to the San Francisco Bay Area

Basar, G.; Bhat, C.; Oct. 2003; 58 pp.; In English

Report No.(s): PB2004-105725; SWUTC/03/167520-1; No Copyright; Avail: CASI; A04, Hardcopy

Airport choice is an important air travel-related decision in multiple airport regions. This report proposes the use of a probabilistic choice set multinomial logit (PCMNL) model for airport choice that generalizes the multinomial logit model used in all earlier airport choice studies. This study discusses the properties of the PCMNL model, and applies it to examine airport choice of business travelers residing in the San Francisco Bay Area. Substantive policy implications of the results are discussed. Overall, the results indicate that it is important to analyze the choice (consideration) set formation of travelers. Failure to recognize consideration effects of air travelers can lead to biased model parameters, misleading evaluation of the effects of policy action, and a diminished data fit.

NTIS

Airports; Cities; Decisions

20040073485 Sikorsky Aircraft, USA

The Development of a New Lateral-Control Arrangement

Baker, Paul S.; October 1941; 39 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Development work on an arrangement using ailerons and spoilers for lateral control was carried out by the Vought-Sikorsky Aircraft Division of the United Aircraft Corporation on a small commercial airplane in flight and on an airfoil in a wind tunnel. Spoiler hinge moments were reduced by aerodynamic balance. The arrangement was then built into an experimental airplane and further improvements were adopted as the result of flight and tunnel tests. The use of ailerons for lateral control with flaps up, spoilers with flaps full down, and gradual transition as the flaps are lowered was found to provide lateral control under the flight conditions for which they were best suited. The ailerons were of short span, permitting the use of long-span flaps, and were drooped to a relatively large angle when the flaps were deflected. A high maximum lift coefficient was thus attained. With large control deflections in the intermediate flap-angle range and spoiler effectiveness near neutral improved by "ventilating" the spoiler, the lateral control was satisfactory for the experimental airplane and was a definite improvement over that of a conventional control arrangement.

Author

Lateral Control; Sikorsky Aircraft; Wind Tunnel Tests; Commercial Aircraft; Flight Tests; Aircraft Design

20040073561 Naval Postgraduate School, Monterey, CA

Autonomous Landing System for a UAV

Lizarraga, Mariano I.; Mar. 2004; 147 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422364; No Copyright; Avail: CASI; A07, Hardcopy

This thesis is part of an ongoing research conducted at the Naval Post-graduate School to achieve the autonomous shipboard landing of Unmanned Aerial Vehicles (UAV). Two main problems are addressed in this thesis. The first is to establish communication between the UAV's ground station and the Autonomous Landing Flight Control Computer effectively. The second addresses the design and implementation of an autonomous landing controller using classical control techniques. Device drivers for the sensors and the communications protocol were developed in ANSI C. The overall system was implemented in a PC1O4 computer running a real-time operating system developed by The Math- works, Inc. Computer and hardware in the loop (HIL) simulation, as well as ground test results show the feasibility of the algorithm proposed here. Flight tests are scheduled to be performed in the near future.

DTIC

Autonomous Navigation; Autonomy; Drone Vehicles; Landing Aids

20040073580 Naval Postgraduate School, Monterey, CA

Crossbow Executive Summary

Muldoon, Richard; Mar. 2002; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422417; SEI12-001-ES; No Copyright; Avail: CASI; A03, Hardcopy

Distributing naval combat power into many small ships and unmanned air vehicles that capitalize on emerging technology offers a transformational way to think about naval combat in the littorals in the 2020 timeframe. Project CROSSBOW is an engineered system of systems that proposes to use such distributed forces to provide forward presence, to gain and maintain access, to provide sea control, and to project combat power in the littoral regions of the world. Project CROSSBOW is the

result of a yearlong, campus-wide, integrated research systems engineering effort involving 40 student researchers and 15 supervising faculty members. This report (Volume 1) summaries the CROSSBOW project. It catalogs the major features of each of the components, and includes by reference a separate volume for each of the major systems (ships, aircraft, and logistics). It also presents the results of the mission and campaign analyses that informed the trade offs between these components. It describes certain functions of CROSSBOW in detil through specialized supporting studies. The student work presnted here is technologically feasible, integrated, and imaginative. This student project cannot by itslef provide definitive designs for analyses covering such a broad topic. It does strongly suggest that the underlying concepts have merit and deserve further serious study by the Navy as it transforms itself.
DTIC
Military Operations; Systems Engineering

20040073587 Naval Postgraduate School, Monterey, CA
Deployable Combat Simulation Via Wireless Architectures
Lock Jr, Jeffrey S.; Mar. 2004; 97 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422429; No Copyright; Avail: CASI; A05, Hardcopy

This thesis details the critical need for deployable combat simulations for training in today's surge force environment. To truly realize deployment of these simulations on Naval vessels and in remote theaters, simulations for training must be wireless. Wireless standards 8O2.ll/a/b/g are presented in detail to highlight the strengths and weaknesses of each. This thesis then investigates the viability of deploying combat simulations for training using wireless devices. To this end, the Joint Semi-Automated Forces (JSAF), combat simulation model and the Virtual Helicopter (VEHELO) training simulation entity are tested in an 8O2.lla wireless environment against the VEHELO application in a wired environment. 8O2.lla is proposed as part of an overall solution to deploy combat simulations for training. This is primarily because of its high data rates and ability to co-locate access points without interference. Testing reveals that operating JEAF and Virtual Helicopter via the High Level Architecture (HLA) with User Datagram Protocol (UDP) packets in an 8O2.lla environment provides ample bandwidth with which to deploy combat simulation for training for the simulations conducted.
DTIC
Combat; Flight Training; Mathematical Models; Simulation

20040073604 Space and Naval Warfare Systems Center, San Diego, CA
Applications for Mini VTOL UAV for Law Enforcement
Murphy, Douglas; Cycon, James; Nov. 1998; 10 pp.; In English
Report No.(s): AD-A422459; No Copyright; Avail: CASI; A02, Hardcopy

Remotely operated vehicle systems, ground and air, have great potential for supporting law enforcement operations. These systems, with their onboard sensors, can assist in collecting evidence, performing long term surveillance or in assessing hazardous situations prior to committing personnel. Remote ground vehicles are presently used by many police departments for ordnance clearing missions. Unmanned ground vehicles (UGVs) typically offer long endurance, and a intuitive to operate but can be severely limited in where they can go by terrain and obstacles. Unmanned air vehicles (UAVs) have three-dimensional mobility but have landing and takeoff restrictions, mission time limitations, and typically are demanding to operate. A new capability has been demonstrated for the U.S. military that shows great promise for aiding police agencies. This concept uses a shrouded rotor, vertical take-off and landing (VTOL), unmanned air vheicle to provide mobility to sensors nd other payloads. This system can either perform surveillance from the air or travel to a remote location and land to position onboard sensors to perform long term surveillance from the ground. This mobility platform concept can also be used to position packages (e.g. communications repeaters) or deliver and deploy non-lethal agents. This paper presents the concept of a small UAV, VTOL sensor mobility system for support of law enforcement operations. It tehn discusses operational feasibility and briefly reviews demonstrations of surveillance and sensor placement operations in mility urban terrain scenarios performed by the Space and Naval Warfare (SPAWAR) systems Center San Diego (SSC/SD) and Sikorsky Aircraft with their full size Cypher UAV. We then discuss the practicality of reducing the size of this capability to a system small enough to be transported in standard police vehicles and which can easily be operated by law enforcement personnel.
DTIC
Law (Jurisprudence); Remotely Piloted Vehicles; Vertical Takeoff Aircraft

20040073643 Naval Research Lab., Stennis Space Center, MS

Finland Air Force F/A-18 Moving-Map Composer (MMC) Version 3.4P, Software User's Manual

Lohrenz, Maura C.; Myrick, Stephanie A.; Trenchard, Michael E.; Gendron, Marlin L.; Watkins, Jessica L.; Apr. 9, 2004; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422527; NRL/FR/7440--04-10030; No Copyright; Avail: CASI; A04, Hardcopy

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 7440. 1. This is the third edition of the MMC User's Manual (the first and second editions are NRL/FR/7441--97-9677 and NRL/FR/7440--00-9983, respectively) and reflects changes that were implemented for the version 3.4P release of MMC.

DTIC

Computer Programs; Digital Data; Fighter Aircraft; Finland; Jet Aircraft; Maps; User Manuals (Computer Programs)

20040073652 Naval Command, Control and Ocean Surveillance Center, San Diego, CA

Telerobotic Requirements for Sensing, Navigation, and Communications

Gage, Douglas W.; May 1994; 5 pp.; In English

Report No.(s): AD-A422536; No Copyright; Avail: CASI; A01, Hardcopy

The coming decade will see a wide variety of large and small unmanned vehicle systems emerging from laboratories to tackle real-world applications. These systems will not only perform reconnaissance and inspection tasks, but also do real physical work, such as installing subsea completions in offshore oilfields. This presentation is intended to promote an appreciation of the broad range of telerobotic systems which offer opportunities for microwave and analogous technologies to support required functions of navigation, sensing, and communication. One thrust is to identify some of the many significant dimensions of variability between different systems characterizable as "telerobotic" -- dimensions which accommodate a wide variety of system concepts not yet explored. The specific details of an application's requirements -- in terms of functionality performance and environment -- sensitively affect the tradeoffs leading to an optimally cost effective system design approach.

DTIC

Detection; Navigation; Robotics; Telerobotics

20040073679 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Verification of Meteorological Data Reports from the RQ-4A Global Hawk Unmanned Aerial Vehicle

Callis, Steven M.; Mar. 2004; 120 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422577; AFIT/GM/ENP/04-03; No Copyright; Avail: CASI; A06, Hardcopy

Unmanned aerial vehicles (UAVs) have onboard sensors that continuously record weather data during their missions. This information is extremely valuable to both the meteorological and UAV communities with numerous potential benefits, which include improved weather forecast products and additional weather intelligence for military planners. The value of any dataset is directly related to its accuracy and this research determined the accuracy of weather data obtained from a particular UAV, the RQ-4A Global Hawk. This was accomplished through statistical analysis and comparisons with upper-air data and Atmospheric Slant Path Analysis Model (ASPAM) profiles of the atmosphere. Recommendations are provided for the use of this valuable environmental intelligence source to multiple user communities.

DTIC

Drone Vehicles; Meteorological Parameters; Pilotless Aircraft

20040073690 Defense Science Board, Washington, DC

Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles

Israel, Kenneth; Nesbit, Robert; Feb. 2004; 80 pp.; In English

Report No.(s): AD-A422590; No Copyright; Avail: CASI; A05, Hardcopy

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

DTIC

Combat; Drone Vehicles; Pilotless Aircraft

20040073826 Air Force Inst. of Tech., Wright-Patterson AFB, OH

A Demand Side Requirements Model to Forecast C-17 Mobility Aircraft Availability

Huscroft, Joseph R., Jr; Mar. 2004; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422881; AFIT/GLM/ENS/04-06; No Copyright; Avail: CASI; A06, Hardcopy

Current aircraft forecasting methods of the Air Mobility Command (AMC) directorate of Logistics are reliant on the experience of personnel and lead to after the fact, labor- intensive analysis. These deficiencies led AMC to the development of a Mobility Aircraft Availability Forecasting (MAAF) model. The purpose of the MAAF model is threefold: predict aircraft availability in order to provide the Tanker Airlift Control Center (TACC) with a forecast of aircraft that will be available for AMC mission requirements, provide what if capabilities that analyze the effects of tasking and policy changes, and to provide foresight into problems associated with aircraft availability (Briggs, 2003b). This research uses Arena simulation to model C-17 aircraft generation at a major enroute location to determine how significant the factors of crew chief manning and spares levels affect aircraft throughput and turn-times. From the simulation, ANOVA statistical techniques are applied to determine factor significance. In addition, a hierarchical structure of aircraft generation is generated to include the variability of unscheduled maintenance actions. This provides a more precise analysis of expected turn-time duration, which leads to overall throughput of the system. Ultimately, this research provides an key input to the MAAF project that will enable AMC to predict aircraft availability and provide the TACC with a monthly forecast of the number of aircraft that will be available to fulfill AMC mission requirements.

DTIC

C-17 Aircraft; Forecasting; Mobility; Tanker Aircraft

20040074126 Naval Research Lab., Washington, DC

Replacement of Chromium Electroplating on C-2, E-2, P-3 and C-130 Propeller Hub Components Using HVOF Thermal Spray Coatings

Sartwell, Bruce D.; Legg, Keith O.; Nardi, Aaron; Kestler, Robert; Assink, Warren; Mar. 31, 2004; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422443; NRL/MR/6170-04-8763; No Copyright; Avail: CASI; A06, Hardcopy

Hard chromium electroplating is extensively used by aircraft manufacturers and military maintenance depots to provide wear and/or corrosion resistance or to restore dimensional tolerance to components. However, chrome plating utilizes hexavalent chromium, winch is a highly toxic carcinogen, and increasingly stringent environmental and worker-safety regulations are making chrome plating more expensive for the DoD. This document constitutes the final report on a project to qualify high-velocity oxygen-fuel (HVOF) thermal spray coatings as a replacement for hard chrome plating on propeller hub components from various military aircraft. Extensive fatigue, wear, and corrosion test results comparing HVOF WC/l7Co, WC/lOCo4Cr, and Tribaloy 800 coatings against hard chrome are presented. In general, the performance of the HvOF coatings was superior to hard chrome. A rig test on a P-3 low-pitch-stop lever sleeve coated with WC/l7Co showed acceptable performance. A cost/benefit analysis conducted for a military repair depot that overhauls propeller hub components showed a slight cost increase associated with use of the HVOF coatings.

DTIC

Chromium; Cost Analysis; Cost Effectiveness; Electroplating; Hvof Thermal Spraying; Propellers; Replacing; Sprayers; Thermodynamic Properties

20040074136 National Defense Univ., Washington, DC

Defense Horizons. Number 22, December 2002. The Emergence of Mini UAVs for Military Applications

Coffey, Timothy; Montgomery, John A.; Dec. 2002; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422461; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Drone Vehicles; Horizon; Military Technology; Miniaturization

20040074148 National Defense Univ., Washington, DC

UCAVs- Technological, Policy, and Operational Challenges (Defense Horizons, Number 3, October 2001)

Barry, Charles L.; Zimet, Elihu; Oct. 2001; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422553; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Drone Vehicles; Horizon; Military Operations; Policies

20040074155 Air Force Inst. of Tech., Wright-Patterson AFB, OH

An Analysis of Coast Guard HH-65 Engine Reliability: A Comparison of Malfunctions to Component Removals

Corttrell, Donna L.; Mar. 2004; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422618; AFIT/GIR/ENC/04-01; No Copyright; Avail: CASI; A06, Hardcopy

The Coast Guard HH-65 helicopter experienced 3 tin- flight loss of power incidents during FY 2003 and 21 during the first two months of FY 2003, Concurrent with this apparent decrease in reliability, the Coast Guard seeks ways to expand the HH-65's Airborne Use of Force capabilities as a result of the September 11th, 2001 tenorists' attacks,

DTIC

Armed Forces (United States); Helicopters; Malfunctions

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*.

20040070781 NASA Glenn Research Center, Cleveland, OH, USA

New Reduced Two-Time Step Method for Calculating Combustion and Emission Rates of Jet-A and Methane Fuel With and Without Water Injection

Molnar, Melissa; Marek, C. John; April 2004; 78 pp.; In English

Contract(s)/Grant(s): WBS 714-20-10

Report No.(s): NASA/TM-2004-213046; E-14483; No Copyright; Avail: CASI; A05, Hardcopy

A simplified kinetic scheme for Jet-A, and methane fuels with water injection was developed to be used in numerical combustion codes, such as the National Combustor Code (NCC) or even simple FORTRAN codes that are being developed at Glenn. The two time step method is either an initial time averaged value (step one) or an instantaneous value (step two). The switch is based on the water concentration in moles/cc of 1x10(exp -20). The results presented here results in a correlation that gives the chemical kinetic time as two separate functions. This two step method is used as opposed to a one step time averaged method previously developed to determine the chemical kinetic time with increased accuracy. The first time averaged step is used at the initial times for smaller water concentrations. This gives the average chemical kinetic time as a function of initial overall fuel air ratio, initial water to fuel mass ratio, temperature, and pressure. The second instantaneous step, to be used with higher water concentrations, gives the chemical kinetic time as a function of instantaneous fuel and water mole concentration, pressure and temperature (T4). The simple correlations would then be compared to the turbulent mixing times to determine the limiting properties of the reaction. The NASA Glenn GLSENS kinetics code calculates the reaction rates and rate constants for each species in a kinetic scheme for finite kinetic rates. These reaction rates were then used to calculate the necessary chemical kinetic times. Chemical kinetic time equations for fuel, carbon monoxide and NOx were obtained for Jet-A fuel and methane with and without water injection to water mass loadings of 2/1 water to fuel. A similar correlation was also developed using data from NASA's Chemical Equilibrium Applications (CEA) code to determine the equilibrium concentrations of carbon monoxide and nitrogen oxide as functions of overall equivalence ratio, water to fuel mass ratio, pressure and temperature (T3). The temperature of the gas entering the turbine (T4) was also correlated as a function of the initial combustor temperature (T3), equivalence ratio, water to fuel mass ratio, and pressure.

Author

Jet Engine Fuels; Methane; Water Injection; Reaction Kinetics; Combustion Chambers; Emission; Mathematical Models

20040073436 NASA Glenn Research Center, Cleveland, OH, USA

Measurement of Initial Conditions at Nozzle Exit of High Speed Jets

Panda, J.; Zaman, K. B. M. Q.; Seasholtz, R. G.; May 2004; 18 pp.; In English; Seventh Aeroacoustics Conference, 28-30 May 2001, Maastricht, Netherlands

Report No.(s): NASA/TM-2004-212392; AIAA Paper 2001-2143; E-13969; No Copyright; Avail: CASI; A03, Hardcopy

The time averaged and unsteady density fields close to the nozzle exit (0.1 less than or = x/D less than or = 2, x: downstream distance, D: jet diameter) of unheated free jets at Mach numbers of 0.95, 1.4, and 1.8 were measured using a molecular Rayleigh scattering based technique. The initial thickness of shear layer and its linear growth rate were determined from time-averaged density survey and a modeling process, which utilized the Crocco-Busemann equation to relate density profiles to velocity profiles. The model also corrected for the smearing effect caused by a relatively long probe length in the

measured density data. The calculated shear layer thickness was further verified from a limited hot-wire measurement. Density fluctuations spectra, measured using a two-Photomultiplier-tube technique, were used to determine evolution of turbulent fluctuations in various Strouhal frequency bands. For this purpose spectra were obtained from a large number of points inside the flow; and at every axial station spectral data from all radial positions were integrated. The radially-integrated fluctuation data show an exponential growth with downstream distance and an eventual saturation in all Strouhal frequency bands. The initial level of density fluctuations was calculated by extrapolation to nozzle exit.
Author
Emission Spectra; Free Jets; High Speed; Time Functions; Density (Mass/Volume); Unsteady Flow; Nozzle Flow

20040073479 QSS Group, Inc., Cleveland, OH, USA
Measurements With a Split-Fiber Probe in Complex Unsteady Flows
Lepicovsky, Jan; April 2004; 18 pp.; In English; Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria
Contract(s)/Grant(s): NAS3-00145; WBS 22-708-28-03
Report No.(s): NASA/CR-2004-213065; GT-2004-53954; E-14531; No Copyright; Avail: CASI; A03, Hardcopy

A split-fiber probe was used to acquire unsteady data in a research compressor. A calibration method was devised for a split-fiber probe, and a new algorithm was developed to decompose split-fiber probe signals into velocity magnitude and direction. The algorithm is based on the minimum value of a merit function that is built over the entire range of flow velocities for which the probe was calibrated. The split-fiber probe performance and signal decomposition was first verified in a free-jet facility by comparing the data from three thermo-anemometric probes, namely a single-wire, a single-fiber, and the split-fiber probe. All three probes performed extremely well as far as the velocity magnitude was concerned. However, there are differences in the peak values of measured velocity unsteadiness in the jet shear layer. The single-wire probe indicates the highest unsteadiness level, followed closely by the split-fiber probe. The single-fiber probe indicates a noticeably lower level of velocity unsteadiness. Experiments in the NASA Low Speed Axial Compressor facility revealed similar results. The mean velocities agreed well, and differences in the velocity unsteadiness are similar to the case of a free jet. A reason for these discrepancies is in the different frequency response characteristics of probes used. It follows that the single-fiber probe has the slowest frequency response. In summary, the split-fiber probe worked reliably during the entire program. The acquired data averaged in time followed closely data acquired by conventional pneumatic probes.
Author
Anemometers; Thermal Analysis; Unsteady Flow; Velocity; Data Compression

20040074330 NASA Glenn Research Center, Cleveland, OH, USA
Leakage and Power Loss Test Results for Competing Turbine Engine Seals
Proctor, Margaret P.; Delgado, Irebert R.; April 2004; 18 pp.; In English; Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria
Contract(s)/Grant(s): WBS 714-09-18
Report No.(s): NASA/TM-2004-213049; GT2004-53935; E-14452; No Copyright; Avail: CASI; A03, Hardcopy

Advanced brush and finger seal technologies offer reduced leakage rates over conventional labyrinth seals used in gas turbine engines. To address engine manufacturers concerns about the heat generation and power loss from these contacting seals, brush, finger, and labyrinth seals were tested in the NASA High Speed, High Temperature Turbine Seal Test Rig. Leakage and power loss test results are compared for these competing seals for operating conditions up to 922 K (1200 F) inlet air temperature, 517 KPa (75 psid) across the seal, and surface velocities up to 366 m/s (1200 ft/s).
Author
Brush Seals; Labyrinth Seals; Leakage; Gas Turbine Engines

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*.

20040071015 Advanced Optical Systems, Inc., Huntsville, AL, USA
Advanced Video Guidance Sensor and Next Generation Autonomous Docking Sensors
Granade, Stephen R.; 2004; 12 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA
Contract(s)/Grant(s): NNM04AA23C; No Copyright; Avail: CASI; A03, Hardcopy

In recent decades, NASA's interest in spacecraft rendezvous and proximity operations has grown. Additional

instrumentation is needed to improve manned docking operations' safety, as well as to enable telerobotic operation of spacecraft or completely autonomous rendezvous and docking. To address this need, Advanced Optical Systems, Inc., Orbital Sciences Corporation, and Marshall Space Flight Center have developed the Advanced Video Guidance Sensor (AVGS) under the auspices of the Demonstration of Autonomous Rendezvous Technology (DART) program. Given a cooperative target comprising several retro-reflectors, AVGS provides six-degree-of-freedom information at ranges of up to 300 meters for the DART target. It does so by imaging the target, then performing pattern recognition on the resulting image. Longer range operation is possible through different target geometries. Now that AVGS is being readied for its test flight in 2004, the question is: what next? Modifications can be made to AVGS, including different pattern recognition algorithms and changes to the retro-reflector targets, to make it more robust and accurate. AVGS could be coupled with other space-qualified sensors, such as a laser range-and-bearing finder, that would operate at longer ranges. Different target configurations, including the use of active targets, could result in significant miniaturization over the current AVGS package. We will discuss these and other possibilities for a next-generation docking sensor or sensor suite that involve AVGS.
Author
Autonomy; Guidance Sensors; Imaging Techniques; Miniaturization; Reflectors; Telerobotics

20040073542 Office National d'Etudes et de Recherches Aerospatiales, Paris
A Concept of Flight Execution Monitor (FEM) for Helicopter Pilot Assistance
Le Blaye, Patrick; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422308; No Copyright; Avail: CASI; A03, Hardcopy

PAVE (Pilot Assistant in the Vicinity of hElipads) is a global research project conducted under the ONERA-DLR common research programme. Several new technologies are now available for helicopter onboard applications that have potentialities to support the pilot's perception and decision making. The technologies addressed in the frame of this project include an advanced flight control system, calculation of flight envelope limitations, enhanced and synthetic vision, and mission inflight planning and guidance. To obtain actual performance and safety benefits, integration of these technologies is one of the key issues addressed in this project. ONERA is especially involved in the development of a particular module of the pilot assistant, called the Flight Execution Monitor (FEM). The module is dedicated to the monitoring of the current helicopter situation and of the pilot's procedural activity. It is based on a high-level Petri net description of the procedures, derived from the specifications of the flight manual and from interviews with the users. This Petri net description is used to monitor the execution of the procedure, to graphically display the progress of the helicopter situation, including some flight limitations that are calculated online and displayed to support the pilot's decision. An initial prototype of the module has been developed and implemented in a man-in-the-loop simulation environment. The rationale behind the concept, the architecture of the current prototype, and its possible future directions are presented. This development results from applied research on control execution software; it also is a pragmatic attempt to investigate the possible alternatives in the task allocation between the human operator and an automated system, such as the modern helicopter. (7 figures, 14 refs.)
DTIC
Automatic Pilots; Decision Support Systems; Helicopters; Landing Aids; Man Machine Systems

20040073576 Naval Postgraduate School, Monterey, CA
Study of Wireless Transmission Protocol Technology for Use in Flight Line Environment to Assist the Data Loading and Downloading on Aircraft
Meng, Ow K.; Mar. 2004; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422408; No Copyright; Avail: CASI; A07, Hardcopy

Presently, the required data file to be loaded onto the Radar Warning Receiver (RWR) onboard the F-16 aircraft is done manually by the aircraft technicians, two to three hours prior to the actual flight time, This process should be automated As such there is a need to look into the use of wireless tmnsmission technology to complement or replace the manual method of loading the critical data file from the command station onto every F-16 aircraft, The present wireless technology is relatively mature and stable, In this thesis, the feasibility of incol'porating and adapting this technology for use in the flight line environment is examined The propagation effect in wireless transmission is also studied and recommendations proposed with regards to the installation of wireless facilities in the flight line, In addition, the EDNA, a portable maintenance aid that comes with the F-16 aircraft for loading the data file, has to be upgraded, Hence, a system feasibility study is carried out to adapt or upgrade the present equipment to wireless transmission capability.
DTIC
Computer Storage Devices; Data Storage; Flight Recorders; Protocol (Computers); Technology Utilization; Transmission Lines; Wireless Communication

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20040070721 NASA Glenn Research Center, Cleveland, OH, USA
Fuel-Flexible Gas Turbine Combustor Flametube Facility
Little, James E.; Nemets, Stephen A.; Tornabene, Robert T.; Smith, Timothy D.; Frankenfield, Bruce J.; Manning, Stephen D.; Thompson, William K.; April 2004; 18 pp.; In English
Contract(s)/Grant(s): WBS 708-04-01
Report No.(s): NASA/TM-2004-212715; E-14239; No Copyright; Avail: CASI; A03, Hardcopy

Facility modifications have been completed to an existing combustor flametube facility to enable testing with gaseous hydrogen propellants at the NASA Glenn Research Center. The purpose of the facility is to test a variety of fuel nozzle and flameholder hardware configurations for use in aircraft combustors. Facility capabilities have been expanded to include testing with gaseous hydrogen, along with the existing hydrocarbon-based jet fuel. Modifications have also been made to the facility air supply to provide heated air up to 350 psig, 1100 F, and 3.0 lbm/s. The facility can accommodate a wide variety of flametube and fuel nozzle configurations. Emissions and performance data are obtained via a variety of gas sample probe configurations and emissions measurement equipment.
Author
Combustion Chambers; Gas Turbines; Jet Engine Fuels; Hydrocarbon Fuels; Test Facilities

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*.

20040070785 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
From Columbia to Constellation: Crafting a New Space Policy
Sietzen, Frank; Aerospace America; April 2004; ISSN 0740-722X; Volume 42, No. 4, pp. 36-43; In English; Copyright; Avail: Other Sources

Those who have labored to build U.S. space policies over the years know that the task is daunting. From the establishment of NASA itself to the first manned space project to the building of the International Space Station (ISS), NASA's record of stirring achievement is mixed with disappointment and unintended consequences. Six times U.S. presidents have attempted to gain political and public support for human space goals. Twice their proposed projects have been fully successful. Twice they have been delayed and redesigned by Congress, and once rejected entirely. On January 14, a sixth attempt was initiated by President George W. Bush. The 43rd president set the nation on new space exploration agenda, the product of nearly a year of review and consensus building. At the end of what was arguably the worst year in NASA's 45-year history, the agency got a mandate it had longed for and dreamed about in the decades since the last manned lunar flight: Return astronauts to the Moon, evolve a sustained presence there, then head out into the solar system - to Mars and perhaps even beyond.
Author
Policies; NASA Programs; Project Planning

20040073609 Naval War Coll., Newport, RI
Space Wei QI: The Launch of Shenzhou V
Johnson-Freese, Joan; Jan. 2004; 26 pp.; In English
Report No.(s): AD-A422479; No Copyright; Avail: CASI; A03, Hardcopy

Wei Qi is the favorite Chinese board game chess with more than two hundred pieces rather than sixteen, allowing for significantly increased strategic complexity. When Lieutenant Colonel Yang Liwei lifted off into space from China's Jiuquan launch site just after 9 am on 15 October 2003, returning twenty-one hours later after sixteen orbits around the earth China made a significant geostrategic Wei Qi move. China views long-term geostrategic politics as having about the same number of possible permutations as a Wei Qi board, and it is posturing accordingly. The Shenztioti V launch was part of that posturing.

Perched atop a Long March (CZ-2F) launcher, the Shenztioti V spacecraft took China's first taikonaut on a trip thoroughly rehearsed during four unmanned precursor missions. Within China, a publicity campaign was carefully crafted to bring interest and national pride to a peak at the time of the event. Worldwide, media attention was considerable. Prelaunch speculation about the implications of the Chinese manned space program ranged from dubbing it a stunt to speculation about a new space race, to angst over its potential military significance.
DTIC
Space Missions; Spacecraft Launching

13
ASTRODYNAMICS

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

20040068262 Lawrence Livermore National Lab., Livermore, CA
Angular and Linear Velocity Estimation for a Re-Entry Vehicle Using Six Distributed Accelerometers: Theory, Simulation and Feasibility
Clark, G. A.; Apr. 28, 2003; In English
Report No.(s): DE2003-15004928; UCRL-ID-153253; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes a feasibility study. We are interested in calculating the angular and linear velocities of a re-entry vehicle using six acceleration signals from a distributed accelerometer inertial measurement unit (DAIMU). Earlier work showed that angular and linear velocity calculation using classic nonlinear ordinary differential equation (ODE) solvers is not practically feasible, due to mathematical and numerical difficulties. This report demonstrates the theoretical feasibility of using model-based nonlinear state estimation techniques to obtain the angular and linear velocities in this problem. Practical numerical and calibration issues require additional work to resolve. We show that the six accelerometers in the DAIMU are not sufficient to provide observability, so additional measurements of the system states are required (e.g. from a Global Positioning System (GPS) unit). Given the constraint that our system cannot use GPS, we propose using the existing on-board 3-axis magnetometer to measure angular velocity. We further show that the six nonlinear ODE's for the vehicle kinematics can be decoupled into three ODE's in the angular velocity and three ODE's in the linear velocity. This allows us to formulate a three-state Gauss-Markov system model for the angular velocities, using the magnetometer signals in the measurement model. This re-formulated model is observable, allowing us to build an Extended Kalman Filter (EKF) for estimating the angular velocities. Given the angular velocity estimates from the EKF, the three ODE's for the linear velocity become algebraic, and the linear velocity can be calculated by numerical integration. Thus, we do not need direct measurements of the linear velocity to provide observability, and the technique is mathematically feasible. Using a simulation example, we show that the estimator adds value over the numerical ODE solver in the presence of measurement noise. Calculating the velocities in the presence of significant measurement noise is not feasible with a classic ODE solver. The EKF is able to deal effectively with the noise and provide useful angular velocity estimates. The linear velocity estimates for this simulation show numerical difficulties associated with the nonlinear ODE's and the quadrature operation. Future work will focus on dealing with practical numerical issues and the issue of calibrating the DAIMU to deal with uncertainties in the accelerometer positions and locations.
NTIS
Accelerometers; Angular Velocity; Estimating; Reentry Vehicles; Simulation

20040074311 Princeton Univ., NJ, USA
New Frontiers in Spacecraft Orbit Design
Gurfil, Pini; Kasdin, N. Jeremy; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 483-505; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

Utilizing the Sun-Earth spatial elliptic three-body problem (ER3BP) framework, this paper presents new families of geocentric orbits and isolated distant quasiperiodic orbits which do not orbit the Lagrangian equilibrium points. The main driver for this study is the need to find practical orbits that remain within a bounded distance from Earth, thus allowing high data-rate communication while ensuring safe operational environment far from thermal perturbations and visual occultations as well as Earth's magnetic and radiation fields. The orbit characterization procedure is performed using a novel approach. Optimal initial conditions are found using niching genetic algorithms, which render global optimization while permitting several optimal or sub-optimal solutions to co-exist. This approach yields a diverse probing of the statespace of the ER3BP. Stability of the orbits is determined using the notion of practical stability. The effect of solar radiation pressure and the Moon's

gravitational perturbation are simulated, showing that the orbits are not significantly affected. This feature implies that no station-keeping is required. Optimal direct transfer trajectories from Low Earth orbit are briefly examined, showing that insertion into the characterized orbits may be performed using modest energetic requirements.
Author
Spacecraft Orbits; Orbit Determination; Orbit Calculation

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)*.

20040073441 NASA Glenn Research Center, Cleveland, OH, USA
Infrared Heater Used in Qualification Testing of International Space Station Radiators
Ziemke, Robert A.; May 2004; 24 pp.; In English
Contract(s)/Grant(s): WBS-229799-30-01
Report No.(s): NASA/TM-2004-212332; E-13928; No Copyright; Avail: CASI; A03, Hardcopy

Two heat rejection radiator systems for the International Space Station (ISS) have undergone thermal vacuum qualification testing at the NASA Glenn Research Center (GRC), Plum Brook Station, Sandusky, Ohio. The testing was performed in the Space Power Facility (SPF), the largest thermal vacuum chamber in the world. The heat rejection system radiator was tested first; it removes heat from the ISS crew living quarters. The second system tested was the photovoltaic radiator (PVR), which rejects heat from the ISS photovoltaic arrays and the electrical power-conditioning equipment. The testing included thermal cycling, hot- and cold-soaked deployments, thermal gradient deployments, verification of the onboard heater controls, and for the PVR, thermal performance tests with ammonia flow. Both radiator systems are orbital replacement units for ease of replacement on the ISS. One key to the success of these tests was the performance of the infrared heater system. It was used in conjunction with a gaseous-nitrogen-cooled cryoshroud in the SPF vacuum chamber to achieve the required thermal vacuum conditions for the qualification tests. The heater, which was designed specifically for these tests, was highly successful and easily met the test requirements. This report discusses the heating requirements, the heater design features, the design approach, and the mathematical basis of the design.
Author
Infrared Radiation; Heat Radiators; Thermal Cycling Tests; Photovoltaic Cells; Temperature Effects; Infrared Instruments

20040073460 NASA Langley Research Center, Hampton, VA, USA
Linear and Nonlinear Analyses of a Wind-Tunnel Balance
Karkehabadi, R.; Rhew, R. D.; [2004]; 19 pp.; In English; 4th International Symposium on Strain Gauge Balances, 10-13 May 2004, San Diego, CA, USA
Contract(s)/Grant(s): 23-090-80-40; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Langley Research Center (LaRC) has been designing strain-gauge balances for utilization in wind tunnels since its inception. The utilization of balances span a wide variety of aerodynamic tests. A force balance is an inherently critically stressed component due to the requirements of measurement sensitivity. Force balance stress analysis and acceptance criteria are under review due to LaRC wind tunnel operational safety requirements. This paper presents some of the analyses done at NASA LaRC. Research and analyses were performed in order to investigate the structural integrity of the balances and better understand their performance. The analyses presented in this paper are helpful in understanding the overall behavior of an existing balance and can also be used in design of new balances to enhance their performance. As a first step, maximum load combination is used for linear structural analysis. When nonlinear effects are encountered, the analysis is extended to include the nonlinearities. Balance 1621 is typical for LaRC designed balances and was chosen for this study due to its traditional high load capacity, Figure 1. Maximum loading occurs when all 6 components are applied simultaneously with their maximum value allowed (limit load). This circumstance normally will not occur in the wind tunnel. However, if it occurs, is the balance capable of handling the loads with an acceptable factor of safety? Preliminary analysis using Pro/Mechanica indicated that this balance might experience nonlinearity. It was decided to analyze this balance by using NASTRAN so that a nonlinear analysis could be conducted. Balance 1621 was modeled and meshed in PATRAN for analysis in NASTRAN. The model from PATRAN/NASTRAN is compared to the one from Pro/Mechanica. For a complete analysis, it is necessary to consider all the load cases as well as use a dense mesh near all the edges. Because of computer limitations, it is not feasible

to analyze model with the dense mesh near all edges. In the present study, the dense mesh is limited to the surface on the end of the axial sections.
Author
Wind Tunnel Apparatus; Nonlinearity; Finite Element Method; Balance; Computer Programs; Stress Analysis; Structural Analysis

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*.

20040068302 Swedish Defence Research Establishment, Linkoeping
SAR/GMTI Ground Moving Target Indication
Kjellgren, J.; Oct. 2003; In Swedish
Report No.(s): PB2004-104546; FOI-R-0973-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The aim of this study is to support the modeling of the radar function when simulating systems at higher levels. Especially it deals with monostatic synthetic aperture radar for 'Ground Moving Target Indication' (GMTI). The study comprises a short introduction to airborne MTI and especially SAR with DPCA (Displaced Phase Center Antennas) and further there are some estimations regarding the maximum coherency time when limited by linear and rotational movements of a target. Also there are some aspects on application modes and approximate expressions for some performance parameters limited by the measurement geometry. The financial source has mainly been the project NFFP-427 (E7779) from the Swedish Defense Material Administration.
NTIS
Synthetic Aperture Radar; Moving Target Indicators; Targets

20040070707 NASA Ames Research Center, Moffett Field, CA, USA
Modeling and Simulation of Shuttle Launch and Range Operations
Bardina, Jorge; Thirumalainambi, Rajkumar; [2004]; 7 pp.; In English; ESM 2004: 18th European Simulation Multi Conference, Magdeburg, Germany; No Copyright; Avail: CASI; A02, Hardcopy

The simulation and modeling test bed is based on a mockup of a space flight operations control suitable to experiment physical, procedural, software, hardware and psychological aspects of space flight operations. The test bed consists of a weather expert system to advise on the effect of weather to the launch operations. It also simulates toxic gas dispersion model, impact of human health risk, debris dispersion model in 3D visualization. Since all modeling and simulation is based on the internet, it could reduce the cost of operations of launch and range safety by conducting extensive research before a particular launch. Each model has an independent decision making module to derive the best decision for launch.
Author
Spacecraft Launching; Computerized Simulation; Mathematical Models; Space Flight; Flight Operations

20040070786 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Changing the Low-Cost Launch Game
Croft, John; Aerospace America; February 2004; ISSN 0740-722X; Volume 42, No. 2, pp. 39-43; In English; Copyright; Avail: Other Sources

Elon Musk does not want to leave the planet; he just wants to make the trip more affordable and reliable for those who do, and make a profit in the process. His lofty ambitions could come one step closer to fruition in March, when his company, Los Angeles-based Space Exploration Technologies, or SpaceX, attempts to launch its first rocket, a 70-ft-long two-stage liquid-fueled ship called the Falcon. If Musk can claim success - recovering his first stage and putting the U.S. military payload into the correct circular low-Earth orbit after a Vandenberg launch - the company will have set a new low in cost-per-pound to LEO for a commercial venture. Such a reduction will be necessary for any viable future civilian endeavors in space, manned or unmanned. Musk's Falcon, priced at $6 million, can deliver a maximum of 1,400 lb to a 200-km circular orbit at launch site inclination, yielding a $4,000/lb-to-orbit cost. The entrepreneur notes that the nearest U.S. competitor in this booster class

is Orbital Sciences' Pegasus, with a ride he says is priced at $20 million. For an equivalent payload, the Pegasus would cost $14,000/lb to LEO - a difference of more than 70%.
Author
Commercial Spacecraft; Launch Vehicles; Low Cost

20040073703 Rice Univ., Houston, TX
Application of Sequential Auction Techniques to Nonlinear Targeting Assignment for Space-Delivered Entry Vehicles
Stiles, Brian A.; May 2004; 123 pp.; In English
Report No.(s): AD-A422604; CI04-150; No Copyright; Avail: CASI; A06, Hardcopy
In the future, the arsenal of the U.S. military will include Space-delivered weapons, released by reusable launch vehicles. Entry vehicles released from the launch platforms will be capable of guiding to target locations throughout the world. In order to adequately incorporate these weapons into military plans, theater commanders will require sophisticated planning algorithms to maximize the likelihood of destroying the most important targets. This thesis develops a target assignment algorithm which uses a sequence of linear auctions to optimize the assignment of entry vehicles to weighted targets. This result can be improved over time by use of a directed search method, which uses numerous sequences of linear auctions to improve on solutions by eliminating poor assignments. These methods are compared to greedy methods, showing improvement in the assignment solution.
DTIC
Aerospace Vehicles; Launch Vehicles; Military Operations; Nonlinearity; Planning

20040073751 Air Force Research Lab., Edwards AFB, CA
Some Results of a Study of the Effectiveness and Cost of a Laser-Powered Lightcraft Vehicle System
Froning, David; McKinney, Leon; Mead, Franklin; Larson, William; Pike, Alan; Apr. 2004; 30 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A422675; AFRL-PR-ED-TP-2004-094; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Costs; Laser Applications; Laser Beams; Lasers; Propulsion

20040074159 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Comparative Analysis on the Cost of Oversight for the New National Security Space Acquisition Policy- A Delphi Method Approach
DeReus, Darrin L.; Mar. 2004; 112 pp.; In English
Report No.(s): AD-A422619; AFIT/GCA/ENV/04M-2; No Copyright; Avail: CASI; A06, Hardcopy
For the past 50 years, the military's use of space for our national defense has increased exponentially. The use of space has increased so much that recent events have led to the approval for most space Major Defense Acquisition Programs to fall under their own process of oversight to track and monitor these programs. The largest reason for this change is due to the difference in spending profiles and current acquisition regulations that are not structured to meet these space expenditure plans. The key problem is no one knows, for sure, how much the oversight process actually costs and if one form of oversight is actually statistically better than the other. If the other processes are better, what actually drives the cost for their oversight?
DTIC
Costs; Delphi Method (Forecasting); Security; Space Law

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20040074329 NASA Glenn Research Center, Cleveland, OH, USA
A Reconfigurable Communications System for Small Spacecraft
Kifle, Muli; Chu, Pong P.; May 2004; 16 pp.; In English
Contract(s)/Grant(s): WBS 704-60-14
Report No.(s): NASA/TM-2004-212534; E-14098; No Copyright; Avail: CASI; A03, Hardcopy
Two trends of NASA missions are the use of multiple small spacecraft and the development of an integrated space

network. To achieve these goals, a robust and agile communications system is needed. Advancements in field programmable gate array (FPGA) technology have made it possible to incorporate major communication and network functionalities in FPGA chips; thus this technology has great potential as the basis for a reconfigurable communications system. This report discusses the requirements of future space communications, reviews relevant issues, and proposes a methodology to design and construct a reconfigurable communications system for small scientific spacecraft.
Author
Communication Networks; Field-Programmable Gate Arrays; Space Communication; Trends

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*.

20040068192 Fraunhofer-Inst. fuer Mikrostrukturtechnik, Germany
High Aspect Ratio Hole Array Filters for a Wide Range of Wavelength
Fettig, R. K.; Hein, H.; Schulz, J.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P3; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Metal mesh filters are used as cutoff and band pass filters for radiation from the infrared to microwaves. Usually they are constructed of metal films where the thickness is much thinner than the size of the structures. In some instances films thicker than the size of the apertures are of advantage. Simple theoretical models predict that thick metal films with densely packed circular or hexagonal holes act as high pass filters. They should exhibit a sharp cutoff and an out of band rejection which is the better, the larger the aspect ratio of film thickness to hole diameter. The cutoff wavelength is about twice the hole diameter. The LIGA process that combines E-beam or x-ray lithography with electroplating is well suited to produce filters with the favorable aspect ratios of > 2:1. With this process filters were produced for the Isophot instrument onboard ESAs ISO satellite. The filters had hexagonal holes of 80 micron width in a 180-micron thick film. The rejection of radiation of wavelength > 150 micron is excellent. Recently filters have been produced using E-beam lithography and electroplating with hole diameters of 1 micron in a 2.5-micron thick gold film with a similarly good rejection for wavelengths > 2 micron. With these filters the suitability of layout and processes is demonstrated for the entire range from 2 micron to the microwave region.
Author
Bandpass Filters; Infrared Space Observatory (Iso)

20040070737 Space Systems/Loral, Palo Alto, CA, USA
Sodium Sulfur Cell Technology Flight Experiment
Chang, Rebecca R.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 45; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

A practical and technically low risk sodium sulfur (Na-S) cell experiment has been identified to address all critical issues related to Na-S battery operation under microgravity conditions. This work was performed by Space Systems/Loral (SS/L) formerly known as Ford Aerospace Corporation's Space Systems Division, Sodium Sulfur Battery Flight Experiment Definition Study (Phase A), and documented in the Phase A final report. The advantage of the Na-S battery for space applications, and the benefits, justifications, and objectives of the flight experiment were also presented at the IN-STEP 88 and previous SERT conference. The development of a detailed experiment concept will be performed in the Concept Development Phase (Phase B); and the final design, fabrication, testing, flight, and data analysis of the experiment will be performed in the Flight Development and Operations Phase (Phase C/D). This paper summarizes the current status and update of the flight experiment.
Author
Fabrication; Technology Utilization; Sodium Sulfur Batteries; Aerospace Engineering; Flight Tests

20040070775 NASA Langley Research Center, Hampton, VA, USA
One Idea for a Next Generation Shuttle
MacConochie, Ian O.; Cerro, Jeffrey A.; [2004]; 8 pp.; In English; 63rd Annual Conference of Society of Allied Weight Engineers, Inc., 17-19 May 2004, Newport Beach, CA, USA
Report No.(s): SAWE Paper-3324; Copyright; Avail: CASI; A02, Hardcopy

In this configuration, the current Shuttle External Tank serves as core structure for a fully reusable second stage. This stage is equipped with wings, vertical fin, landing gear, and thermal protection. The stage is geometrically identical to (but smaller than) a single stage that has been tested hyper-sonically, super-sonically, and sub-sonically in the NASA Langley Research Center wind tunnels. The three LOX/LH engines that currently serve as main propulsion for the Shuttle Orbiter, serve as main propulsion on the new stage. The new stage is unmanned but is equipped with the avionics needed for automatic maneuvering on orbit and for landing on a runway. Three rails are installed along the top surface of the vehicle for attachment of various payloads. Pay- loads might include third stages with satellites attached, personnel pods, propellants, or other items.
Author
External Tanks; Liquid Oxygen; Payloads; Pods (External Stores); Thermal Protection

20040070911 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tethers as Debris: Simulating Impacts of Kevlar Tethers on Shuttle Tiles
Evans, Steven W.; 2004; 1 pp.; In English; 45th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, 19-24 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In a previous paper I examined the effects of impacts of polymer tethers on aluminum plates using the SPHC hydrodynamic code. In this paper I apply tether models to a new target - models of Space Shuttle tiles developed during the STS 107 accident investigation. In this three-dimensional simulation, a short tether fragment strikes a single tile supported on an aluminum backing plate. A tile of the LI-900 material is modeled. Penetration and damage to the tile and the backwall are characterized for three normal impact velocities. The tether is modeled as a bundle of eight 1-mm strands, with the bundle having dimensions 2-mm x 4-mm x 20-cm. The bulk material properties used are those of Kevlar(TradeMark) 49, for which a Mie-Gruneisen multiphase equation of state (eos) is used. In addition, the strength model is applied in a linear sense, such that tensile loads along the strand length are supported, but there is no strength in the lateral directions. Tile models include the various layers making up the tile structure. The outermost layer is a relatively dense borosilicate glass, known as RCG, 0.5-mm thick. The RCG layer is present on the top and four sides of the tile. Below this coating is the bulk of the tile, 1.8-in thick, made of LI-900, a product consisting of rigidized fiberous silica with a density of 9 lWft3. Below the main insulating layer is a bottom layer of the same material that has been treated to increase its density by approximately 69% to improve its strength. This densified layer is bonded to a Strain Isolation Pad (SIP), modeled as a refractory felt fabric. The SIP is bonded to an aluminum 2024 wall 0.1-in thick. The tile and backwall materials use a Me-Gruneisen multiphase eos, with the exception of the SIP felt, which uses a fabric equation of state. Fabrics must be crushed to the full bulk material density before bulk material properties and a Mie-Gruneisen eos are applied. Tether fragment impact speeds of 3,7, and 10 km/s are simulated, with impact velocities normal to the tile face. Damage results are presented in tabular format.
Author
Kevlar (Trademark); Computerized Simulation; Tethering; Tiles; Debris; Space Transportation System; Space Shuttles; Three Dimensional Models

20040070938 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thermal Performance of Capillary Pumped Loops Onboard Terra Spacecraft
Ku, Jentung; Ottenstein, Laura; Butler, Charles D.; Swanson, Theodore; Thies, Diane; 2004; 18 pp.; In English; 34th ICES Conference, 19-22 Jul. 2004, Colorado Springs, CO, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Terra spacecraft is the flagship of NASA's Earth Science Enterprise. It provides global data on the state of atmosphere, land and oceans, as well as their interactions with solar radiation and one another. Three Terra instruments utilize Capillary Pumped Heat Transport System (CPHTS) for temperature control: Each CPHTS, consisting of two capillary pumped loops (CPLs) and several heat pipes and electrical heaters, is designed for instrument heat loads ranging from 25W to 264W. The working fluid is ammonia. Since the launch of the Terra spacecraft, each CPHTS has been providing a stable interface temperature specified by the instrument under all modes of spacecraft and instrument operations. The ability to change the CPHTS operating temperature upon demand while in service has also extended the useful life of one instrument. This paper describes the design and on-orbit performance of the CPHTS thermal systems.
Author
Capillary Pumped Loops; Heat Pipes; Heat Transfer; Solar Radiation; Temperature Effects; Temperature Measuring Instruments; Terra Spacecraft

20040070939 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radiation Assurance for the Space Environment
Barth, Janet L.; LaBel, Kenneth A.; Poivey, Christian; 2004; 11 pp.; In English; IEEE International Conference on Integrated Circuit Design and Technology, 18-20 May 2004, Austin, TX, USA; No Copyright; Avail: CASI; A03, Hardcopy

The space radiation environment can lead to extremely harsh operating conditions for spacecraft electronic systems. A hardness assurance methodology must be followed to assure that the space radiation environment does not compromise the functionality and performance of space-based systems during the mission lifetime. The methodology includes a definition of the radiation environment, assessment of the radiation sensitivity of parts, worst-case analysis of the impact of radiation effects, and part acceptance decisions which are likely to include mitigation measures.
Author
Aerospace Environments; Extraterrestrial Radiation; Radiation Effects; Spacecraft Electronic Equipment

20040071010 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview af MSFC's Applied Fluid Dynamics Analysis Group Activities
Garcia, Roberto; Griffin, Lisa; Williams, Robert; [2004]; 22 pp.; In English; MSFC Spring Fluids Workshop, 13 Apr. 2004, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents viewgraphs on NASA Marshall Space Flight Center's Applied Fluid Dynamics Analysis Group Activities. The topics include: 1) Status of programs at MSFC; 2) Fluid Mechanics at MSFC; 3) Relevant Fluid Dynamics Activities at MSFC; and 4) Shuttle Return to Flight.
CASI
General Overviews; Computational Fluid Dynamics; Space Shuttles; Space Transportation System Flights; Spacecraft Design

20040071011 NASA Marshall Space Flight Center, Huntsville, AL, USA
Automated Rendezvous and Capture System Development and Simulation for NASA
Roe, Fred D.; Howard, Richard T.; Murphy, Leslie; 2004; 8 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

The USA does not have an Automated Rendezvous and Capture Docking (AR&C) capability and is reliant on manned control for rendezvous and docking of orbiting spacecraft. T h i s reliance on the labor intensive manned interface for control of rendezvous and docking vehicles has a significant impact on the cost of the operation of the International Space Station (ISS) and precludes the use of any U.S. expendable launch capabilities for Space Station resupply. The Marshall Space Flight Center (MSFC) has conducted pioneering research in the development of an automated rendezvous and capture (or docking) (AR&C) system for U.S. space vehicles. This A M C system was tested extensively using hardware-in-the-loop simulations in the Flight Robotics Laboratory, and a rendezvous sensor, the Video Guidance Sensor was developed and successfully flown on the Space Shuttle on flights STS-87 and STS-95, proving the concept of a video- based sensor. Further developments in sensor technology and vehicle and target configuration have lead to continued improvements and changes in AR&C system development and simulation. A new Advanced Video Guidance Sensor (AVGS) with target will be utilized as the primary navigation sensor on the Demonstration of Autonomous Rendezvous Technologies (DART) flight experiment in 2004. Realtime closed-loop simulations will be performed to validate the improved AR&C systems prior to flight.
Author
Autonomy; Navigation Instruments; Orbital Rendezvous; Rendezvous Guidance; Robotics; Spacecraft Docking

20040073458 NASA Langley Research Center, Hampton, VA, USA
Development of Modal Test Techniques for Validation of a Solar Sail Design
Gaspar, James L.; Mann, Troy; Behun, Vaughn; Wilkie, W. Keats; Pappa, Richard; [2004]; 11 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-755-06-00
Report No.(s): AIAA Paper 2004-1665; No Copyright; Avail: CASI; A03, Hardcopy

This paper focuses on the development of modal test techniques for validation of a solar sail gossamer space structure design. The major focus is on validating and comparing the capabilities of various excitation techniques for modal testing solar sail components. One triangular shaped quadrant of a solar sail membrane was tested in a 1 Torr vacuum environment using various excitation techniques including, magnetic excitation, and surface-bonded piezoelectric patch actuators. Results from modal tests performed on the sail using piezoelectric patches at different positions are discussed. The excitation methods were evaluated for their applicability to in-vacuum ground testing and to the development of on orbit flight test techniques. The solar sail membrane was tested in the horizontal configuration at various tension levels to assess the variation in frequency with tension in a vacuum environment. A segment of a solar sail mast prototype was also tested in ambient atmospheric conditions

using various excitation techniques, and these methods are also assessed for their ground test capabilities and on-orbit flight testing.
Author
Ground Tests; Solar Sails; Design Analysis; Fabrication; Flight Tests

20040074265 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tethered Formation Configurations: Meeting the Scientific Objectives of Large Aperture and Interferometric Science
Farley, Rodger E.; Quinn, David A.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 463-471; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

With the success of the Hubble Space Telescope, it has become apparent that new frontiers of science and discovery are made every time an improvement in imaging resolution is made. For the HST working primarily in the visible and near-visible spectrum, this meant designing, building and launching a primary mirror approximately three meters in diameter. Conventional thinking tells us that accomplishing a comparable improvement in resolution at longer wavelengths for Earth and Space Science applications requires a corresponding increase in the size of the primary mirror. For wavelengths in the sub-millimeter range, a very large telescope with an effective aperture in excess of one kilometer in diameter would be needed to obtain high quality angular resolution. Realistically a single aperture this large is practically impossible. Fortunately such large apertures can be constructed synthetically. Possibly as few as three 3 - 4 meter diameter mirrors flying in precision formation could be used to collect light at these longer wavelengths permitting not only very large virtual aperture science to be carried out, but high-resolution interferometry as well. To ensure the longest possible mission duration, a system of tethered spacecraft will be needed to mitigate the need for a great deal of propellant. A spin-stabilized, tethered formation will likely meet these requirements. Several configurations have been proposed which possibly meet the needs of the Space Science community. This paper discusses two of them, weighing the relative pros and cons of each concept. The ultimate goal being to settle on a configuration which combines the best features of structure, tethers and formation flying to meet the ambitious requirements necessary to make future large synthetic aperture and interferometric science missions successful.
Author
Tethered Satellites; Astronomical Satellites; Formation Flying; Astronomical Interferometry; Synthetic Apertures

20040074266 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Formations of Tethered Spacecraft as Stable Platforms for Far IR and Sub-mm Astronomy
Quadrelli, Marco B.; Hadaegh, Fred Y.; Shao, Michael; Lorenzini, Enrico C.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 472-482; In English; See also 20040074260
Contract(s)/Grant(s): JPL-1215076; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we describe current research in tethered formations for interferometry, and a roadmap to demonstrating the required key technologies via on-ground and in-orbit testing. We propose an integrated kilometer-size tethered spacecraft formation flying concept which enables Far IR and Sub-mm astronomy observations from space. A rather general model is used to predict the dynamics, control, and estimation performance of formations of spacecraft connected by tethers in LEO and deep space. These models include the orbital and tethered formation dynamics, environmental models, and models of the formation estimator/controller/commander. Both centralized and decentralized control/sensing/estimation schemes are possible, and dynamic ranges of interest for sensing/control are described. Key component/subsystem technologies are described which need both ground-based and in-orbit demonstration prior to their utilization in precision space interferometry missions using tethered formations. Defining an orbiting formation as an ensemble of orbiting spacecraft performing a cooperative task, recent work has demonstrated the validity of the tethering the spacecraft to provide both the required formation rigidity and satisfy the formation reconfiguration needs such as interferometer baseline control. In our concept, several vehicles are connected and move along the tether, so that to reposition them the connecting tether links must vary in length. This feature enables variable and precise baseline control while the system spins around the boresight. The control architecture features an interferometer configuration composed of one central combiner spacecraft and two aligned collector spacecraft. The combiner spacecraft acts as the formation leader and is also where the centralized sensing and estimation functions reside. Some of the issues analyzed with the model are: dynamic modes of deformation of the distributed structure, architecture of the formation sensor, and sources of dynamical perturbation that need to be mitigated for precision operation in space. Examples from numerical simulation of an envisioned scenario in heliocentric orbit demonstrate the potential of the concept for space interferometry.
Author
Tethered Satellites; Formation Flying; Astronomical Satellites; Infrared Astronomy; Radio Astronomy

20040074322 NASA Langley Research Center, Hampton, VA, USA

Parametric Studies of Square Solar Sails Using Finite Element Analysis

Sleight, David W.; Muheim, Danniella M.; March 25, 2004; 13 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA

Contract(s)/Grant(s): 755-06-00

Report No.(s): AIAA Paper 2004-1509; No Copyright; Avail: CASI; A03, Hardcopy

Parametric studies are performed on two generic square solar sail designs to identify parameters of interest. The studies are performed on systems-level models of full-scale solar sails, and include geometric nonlinearity and inertia relief, and use a Newton-Raphson scheme to apply sail pre-tensioning and solar pressure. Computational strategies and difficulties encountered during the analyses are also addressed. The purpose of this paper is not to compare the benefits of one sail design over the other. Instead, the results of the parametric studies may be used to identify general response trends, and areas of potential nonlinear structural interactions for future studies. The effects of sail size, sail membrane pre-stress, sail membrane thickness, and boom stiffness on the sail membrane and boom deformations, boom loads, and vibration frequencies are studied. Over the range of parameters studied, the maximum sail deflection and boom deformations are a nonlinear function of the sail properties. In general, the vibration frequencies and modes are closely spaced. For some vibration mode shapes, local deformation patterns that dominate the response are identified. These localized patterns are attributed to the presence of negative stresses in the sail membrane that are artifacts of the assumption of ignoring the effects of wrinkling in the modeling process, and are not believed to be physically meaningful. Over the range of parameters studied, several regions of potential nonlinear modal interaction are identified.

Author

Solar Sails; Stresses; Vibration Mode; Design Analysis; Dynamic Structural Analysis; Membrane Structures; Computation

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20040068196 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

NASA Space Cryocooler Programs: A 2003 Overview

Ross, R. G., Jr.; Boyle, R. F.; Kittel, P.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 6-1 - 6-7; In English; See also 20040068186; No Copyright; Avail: CASI; A02, Hardcopy

Mechanical cryocoolers represent a significant enabling technology for NASA's Earth and Space Science missions. An overview is presented of ongoing cryocooler activities within NASA in support of current flight projects, near-term flight instruments, and long-term technology development. NASA programs in Earth and space science observe a wide range of phenomena, from crop dynamics to stellar birth. Many of the instruments require cryogenic refrigeration to improve dynamic range, extend wavelength coverage, and enable the use of advanced detectors. Although, the largest utilization of coolers over the last decade has been for instruments operating at medium to high cryogenic temperatures (55 to 150 K), reflecting the relative maturity of the technology at these temperatures, important new developments are now focusing at the lower temperature range from 4 to 20 K in support of studies of the origin of the universe and the search for planets around distant stars. NASA's development of a 20K cryocooler for the European Planck spacecraft and its new Advanced Cryocooler Technology Development Program (ACTDP) for 6-18 K coolers are examples of the thrust to provide low temperature cooling for this class of missions.

Author

Cryogenic Cooling; NASA Space Programs; General Overviews; Flight Instruments; Technology Utilization

20040068226 Northrop Grumman Space Technology, Redondo Beach, CA, USA

Space Cryocoolers

Tward, Emanuel; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 6-16; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Cryogenic coolers for use in space require low power and minimum weight. In this paper we describe the typical requirements and performance of a number of reliable, small, efficient, low-power, vibrationally balanced coolers designed and

manufactured by NGST (formerly TRW). Eight coolers are currently in orbit on both NASA and military missions. Seven of the eight are pulse tube coolers which since launch have been continuously and successfully cooling ir focal planes to wavelengths up to 16 microns on payloads such as AIRS, Hyperion, Saber, MTI, and CX. The longest of these missions is now greater than 5 years. The eighth is a Stirling cooler that is cooling a high-temperature superconducting mux on the HTSSE payload. The next generation of these coolers and their sophisticated control electronics are even smaller and more efficient and have been scaled over two orders of magnitude in size. Some are already integrated onto payloads and are scheduled for launch this year. Cooler capabilities are being pushed to lower temperatures (6 K), to multiple cooling stages, to higher cooling capacity and to smaller sizes. These developments will be described.
Author
Cryogenic Cooling; NASA Programs; Onboard Equipment; Cooling Systems

20040068229 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Heterodyne Spectroscopy in the Thermal Infrared Region: A Window on Physics and Chemistry
Kostiuk, Theodor; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 7-1 - 7-7; In English; See also 20040068186; No Copyright; Avail: CASI; A02, Hardcopy

The thermal infrared region contains molecular bands of many of the most important species in gaseous astronomical sources. True shapes and frequencies of emission and absorption spectral lines from these constituents of planetary and stellar atmospheres contain unique information on local temperature and abundance distribution, non-thermal effects, composition, local dynamics and winds. Heterodyne spectroscopy in the thermal infrared can remotely measure true line shapes in relatively cool and thin regions and enable the retrieval of detailed information about local physics and chemistry. The concept and techniques for heterodyne detection will be discussed including examples of thermal infrared photomixers and instrumentation used in studies of several astronomical sources. Use of heterodyne detection to study non-LTE phenomena, planetary aurora, minor planetary species and gas velocities (winds) will be discussed. A discussion of future technological developments and relation to space flight missions will be addressed.
Author
Heterodyning; Infrared Radiation; Spectroscopy; Detection; Astrophysics; Infrared Instruments

20040070757 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Flying the Earth Observing Constellations
Kelly, Angelita C.; Case, Warren F.; [2004]; 3 pp.; In English; SpaceOps 2004, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

Prior to the launch of the Earth Observing System (EOS) Terra and Landsat-7 satellites in 1999, the Project Scientists for the two missions and the Earth Science Data and Information System (ESDIS) Project at the Goddard Space Flight Center signed an inter-project agreement document describing their plan to fly in loose formation, approximately 20 minutes within each other. In November 2000, a technology demonstration satellite, Earth Observer-1 (EO-1), was launched into the same orbit as that of Landsat-7 and Terra, with a goal of flying within a minute from Landsat-7. The SAC-C satellite, developed and operated by the government of Argentina, was launched along with EO-1, with a goal of flying near both Terra and Landsat-7. This formation enables the scientists to make use of the scientific synergy among the instruments on the different spacecraft. This group of satellites constitutes the morning constellation, which is led by the Landsat-7, which has a mean local time (MLT) at 10:00 a.m. In May 2002, the EOS Aqua satellite was launched into an orbit with an altitude of 705 km. and a 1:30 p.m. MLT. Two smaller satellites, CALIPSO (a joint U.S./French mission), and CloudSat (a joint NASA/Colorado State University/Air Force mission), plan to fly in tight formation, within 15 seconds of each other. In addition, CALIPSO and CloudSat also plan to be within 30 to 60 seconds of the Aqua satellite. A third satellite, PARASOL, managed by the French Space Agency, CNES, will be placed within a minute of the CALIPSO satellite. In 2004, the Aura satellite will be launched and phased in relation to the Aqua satellite, such that the instruments on Aura will be able to view the same mass of air no later than 8 minutes after the instruments on Aqua have observed it. Representatives from each mission are currently documenting a plan on how they will coordinate on-orbit operations. Why are all these satellites planning to fly as a constellation? The answer is that as a constellation. the scientists will be able to acquire science data not only from their specific instruments on a single satellite, but science data from the other satellites which will have been taken at approximately the same time, thus resulting in coordinated science observation data. This leads to better quality science. This paper describes how the mission design has been driven by the science requirements. The morning and the afternoon constellations present operational challenges, which had not previously been encountered. Operations planning must address not only how the satellites of each constellation operate safely together, but also, how the two constellations fly on the same orbits without interfering with each other as they downlink data to their respective ground stations. This paper describes the operations

experience gained from the morning constellation and the planning for the afternoon constellation.
Author
Earth Observing System (Eos); Spacecraft Launching; Formation Flying; Earth Sciences

20040070758 NASA Glenn Research Center, Cleveland, OH, USA
Microgravity Environment on the International Space Station
DeLombard, Richard; Hrovat, Kenneth; Kelly, Eric; McPherson, Kevin; April 2004; 15 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-101-46-02
Report No.(s): NASA/TM-2004-213039; AIAA Paper 2004-0125; E-14473; No Copyright; Avail: CASI; A03, Hardcopy

A primary feature of the International Space Station will be its microgravity environment--an environment in which the effects of gravity are drastically reduced. The International Space Station design has been driven by a long-standing, high-level requirement for a microgravity mode of operation. Various types of data are gathered when science experiments are conducted. The acceleration levels experienced during experiment operation should be factored into the analysis of the results of most microgravity experiments. To this end, the Space Acceleration Measurement System records the acceleration levels to support microgravity researchers for nearly three years of International Space Station operations. The Principal Investigator Microgravity Services project assists the experiments principal investigators with their analysis of the acceleration (microgravity) environment. The Principal Investigator Microgravity Services project provides cataloged data, periodic analysis summary reports, specialized reports for experiment teams, and real-time data in a variety of user-defined formats. Characterization of the various microgravity carriers (e.g., Shuttle and International Space Station) is also accomplished for the experiment teams. Presented in this paper will be a short description of how microgravity disturbances may affect some experiment classes, a snapshot of the microgravity environment, and a view into how well the space station is expected to meet the user requirements.
Author
Gravitational Effects; Microgravity; International Space Station; Real Time Operation

20040071003 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Video Guidance Sensor (AVGS) Development Testing
Howard, Richard T.; Johnston, Albert S.; Bryan, Thomas C.; Book, Michael L.; 2004; 11 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA; No Copyright; Avail: CASI; A03, Hardcopy

NASA's Marshall Space Flight Center was the driving force behind the development of the Advanced Video Guidance Sensor, an active sensor system that provides near-range sensor data as part of an automatic rendezvous and docking system. The sensor determines the relative positions and attitudes between the active sensor and the passive target at ranges up to 300 meters. The AVGS uses laser diodes to illuminate retro-reflectors in the target, a solid-state camera to detect the return from the target, and image capture electronics and a digital signal processor to convert the video information into the relative positions and attitudes. The AVGS will fly as part of the Demonstration of Autonomous Rendezvous Technologies (DART) in October, 2004. This development effort has required a great deal of testing of various sorts at every phase of development. Some of the test efforts included optical characterization of performance with the intended target, thermal vacuum testing, performance tests in long range vacuum facilities, EMI/EMC tests, and performance testing in dynamic situations. The sensor has been shown to track a target at ranges of up to 300 meters, both in vacuum and ambient conditions, to survive and operate during the thermal vacuum cycling specific to the DART mission, to handle EM1 well, and to perform well in dynamic situations.
Author
Guidance Sensors; Rendezvous Guidance; Digital Systems; Cameras; Thermal Cycling Tests; Signal Processing

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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*.

20040068126 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Development of Solar Sail Propulsion for NASA Science Missions to the Inner Solar System
Montgomery, Edward E, IV; Johnson, Charles Les; March 19, 2004; 6 pp.; In English; 45th AIAA/ASME/ASCE/ASH/ASC Structures, Structural Dynamics and Materials Conference, 10-24 Apr. 2004, Palm Springs, CA, USA
Report No.(s): AIAA Paper 2004-1506; No Copyright; Avail: CASI; A02, Hardcopy

This paper examines recent assessments of the technology challenges facing solar sails, identifies the systems and technologies needing development, and the approach employed by NASA's In-space Propulsion Program in NASA to achieve near term products that move this important technology from low technology readiness level (TRL) toward the goal of application to science missions in near earth space and beyond. The status of on-going efforts to design, build, and test ground demonstrators of alternate approaches to structures (inflatable versus rigid), membrane materials, optical shape sensing, and attitude control will be presented along with planned future investments.
Author
Solar Sails; Technology Assessment

20040068314 National Defence Research Establishment, Stockholm, Sweden
Experiments with a PDE Using Multiple Injection
Tegner, J.; Olsson, S.; Sep. 2003; In Swedish; In English
Report No.(s): PB2004-104544; FOI-R-0925-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A Pulse Detonation Engine using premixed fuel/air and multiple injection has been constructed. Numerical simulations have shown that the hot products remaining from a previous cycle can facilitate the initiation of the detonation in the following pulse, and the engine described in this report has been constructed to study and take advantage of this effect. However, no detonations have been detected in these preliminary experiments, but as a base for the continuing effort a detailed presentation of the obtained results are given.
NTIS
Pulse Detonation Engines; Combustion; Gas Mixtures; Fuel Injection

20040070713 NASA Ames Research Center, Moffett Field, CA, USA
Web-Based Toxic Gas Dispersion Model for Shuttle Launch Operations
Bardina, Jorge; Thirumalainambi, Rajkumar; 2004; 9 pp.; In English; SPIE Defense and Security Symposium, Apr. 2004, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

During the launch of the Space Shuttle vehicle, the burning of liquid hydrogen fuel with liquid oxygen at extreme high temperatures inside the three space shuttle main engines, and the burning of the solid propellant mixture of ammonium perchlorate oxidizer, aluminum fuel, iron oxide catalyst, polymer binder, and epoxy curing agent in the two solid rocket boosters result in the formation of a large cloud of hot, buoyant toxic exhaust gases near the ground level which subsequently rises and entrains into ambient air until the temperature and density of the cloud reaches an approximate equilibrium with ambient conditions. In this paper, toxic gas dispersion for various gases are simulated over the web for varying environmental conditions which is provided by rawinsonde data. The model simulates chemical concentration at ground level up to 10 miles (1 KM grids) in downrange up to an hour after launch. The ambient concentration of the gas dispersion and the deposition of toxic particles are used as inputs for a human health risk assessment model. The advantage of the present model is the accessibility and dissemination of model results to other NASA centers over the web. The model can be remotely operated and various scenarios can be analyzed.
Author
Toxicity; Hydrogen Fuels; Liquid Oxygen; Liquid Hydrogen; Exhaust Gases; Solid Propellant Rocket Engines; Space Shuttle Boosters; Spacecraft Launching

20040070749 Eagle-Picher Industries, Inc., Joplin, MO, USA

Small Capacity, Low Cost (Ni-H2) Design Concept for Commercial, Military, and Higher-Volume Aerospace Applications

Cook, William; Smith, Ron; Wheeler, James; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 41; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The development of Ni-Hsub2, cells in capacities of 20 ampere-hours (AH) or less has been delayed because of the initial demand for development of the technology for larger satellites. Two cell designs are manufactured at Eagle-Picher which are tailored to the specific requirements of the small satellite, not only in terms of power and volume, but also in terms of economic feasibility. The RNH-12-1 is a 12 AH common pressure vessel design that has been manufactured, tested, and delivered to Intraspace Corporation for use as a power source on the SPINSAT mission. The RNH-5-1 is a new design which can be built in sizes from 5 through 120 AH in an IPV of CPV configuration. These two designs are based upon proven manufacturing processes and component heritage and therefore retain the reliability and performance advantages of their predecessors. Details of these two designs and their play in the "small sat" market will be described in this paper. Author

Nickel Hydrogen Batteries; Spacecraft Power Supplies

20040070750 Sverdrup Technology, Inc., Brook Park, OH, USA

Mathematical Analyses of the Transport and Reaction Mechanisms in Solid Oxide Fuel Cells

Maloney, Thomas M.; Dees, Dennis W.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 43; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Computer models have been developed to quantitatively predict performance properties of high temperature H2O2, solid oxide fuel cells. Current voltage relationships were estimated by analyzing effects due to charge transfer, surface migration, and material transport within the solid electrolyte. Model parameters included electrical conductivity, electrolyte thickness, reference exchange currents, and length of diffusion paths near the electrolyte surface.Results from the mathematical model were in close agreement with experimental data for single cells at 1000 C and 1 atm. Results indicated that the solid electrolyte thickness should be greater than 25 sq microns and the average fuel cell operating current density should exceed 250 mA/sq cm to maintain high current efficiencies.

Author

Solid Oxide Fuel Cells; Mathematical Models

20040070929 NASA Marshall Space Flight Center, Huntsville, AL, USA

Subscale Testing of Nozzle Ablative Materials in a Supersonic Particle Impingement Environment

Howse, S.; Lawrence, T.; [2004]; 2 pp.; In English; JANNAF 14th NDES/23rd RNTS/36th S/MBS Joint Subcommittee Meeting, 30 Mar. - 1 Apr. 2004, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

Recent efforts to evaluate materials to replace the current NARC rayon used in the nozzle ablative of the NASA's Reusable Solid Rocket Motor (SRM), several tests were developed to look at the performance of supersonic particle impact region of the aft exit cone. It was seen in early testing that some potential candidates did not perform as well as the current NARC based material and so the 24 inch Solid Rocket Motor (SRTM) exit cone design was extended and contoured to induce particle impingement in the aft end. The SRTM testing provided a larger testbed to evaluate the results seen in the Solid Fuel Supersonic Blast Tube. Testing was performed in each test bed on two variants of the final two candidate materials. The materials were a standard prewoven Lyocell, a postwoven Lyocell, an Enka rayon, and Enka rayon processed at a higher carbonization temperature. This paper presents the results of the four materials in the SSBT and the SRTM tests as compared against the NARC baseline. Erosion, char, and plylift results are discussed in detail.

Author

Ablative Materials; Impingement; Solid Propellant Rocket Engines; Supersonic Speed; Particles; Nozzle Design

20040073432 NASA Glenn Research Center, Cleveland, OH, USA

Overview of NASA GRC Stirling Technology Development

Schreiber, Jeffrey G.; Thieme, Lanny G.; May 2004; 16 pp.; In English; First International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA

Report No.(s): NASA/TM-2004-212969; AIAA Paper 2003-6093; E-14442; No Copyright; Avail: CASI; A03, Hardcopy

The Stirling Radioisotope Generator (SRG) is currently being developed by Lockheed Martin Astronautics (LMA) under contract to the Department of Energy (DOE). The generator will be a high efficiency electric power source for NASA Space

Science missions with the ability to operate in vacuum or in an atmosphere such as on Mars. High efficiency is obtained through the use of free-piston Stirling power conversion. Power output will be greater than 100 watts at the beginning of life with the decline in power largely due to the decay of the plutonium heat source. In support of the DOE SRG project, the NASA Glenn Research Center (GRC) has established a technology effort to provide data to ensure a successful transition to flight for what will be the first dynamic power system in space. Initially, a limited number of areas were selected for the effort, however this is now being expanded to more thoroughly cover key technical issues. There is also an advanced technology effort that is complementary to the near-term technology effort. Many of the tests use the 55-We Technology Demonstration Convertor (TDC). There have been multiple controller tests to support the LMA flight controller design effort. Preparation is continuing for a thermal/vacuum system demonstration. A pair of flight prototype TDC s have been placed on continuous operation. Heater head life assessment continues, with the material data being refined and the analysis moving toward the system perspective. Magnet aging tests continue to characterize any possible aging in the strength or demagnetization resistance of the magnets in the linear alternator. A reliability effort has been initiated to help guide the development activities with focus on the key components and subsystems. This paper will provide an overview of some of the GRC technical efforts, including the status, and a description of future efforts.
Author
Radioisotope Batteries; Generators; Heat Sources; Stirling Cycle; Transition Flight

20040073693 Air Force Research Lab., Edwards AFB, CA
Ph.D. Research
Beasley, Joe; Holmes, Mike; Apr. 28, 2004; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A422593; No Copyright; Avail: CASI; A03, Hardcopy

A major requirement for using a solar propulsion system is the proper placement of the focal spot on the thruster absorber plane. Without proper placement of the focal spot, solar energy is not transferred to the propellant gas or at worst case, a significantly smaller proportion of the incident energy is transferred to the gas.
DTIC
Solar Energy

20040073774 Maryland Univ., College Park, MD
Small-Scale Propulsion for Jump Augmentation
Lewis, Mark J.; Beksinski, David; White, Peter; Dec. 31, 2001; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-01-0129
Report No.(s): AD-A422725; ARO-41275.1-CH; No Copyright; Avail: CASI; A03, Hardcopy

This program was an examination of the feasibility of providing small-scale propulsion systems to provide power and propulsion assistance for soldiers, especially to offer a capability for extended vertical leap with heavy combat weights. The concept under development was the use of multiple small-scale (though not micro) gas turbine engines, capable of providing thrust levels in the 50-lb range, with engine weights of 5 lbs. The concept was to use these engines to help a soldier jump over an obstacle, or possibly to produce electrical power with the efficiency of a gas turbine engine. Work on this project proceeded along two tracks. First, the analysis, testing, and design of a benchmark propulsion pack was performed, culminating in the development of prototype hardware with gas turbine engines mounted, powered, and coordinated. Various issues related to their starting and operational characteristics of these engines were explored, as well as practical operational issues associated with their use in a backpack configuration, including acoustic signature, heating, etc, In the final phase, since the last interim report, practical issues of engine mounting, starting of multiple engines, and body mounting of the engines were explored.
DTIC
Augmentation; Propulsion; Propulsion System Configurations; Propulsion System Performance

20040074214 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Implementation of Wireless and Intelligent Sensor Technologies in the Propulsion Test Environment
Solano, Wanda M.; Junell, Justin C.; Shumard, Kenneth; July 1, 2003; 5 pp.; In English; SiCon/04 Sensors for Industry Conference, 27-29 Jan. 2004, New Orleans, LA, USA
Report No.(s): SE-2003-07-00049-SSC; No Copyright; Avail: CASI; A01, Hardcopy

From the first Saturn V rocket booster (S-II-T) testing in 1966 and the routine Space Shuttle Main Engine (SSME) testing beginning in 1975, to more recent test programs such as the X-33 Aerospike Engine, the Integrated Powerhead Development

(IPD) program, and the Hybrid Sounding Rocket (HYSR), Stennis Space Center (SSC) continues to be a premier location for conducting large-scale propulsion testing. Central to each test program is the capability for sensor systems to deliver reliable measurements and high quality data, while also providing a means to monitor the test stand area to the highest degree of safety and sustainability. As part of an on-going effort to enhance the testing capabilities of Stennis Space Center, the Test Technology and Development group is developing and applying a number of wireless and intelligent sensor technologies in ways that are new to the test existing test environment.
Derived from text
Wireless Communication; Sensors; Spacecraft Propulsion; Technology Utilization; Engine Tests; Rocket Engine Design

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CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20040068275 Lawrence Livermore National Lab., Livermore, CA
Electrical Impedance Tomography at the A-014 Outfall for Detection of DNAPL
Daily, W.; Ramirez, A.; May 28, 2003; In English
Report No.(s): DE2003-15004881; UCRL-ID-153535; No Copyright; Avail: National Technical Information Service (NTIS)
Some laboratory studies have shown that the low frequency electrical properties of some soil minerals contaminated by dense non-aqueous phase liquid (DNAPL) may be sufficiently unique to make it possible to use electrical impedance tomography (EIT) to differentiate normal electrical heterogeneities of the subsurface from DNAPL contamination. The goal of this work is to determine if electrical impedance measurements of the soil and groundwater at a contaminated site can be used to detect the presence and map the distribution of DNAPL.
NTIS
Tomography; Electrical Impedance; Low Frequencies

20040068279 Lawrence Livermore National Lab., Livermore, CA
Porous Silicon Coated With Ultrathin Diamond-Like Carbon Film Cathodes
Evtukh, A. A.; Litovchenko, V. G.; Litvin, Y. M.; Fedin, D. V.; Rassamakin, Y. V.; Apr. 01, 2001; In English
Report No.(s): DE2003-15004781; UCRL-JC-143779; No Copyright; Avail: National Technical Information Service (NTIS)
The main requirements to electron field emission cathodes are their efficiency, stability and uniformity. In this work we combined the properties of porous silicon layers and diamond-like carbon (DLC) film to obtain emission cathodes with improved parameters. The layered structures of porous silicon and DLC film were formed both on flat n-Si surface and silicon tips created by chemical etching. The conditions of the anodic and stain etching of silicon in HF containing solution under the illumination have been widely changed. The influence of thin (less than or equal to 10nm) DLC film coating of the porous silicon layer on electron emission has been investigated. The parameters of emission efficiency such as field enhancement coefficient, effective emission areas and threshold voltages have been estimated from current-voltage dependencies to compare and characterize different layered structures. The improvement of the emission efficiency of silicon tip arrays with porous layers coated with thin DLC film has been observed. These silicon-based structures are promising for flat panel display applications.
NTIS
Coatings; Porous Silicon; Thin Films; Diamond Films; Carbon; Cathodes

20040068286 Lawrence Livermore National Lab., Livermore, CA
Science and Technology Review: National Ignition Facility Comes to Life
Sep. 2003; In English
Report No.(s): DE2003-15004864; No Copyright; Avail: National Technical Information Service (NTIS)
This issue covers the following articles: (1) 'The National Ignition Facility Is Born'; (2) 'The National Ignition Facility Comes to Life'- Over the last 15 years, thousands of Livermore engineers, scientists, and technicians as well as hundreds of industrial partners have worked to bring the National Ignition Facility into being; (3) 'Tracking the Activity of Bacteria Underground' - Using real-time polymerase chain reaction and liquid chromatography/tandem mass spectrometry, researchers at Livermore are gaining knowledge on how bacteria work underground to break down compounds of environmental concern;

(4) 'When Every Second Counts--Pathogen Identification in Less Than a Minute' - Livermore has developed a system that can quickly identify airborne pathogens such as anthrax; (5) 'Portable Radiation Detector Provides Laboratory-Scale Precision in the Field' - A team of Livermore physicists and engineers has developed a handheld, mechanically cooled germanium detector designed to identify radioisotopes.
NTIS
Research Facilities; Ignition; Research and Development; Radiation Detectors; Liquid Chromatography

20040068320 Louisiana State Univ., Baton Rouge, LA
Applications of Smart Materials in Structural Engineering
Cai, C. S.; Wu, W.; Chen, S.; Voyiadjis, G.; Oct. 2003; In English
Report No.(s): PB2004-104343; No Copyright; Avail: National Technical Information Service (NTIS)

With the development of materials and technology, many new materials find their applications in civil engineering to deal with the deteriorating infrastructure. Smart material is a promising example that deserves a wide focus, from research to application. With two crystal structures called Austenite and Martensite under different temperatures, smart material exhibits two special properties different from ordinary steels. One is shape memory, and the other is superelasticity. Both of these two properties can suit varied applications in civil engineering, such as prestress bars, self-rehabilitation, and two-way actuators, etc. One of the main objectives of the research is to investigate the application of smart materials in civil engineering by focusing on the literature review, basic information collection, and basic mechanic properties of smart materials. In axial tension tests, the force-extension curve and stress-strain curve of shape memory and superelasticity materials were measured separately. These curves verify the research of forerunners. Four beam experiments were conducted to evaluate the performance of flexure beams with superelasticity material as reinforcement bars. Load-displacement relationship at the midspan, strains on the surface of the concrete beam, and cracking width for different loads were measured.
NTIS
Smart Materials; Structural Engineering; Mechanical Properties; Technology Utilization

20040071028 Lawrence Livermore National Lab., Livermore, CA
FY02 Engineering Technology Reports. Volume 1: Technology Base
Mar. 2003; In English
Report No.(s): DE2003-15005370; UCRL-53868-01; No Copyright; Avail: National Technical Information Service (NTIS)

Engineering has touched on every challenge, every accomplishment, and every endeavor of Lawrence Livermore National Laboratory during its fifty-year history. This volume of Engineering Technical Reports summarizes progress on the projects funded for technology-base efforts. Objectives of technology-base funding include: (1) the development and enhancement of tools and processes to provide Engineering support capability, such as code maintenance and improved fabrication methods; (2) the support of Engineering science and technology infrastructure, such as the installation or integration of a new capability; (3) support for technical and administrative leadership through our technology Centers; and (4) the initial scoping and exploration of selected technology areas with high strategic potential, such as assessment of university, laboratory, and industrial partnerships. Five Centers focus and guide longer-term investments within Engineering. The Centers attract and retain top staff, develop and maintain critical core technologies, and enable programs. Through their technology-base projects, they oversee the application of known engineering approaches and techniques to scientific and technical problems.
NTIS
Technologies; Fabrication; Installing; Engineering Management

20040071029 Lawrence Livermore National Lab., Livermore, CA
Ab initio Calculation of Thermodynamic Data for Oxygenated Hydrocarbon Fuels and Radical Breakdown Species: R(OMe)n
Kubota, A.; Pitz, W. J.; Westbrook, C. K.; Bozzelli, J.; Glaude, P. A.; 2003; In English
Report No.(s): DE2003-15004999; No Copyright; Avail: National Technical Information Service (NTIS)

There has long been interest in the use of oxygenated hydrocarbon additives to conventional fuels. These oxygenates have been shown to reduce soot emissions in diesel engines and CO emissions in spark-ignition engines; and often allow diesel operation with decreased NO(x). The current widely used additive, MTBE is targeted for elimination as a gasoline additive due to its damaging effects on the environment. This creates a need for alternative oxygenated additives; and more importantly, amplifies the importance to fully understand the thermochemical and kinetic properties on these oxyhydrocarbons fuels and for their intermediate and radical breakdown products. We use CBS-Q and density-functional methods with isodesmic

reactions (with group balance when possible) to compute thermodynamic quantities for these species.
NTIS
Computation; Thermodynamics; Oxygenation; Hydrocarbon Fuels

20040071108 North Dakota Univ., Grand Forks, ND, USA
CO2 Budget and Rectification Airborne Study
Grainger, C. A.; [2004]; 10 pp.; In English
Contract(s)/Grant(s): NAG5-7950; No Copyright; Avail: CASI; A02, Hardcopy

The main purpose of this award was to supply a platform for the airborne measurements of gases associated with the CO2 Budget and Regional Airborne Study (COBRA). The original program was to consist of three field programs: the first was to be in 1999, the second in 2000, and the third in 2001. At the end of the second field program, it was agreed that the science could better be served by making the measurements in northern Brazil, rather than in North America. The final North American program would be postponed until after two field programs in Brazil. A substantial amount of effort was diverted into making plans and preparations for the Brazil field programs. The Brazil field programs were originally scheduled to take place in the Fall of 2002 and Spring of 2003. Carrying out the field program in Brazil was going to logistically much more involved than a program in the US. Shipping of equipment, customs, and site preparations required work to begin many months prior to the actual measurement program. Permission to fly in that country was also not trivial and indeed proved to be a major obstacle. When we were not able to get permission to fly in Brazil for the 2002 portion of the experiment, the program was pushed back to 2003. When permission by the Brazilian government was not given in time for a Spring of 2003 field program, the experiment was postponed again to begin in the Fall of 2003.
Derived from text
Carbon Dioxide; Rectification; Gas Analysis

20040073513 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Science
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 13; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Materials Science Program is structured so that NASA s headquarters is responsible for the program content and selection, through the Enterprise Scientist, and MSFC provides for implementation of ground and flight programs with a Discipline Scientist and Discipline Manager. The Discipline Working Group of eminent scientists from outside of NASA acts in an advisory capacity and writes the Discipline Document from which the NRA content is derived. The program is reviewed approximately every three years by groups such as the Committee on Microgravity Research, the National Materials Advisory Board, and the OBPR Maximization and Prioritization (ReMaP) Task Force. The flight program has had as many as twenty-six principal investigators (PIs) in flight or flight definition stage, with the numbers of PIs in the future dependent on the results of the ReMaP Task Force and internal reviews. Each project has a NASA-appointed Project Scientist, considered a half-time job, who assists the PI in understanding and preparing for internal reviews such as the Science Concept Review and Requirements Definition Review. The Project Scientist also insures that the PI gets the maximum science support from MSFC, represents the PI to the MSFC community, and collaborates with the Project Manager to insure the project is well-supported and remains vital. Currently available flight equipment includes the Materials Science Research Rack (MSRR-1) and Microgravity Science Glovebox. Ground based projects fall into one or more of several categories. Intellectual Underpinning of Flight Program projects include theoretical studies backed by modeling and computer simulations; bring to maturity new research, often by young researchers, and may include preliminary short duration low gravity experiments in the KC-135 aircraft or drop tube; enable characterization of data sets from previous flights; and provide thermophysical property determinations to aid PIs. Radiation Shielding and preliminary In Situ Resource Utilization (ISRU) studies work towards future long duration missions. Biomaterials support materials issues affecting crew health. Nanostructured Materials are currently considered to be maturing new research, and Advanced Materials for Space Transportation has as yet no PIs. PIs are assigned a NASA Technical Monitor to maintain contact, a position considered to be a 5 percent per PI effort. Currently 33 PIs are supported on the 1996 NRA, which is about to expire, and 59 on the 1998 NRA. Two new NRAs, one for Radiation Shielding and one for Materials Science for Advanced Space Propulsion are due to be announced by the 2003 fiscal year. MSFC has a number of facilities supporting materials science. These include the Microgravity Development Laboratory/ SD43; Electrostatic Levitator Facility; SCN Purification Facility; Electron Microscope/Microprobe Facility; Static and Rotating Magnetic Field Facility; X-Ray Diffraction Facility; and the Furnace Development Laboratory.
Author
Microgravity; Materials

20040073668 Princeton Univ., NJ

Investigations of Operational Lifetime and Modes of Failure of Organic Light Emitting Devices

Forrest, Stephen R.; Thompson, Mark; Barbara, Paul; Brown, Julia J.; Feb. 2004; 87 pp.; In English

Contract(s)/Grant(s): MDA-972-01-1-0032; Proj-H731

Report No.(s): AD-A422559; AFRL-HE-WP-TR-2003-0154; No Copyright; Avail: CASI; A05, Hardcopy

Reliability limitations of organic light emitting devices (OLEDs) were explored in a joint effort project lead by Princeton University, with subcontracting efforts by the University of Southern California, the University of Texas and Universal Display Corporation. Methodologies and protocols for screening of device structures and materials were developed. Extended lifetimes of red, green and blue phosphorescent OLEDs were achieved. For example, lifetimes of over 50,000 hours were obtained for both red and green devices. Blue device lifetimes observed were still less than 1000 hours. This difference in blue lifetime was studied using through both photo- and electro-luminescence methods, and was determined to be due, in part, to the high energies needed to excite the blue lumophores, which results in charge imbalance in the emission layers of the OLEDs. Contact degradation was also studied at the microscopic scale using near-field scanning optical microscopy (NSOM) in concert with our transparent OLED structure (TOLED). It was found that defects introduced during processing are largely responsible for the formation and growth of dark spots.

DTIC

Failure; Light Emitting Diodes

20040073745 Naval Research Lab., Washington, DC

Bacterial Metabolism, Aromatic Biodegradation, and Lignin Biogeochemistry in Sediment Cores from Pearl Harbor, Hawaii

Montgomery, Michael T.; Osburn, Christopher L.; Apr. 14, 2004; 18 pp.; In English

Report No.(s): AD-A422667; NRL/FR/6114--04-10077; No Copyright; Avail: CASI; A03, Hardcopy

Heterotrophic bacteria require a source of oxygen to rapidly metabolize complex and recalcitrant carbon sources like lignin, 2,4,6 trinitrotoluene (TNT) , and polycyclic aromatic hydrocarbons (PAHs). The activities of burrowing macrofauna can increase oxygenation, which may stimulate bacterial metabolism of PAHs and heterotrophic production. We measured bacterial production, PAH mineralization, and lignin subunit concentration with depth in cores taken from South Loch and Bishop's Point in Pearl Harbor, Hawaii. Bacterial metabolism decreased rapidly with depth but was much higher at South Loch than Bishop's Point. PAH mineralization rates were higher at South Loch than at Bishop's Point and extended down to the depths of bioturbation at each site: upper 4 to 6 cm at Bishop s Point and upper 9 cm at South Loch. Phenolic moieties of lignin at South Loch and Bishop's Point suggest there are different sources of organic matter to the two sites. PAH mineralization was elevated in bioturbated zones from both sites relative to those below this zone. Ambient PAH concentrations were also higher at the less bioturbated site. This is consistent with the hypothesis that benthic infauna stimulate PAH metabolism.

DTIC

Bacteria; Biodegradation; Biogeochemistry; Cores; Harbors; Hydrocarbons; Lignin; Metabolism; Sediments

24
COMPOSITE MATERIALS

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

20040068310 Wichita State Univ., Wichita, KS, USA

Damage Resistance and Tolerance of Composite Sandwich Panels: Scaling Effects

Tomblin, J. S.; Raju, K. S.; Arosteguy, G.; Feb. 2004; In English

Report No.(s): PB2004-105464; No Copyright; Avail: National Technical Information Service (NTIS)

The impact responses and the damage states in flat sandwich panels with thin facesheets are known to be dependent on the diameter of the spherical steel impactor. The residual strength of impact-damaged sandwich panels under static in-plane compressive loads was dependent on the nature of the damage state. The coupon sizes used in these investigations were relatively small, and the finite size effects may be embedded in the observed trends. The effects of scaling the planar dimensions of sandwich specimens on the damage resistance were studied by conducting experiments and finite element analysis. The impact force and the damage size were observed to decrease as both the planar dimensions were increased. These effects were negligible when only a single dimension was scaled. The off-center impacts indicated that for a given energy level, the impacts occurring closer to the boundary supports were more severe compared to those farther away from the boundaries. The impacts on sandwich specimens supported by a rigid base proved to be the most severe case in terms of the impact

behavior and the resulting damage metrics. The parametric study conducted using the finite element model confirmed the observed experimental trends and further indicated that the damage formation is the dominant energy dissipation mechanism when the ratio of the impactor mass to that of the target is greater than 2 and vibrational energy transfer is dominant for ratios less than 2. The effects of the ratio of specimen width to planar damage size on the compressive residual strength and failure modes were investigated for two sandwich configurations. A subsurface damage state was considered for the study and inflicted using a 3 diameter impactor. The scaling effects were characterized in terms of the residual strength and strain distributions in the vicinity of the damage region. The latter was measured using a photogrammetry method. The residual strength was found to increase by 12% when the ratio of the specimen size to damage size was increased from 4.6 to 12.4 for sandwich specimens with two-ply facesheets. No trends were, however, observed for sandwich specimens with four-ply facesheets. The strain and displacement distributions indicated bending of the facesheet within the damage region leading to a strain concentration-driven failure mode resembling an open hole configuration for the two-ply facesheet sandwich panels. The 6.5 wide sandwich specimens with four-ply facesheets failed by global buckling initiated by an unstable dimple propagation. For wider specimens, there was a dimple growth-arrest mechanism that lead to eventual facesheet fracture. The increase of the specimen height resulted in a slight decrease in residual strength. This study showed that the results obtained from small specimens are valid as far as the compressive residual strength obtained experimentally. However, larger specimen sizes will sustain less impact damage for equivalent impact energy levels. Thus, it is valid to test smaller panels if the damage is simulated correctly from the larger specimens. The effects of specimen height were not investigated but could effect the buckling response of the panels.
NTIS
Composite Structures; Sandwich Structures; Damage

20040068371 NASA Marshall Space Flight Center, Huntsville, AL, USA, Sverdrup Technology, Inc., Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Measuring Permeability of Composite Cryotank Laminants
Oliver, Stanley T.; Selvidge, Shawn; Watwood, Michael C.; [2004]; 1 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference (Special Session): Cryogenic Propellant Tanks and Integrated Structures for a Next Generation Reusable Launch Vehicle, 10-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: Other Sources; Abstract Only

This paper describes a test method developed to identify whether certain materials and material systems are suitable candidates for large pressurized reusable cryogenic tanks intended for use in current and future manned launch systems. It provides a quick way to screen numerous candidate materials for permeability under anticipated loading environments consistent with flight conditions, as well as addressing reusability issues. cryogenic tank, where the major design issue was hydrogen permeability. It was successfully used to evaluate samples subjected to biaxial loading while maintaining test temperatures near liquid hydrogen. After each sample was thermally preconditioned, a cyclic pressure load was applied to simulate the in-plane strain. First permeability was measured while a sample was under load. Then the sample was unloaded and allowed to return to ambient temperature. The test was repeated to simulate reusability, in order to evaluate its effects on material permeability.
Author
Permeability; Cryogenic Tanks; Carbon; Laminates

20040070723 NASA Glenn Research Center, Cleveland, OH, USA
Assessment of Erosion Resistance of Coated Polymer Matrix Composites for Propulsion Applications
Miyoshi, Kazuhisa; Sutter, James K.; Horan, Richard A.; Naik, Subhash K.; Cupp, Randall J.; April 2004; 22 pp.; In English
Contract(s)/Grant(s): WBS 708-31-14; WBS 714-30-01
Report No.(s): NASA/TM-2004-212911; E-14102; No Copyright; Avail: CASI; A03, Hardcopy

The erosion behavior of tungsten carbide-cobalt (WC-Co) coated and uncoated polymer matrix composites (PMCs) was examined with solid particle impingement using air jets. Erosion tests were conducted with Arizona road dust impinging at 20 degrees, 60 degrees, and 90 degrees angles at a velocity of 229 meters per second at both 294 and 366 K. Noncontact optical profilometry was used to measure the wear volume loss. Results indicate that the WC-Co coating enhanced erosion resistance and reduced erosion wear volume loss by a factor of nearly 2. This should contribute to longer wear lives, reduced related breakdowns, decreased maintenance costs, and increased product reliability.
Author
Coatings; Cobalt; Erosion; Polymer Matrix Composites; Tungsten Carbides; Jet Propulsion; Corrosion Resistance

20040070823 NASA Langley Research Center, Hampton, VA, USA

Combined In-Plane and Through-the-Thickness Analysis for Failure Prediction of Bolted Composite Joints

Kradinov, V.; Madenci, E.; Ambur, D. R.; [2004]; 24 pp.; In English; 45th AIAA/ASME/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 23-762-55-LE

Report No.(s): AIAA Paper 2004-1703; Copyright; Avail: CASI; A03, Hardcopy

Although two-dimensional methods provide accurate predictions of contact stresses and bolt load distribution in bolted composite joints with multiple bolts, they fail to capture the effect of thickness on the strength prediction. Typically, the plies close to the interface of laminates are expected to be the most highly loaded, due to bolt deformation, and they are usually the first to fail. This study presents an analysis method to account for the variation of stresses in the thickness direction by augmenting a two-dimensional analysis with a one-dimensional through the thickness analysis. The two-dimensional in-plane solution method based on the combined complex potential and variational formulation satisfies the equilibrium equations exactly, and satisfies the boundary conditions and constraints by minimizing the total potential. Under general loading conditions, this method addresses multiple bolt configurations without requiring symmetry conditions while accounting for the contact phenomenon and the interaction among the bolts explicitly. The through-the-thickness analysis is based on the model utilizing a beam on an elastic foundation. The bolt, represented as a short beam while accounting for bending and shear deformations, rests on springs, where the spring coefficients represent the resistance of the composite laminate to bolt deformation. The combined in-plane and through-the-thickness analysis produces the bolt/hole displacement in the thickness direction, as well as the stress state in each ply. The initial ply failure predicted by applying the average stress criterion is followed by a simple progressive failure. Application of the model is demonstrated by considering single- and double-lap joints of metal plates bolted to composite laminates.

Author

Composite Structures; Failure Analysis; Lap Joints; Thickness; Bolts; Two Dimensional Models

20040073434 NASA Langley Research Center, Hampton, VA, USA

Evaluation of Double-Vacuum-Bag Process For Composite Fabrication

Hou, T. H.; Jensen, B. J.; January 16, 2004; 13 pp.; In English; SAMPE 2004 Symposium and Exhibition, 16-20 May 2004, Long Beach, CA, USA

Contract(s)/Grant(s): 23-794-40-4G; No Copyright; Avail: CASI; A03, Hardcopy

A non-autoclave vacuum bag process using atmospheric pressure alone that eliminates the need for external pressure normally supplied by an autoclave or a press is an attractive method for composite fabrication. This type of process does not require large capital expenditures for tooling and processing equipment. In the molding cycle (temperature/pressure profile) for a given composite system, the vacuum application point has to be carefully selected to achieve the final consolidated laminate net shape and resin content without excessive resin squeeze-out. The traditional single-vacuum- bag (SVB) process is best suited for molding epoxy matrix based composites because of their superior flow and the absence of reaction by-products or other volatiles. Other classes of materials, such as polyimides and phenolics, generate water during cure. In addition, these materials are commonly synthesized as oligomers using solvents to facilitate processability. Volatiles (solvents and reaction byproducts) management therefore becomes a critical issue. SVB molding, without additional pressure, normally fails to yield void-free quality composites for these classes of resin systems. A double-vacuum- bag (DVB) process for volatile management was envisioned, designed and built at the NASA Langley Research Center. This experimental DVB process affords superior volatiles management compared to the traditional SVB process. Void-free composites are consistently fabricated as measured by C-scan and optical photomicroscopy for high performance polyimide and phenolic resins.

Author

Epoxy Matrix Composites; Fabrication; Vacuum; Autoclaves; By-Products; Phenolic Resins

20040073454 NASA Langley Research Center, Hampton, VA, USA

Polyimide/Carbon Nanotube Composite Films for Electrostatic Charge Mitigation

Delozier, D. M.; Tigelaar, D. M.; Watson, K. A.; Smith, J. G., Jr.; Lillehei, P. T.; Connell, J. W.; [2004]; 13 pp.; In English; SAMPE 2004 Symposium and Exhibition, 16-20 May 2004, Long Beach, CA, USA

Contract(s)/Grant(s): 23-319-03-01

Report No.(s): LAR-16589-1; No Copyright; Avail: CASI; A03, Hardcopy

Low color, space environmentally durable polymeric films with sufficient electrical conductivity to mitigate electrostatic charge build-up have been under investigation as part of a materials development activity. In the work described herein,

single-walled carbon nanotubes (SWNT) solutions were dispersed in solutions of a novel ionomer in N,N-dimethylacetamide resulting in homogenous suspensions or quasi-solutions. The ionomer was used to aid in the dispersal of SWNTs in to a soluble, low color space environmentally durable polyimide. The use of the ionomer as a dispersant enabled the nanotubes to be dispersed at loading levels up to 3 weight % in a polyimide solution without visual agglomeration. The films were further characterized for their electrical and mechanical properties.
Author
Carbon Nanotubes; Polymeric Films; Electrostatic Charge; Agglomeration; Polyimides

20040073505 NASA Marshall Space Flight Center, Huntsville, AL, USA
Graphite/Ultra-High Modulus Polyethylene Hybrid Fiber Composites with Epoxy and Polyethylene Matrices for Cosmic Radiation Shielding
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 8; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the most significant technical challenges in long-duration space missions is that of protecting the crew from harmful radiation. Protection against such radiation on a manned Mars mission will be of vital importance both during transit and while on the surface of the planet. The development of multifunctional materials that serve as integral structural members of the space vehicle and provide the necessary radiation shielding for the crew would be both mission enabling and cost effective. Additionally, combining shielding and structure could reduce total vehicle mass. Hybrid laminated composite materials having both ultramodulus polyethylene (PE) and graphite fibers in epoxy and PE matrices could meet such mission requirements. PE fibers have excellent physical properties, including the highest specific strength of any known fiber. Moreover, the high hydrogen (H) content of polyethylene makes the material an excellent shielding material for cosmic radiation. When such materials are incorporated into an epoxy or PE matrix a very effective shielding material is expected. Boron (B) may be added to the matrix resin or used as a coating to further increase the shielding effectiveness due to B s ability to slow thermal neutrons. These materials may also serve as micrometeorites shields due to PE s high impact energy absorption properties. It should be noted that such materials can be fabricated by existing equipment and methods. It is the objective of this work therefore to: (a) perform preliminary analysis of the radiation transport within these materials; (b) fabricate panels for mechanical property testing before and after radiation exposure. Preliminary determination on the effectiveness of the combinations of material components on both shielding and structural efficiency will be made.
Author
Graphite-Epoxy Composites; Epoxy Matrix Composites; Radiation Shielding; Hybrid Composites; Matrix Materials; Polyethylenes

20040073509 NASA Marshall Space Flight Center, Huntsville, AL, USA
Nanophase and Composite Optical Materials
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 11; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This talk will focus on accomplishments, current developments, and future directions of our work on composite optical materials for microgravity science and space exploration. This research spans the order parameter from quasi-fractal structures such as sol-gels and other aggregated or porous media, to statistically random cluster media such as metal colloids, to highly ordered materials such as layered media and photonic bandgap materials. The common focus is on flexible materials that can be used to produce composite or artificial materials with superior optical properties that could not be achieved with homogeneous materials. Applications of this work to NASA exploration goals such as terraforming, biosensors, solar sails, solar cells, and vehicle health monitoring, will be discussed.
Author
Composite Materials; Optical Materials; Space Exploration; Microgravity; NASA Programs; Porosity

20040073642 North Carolina Univ., Greensboro, NC
Neural Composite Materials
Sundaresan, Mannur J.; Schmiz, Mark J.; Dec. 30, 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): GDAAD19-00-1-0536
Report No.(s): AD-A422526; NCM-IR-00; ARO-41484-EG-H-2; No Copyright; Avail: CASI; A03, Hardcopy

An embeddable structural health monitoring system has been developed to measure acoustic emission signals generated by incipient damage in Army structures. The structural health monitoring system is built upon two parallel approaches that

mimic signal processing in biological nerve cells. One approach uses a continuous sensor formed by a series connection of piezoelectric sensor nodes and a local signal processor to detect damage. The other uses an array type of sensor with appropriate electronics for quantifying damage. Modeling of wave propagation in simple structural elements was performed and the electrical responses of the sensors were simulated. Coupon specimens and panels were also instrumented with the two types of sensors and tested in the laboratory. The simulation and experimental results both confirmed the advantages offered by these sensors for structural health monitoring applications. A prototype of the acoustic emission local processor was also fabricated, and detailed specifications for implementing the algorithms developed in this project into an embeddable VLSI chip are provided. This project resulted in two U.S. patent applications, of which one has already been granted, and two invention disclosures. Commercialization of this technology is currently being pursued.
DTIC
Composite Materials

20040073724 Minnesota Univ., Minneapolis, MN
Assembly of Functional Porous Solids in Complex Hybrid Composites
Stein, Andreas; Schroden, Rick; Al-Daous, Mohammed; Yu, Dan; Sokolov, Sergey; Mar. 19, 2004; 66 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0512
Report No.(s): AD-A422640; ARO-41714.10-CH; No Copyright; Avail: CASI; A04, Hardcopy

Three-dimensionally ordered macroporous (3DOM) materials with periodic arrays of solid walls possess interesting optical, photonic and reactive properties of interest for camouflage, sensing, sorption, and controlled release. These materials are prepared by colloidal crystal templating techniques. This project was aimed at developing methods for functionalizing 3DOM solids, improving their processibility into shaped structures, forming polymer composites with 3DOM solids, optimizing their optical properties, and evaluating their mechanical properties. Methods were developed for preparing 3DOM oxides and hybrid materials as particles on a multiple gram scale, as supported films, monoliths, and composites with polymers and binders. 3DOM oxides were functionalized with monomeric and polymeric surface groups and with inorganic nanoparticles. 3DOM particles were optimized for optical effects, including tunable colors and control of color intensity. The mechanical properties of the highly porous materials were evaluated by depth sensing indentation, and a parameter was described that allows comparison of mechanical strengths of these materials. Combinations of templating and surface modification methods permitted the preparation of multifunctional systems that combined optical effects with sorption and photocatalytic properties. Other applications that were investigated included adsorption of toxic heavy metals, reactivity of bioactive glass compositions, and a bifunctional catalyst system.
DTIC
Hybrid Composites; Porosity; Porous Materials; Solids; Sorption

20040073741 Delaware Univ., Newark, DE
Dynamic Punch Shear Behavior of Unidirectional and Plain Weave S-2 Glass/ SC15 Composites
Ren, Libo; Gama, Bazle A.; Gillespie, John W., Jr.; Yen, Chian-Fong; Mar. 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0005
Report No.(s): AD-A422660; ARL-CR-535; No Copyright; Avail: CASI; A03, Hardcopy

Dynamic punch shear behavior of unidirectional and plain weave S-2 Glass/ SC15 epoxy composites is presented. An incident bar and a transmission tube assembly in compression split-Hopkinson Bar setup is used for the dynamic punch shear study. Dispersion correction methodology is used with "3-wave" analysis to convert the experimental bar data into dynamic load-displacement curves. A methodology for determining the average transverse shear strength of the composite laminates is described. The average transverse shear strength of unidirectional and plain weave composites as a function of displacement is presented.
DTIC
Dynamic Characteristics; Fiber Composites; Glass

20040074325 NASA Langley Research Center, Hampton, VA, USA
High Temperature Transfer Molding Resins: Preliminary Composite Properties of PETI-375
Connell, J. W.; Smith, J. G., Jr.; Hergenrother, P. M.; Criss, J. M., Jr.; January 08, 2004; 12 pp.; In English; SAMPE 2004 Symposium and Exhibition, 16-20 May 2004, Long Beach, CA, USA
Contract(s)/Grant(s): 757-01-00; Copyright; Avail: CASI; A03, Hardcopy

As part of an ongoing effort to develop materials for resin transfer molding (RTM) of high performance/high temperature composites, a new phenylethynyl containing imide designated as PETI-375 has been under evaluation. PETI-375 was prepared using 2,3,3 ,4 - biphenyltetracarboxylic dianhydride (a-BPDA), 1,3-bis(4-aminophenoxy)benzene and 2,2 - bis(trifluoromethyl)benzidine and endcapped with 4-phenylethynylphthalic anhydride. This material exhibited a stable melt viscosity of 0.1-0.4 Pa sec at 280 C. High quality, void-free laminates were fabricated by high temperature RTM using unsized T-650 carbon fabric and evaluated. After curing for 1 hour at 371 C, the laminates exhibited a glass transition temperature of approx. 375 C by thermomechanical analysis. The laminates were essentially void and microcrack free as evidenced by optical microscopic examination. The chemistry, physical, and composite properties of PETI-375 will be discussed.
Author
High Temperature; Resin Transfer Molding; Glass Transition Temperature; Synthesis (Chemistry)

20040074332 NASA Glenn Research Center, Cleveland, OH, USA
Characterization of C/Enhanced SiC Composite During Creep-Rupture Tests Using an Ultrasonic Guided Wave Scan System
Roth, Don J.; Verrilli, Michael J.; Martin, Richard E.; Cosgriff, Laura M.; May 2004; 22 pp.; In English; 28th Annual International Conference and Exposition on Advanced Ceramics and Composites, 25-30 Jan. 2004, Cocoa Beach, FL, USA
Report No.(s): NASA/TM-2004-213055; E-14333-1; No Copyright; Avail: CASI; A03, Hardcopy

An ultrasonic guided wave scan system was used to nondestructively monitor damage over time and position in a C/enhanced SiC sample that was creep tested to failure at 1200 C in air at a stress of 69 MPa (10 ksi). The use of the guided wave scan system for mapping evolving oxidation profiles (via porosity gradients resulting from oxidation) along the sample length and predicting failure location was explored. The creep-rupture tests were interrupted for ultrasonic evaluation every two hours until failure at approx. 17.5 cumulative hours.
Author
Silicon Carbides; Creep Rupture Strength; Porosity; Oxidation; Failure; Damage

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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*.

20040068147 NASA Ames Research Center, Moffett Field, CA, USA
A Monte Carlo Sensitivity Analysis of CF2 and CF Radical Densities in a c-C4F8 Plasma
Bose, Deepak; Rauf, Shahid; Hash, D. B.; Govindan, T. R.; Meyyappan, M.; January 2004; 12 pp.; In English
Contract(s)/Grant(s): NAS2-99092; Copyright; Avail: CASI; A03, Hardcopy

A Monte Carlo sensitivity analysis is used to build a plasma chemistry model for octacyclofluorobutane (c-C4F8) which is commonly used in dielectric etch. Experimental data are used both quantitatively and quantitatively to analyze the gas phase and gas surface reactions for neutral radical chemistry. The sensitivity data of the resulting model identifies a few critical gas phase and surface aided reactions that account for most of the uncertainty in the CF2 and CF radical densities. Electron impact dissociation of small radicals (CF2 and CF) and their surface recombination reactions are found to be the rate-limiting steps in the neutral radical chemistry. The relative rates for these electron impact dissociation and surface recombination reactions are also suggested. The resulting mechanism is able to explain the measurements of CF2 and CF densities available in the literature and also their hollow spatial density profiles.
Author
Monte Carlo Method; Radicals; Sensitivity Analysis; Fluorocarbons; Plasmas (Physics)

20040068242 Lockheed Martin Corp., Syracuse, NY, USA
Corrosion Behavior of 304 Stainless Steel in High Temperature, Hydrogenated Water
Ziemniak, S. E.; Hanson, M.; May 2001; 40 pp.; In English
Report No.(s): DE2004-821681; LM-01K046; No Copyright; Avail: Department of Energy Information Bridge

The corrosion behavior of an austenitic stainless steel (UNS S30400) has been characterized in a 10,000 hour test conducted in hydrogenated, ammoniated water at 260 degrees C. The corrosion kinetics were observed to follow a parabolic rate dependency, the parabolic rate constant being determined by chemical descaling to be 1. 16 mg dm(sup -2) hr(sup -1/2).

X-ray photoelectron spectroscopy, in combination with argon ion milling and target factor analysis, was applied to provide an independent estimate of the rate constant that agreed with the gravimetric result.
NTIS
Corrosion; Stainless Steels; Austenitic Stainless Steels

20040068245 Lockheed Martin Corp., Syracuse, NY, USA
Thermal-Hydraulics and Electrochemistry of a Boiling Solution in a Porous Sludge Pile. A Test Methodology
Voelker, R. F.; May 2001; 16 pp.; In English
Report No.(s): DE2004-821678; LM-01K030; No Copyright; Avail: Department of Energy Information Bridge

When boiling occurs in a pile of porous corrosion products (sludge), chemical species can concentrate. These species can react with the corrosion products and transform the sludge into a rock hard mass and/or create a corrosive environment. In-situ measurements are required to improve the understanding of this process, and the thermal-hydraulic and electrochemical environment in the pile. A test method is described that utilizes a water heated instrumented tube array in an autoclave to perform the in-situ measurements. As a proof of method feasibility, tests were performed in an alkaline phosphate solution. The test data is discussed.
NTIS
Electrochemistry; Hydraulics; Sludge

20040068284 Lawrence Livermore National Lab., Livermore, CA
Effect of Welding on the Breakdown and Repasivation Potentials of Alloy 22 in 5 M CaC1(2)
Ilevbare, G. O.; Aug. 28, 2003; In English
Report No.(s): DE2003-15004667; UCRL-JC-155209; No Copyright; Avail: National Technical Information Service (NTIS)

The study of the electrochemical behavior of wrought and welded Alloy 22 was carried out in 5 M CaCl2 between 45 and 120 degrees Centigrade with Multiple Crevice Assembly (MCA) specimens. The susceptibility to corrosion was found to increase with increase in temperature in both the wrought and the welded forms of the alloy. The weld metal was found to be less susceptible to localized corrosion under the conditions tested. Alloy 22 (UNS number N06022) is a nickel alloy rich in chromium and molybdenum, with a high degree of corrosion resistance. It exhibits a low general corrosion rate under most conditions and has formidable localized corrosion resistance in most environments compared with other nickel alloys. Alloy 22 is the candidate material for the fabrication of high-level nuclear waste containers. These containers are intended for use for disposal of high-level radioactive waste and spent nuclear fuel.
NTIS
Welding; Nickel Alloys; Electrochemistry; Wrought Alloys

20040068287 Rutherford Appleton Lab., Oxford, UK
Computational Complexity of CCSD(T) Algorithms in Electron Correlation Studies for Atoms and Molecules
Wilson, S.; Sep. 2003; 38 pp.; In English
Report No.(s): PB2004-105657; Copyright; Avail: National Technical Information Service (NTIS)

The CCSD(T) method, a coupled cluster approach including all single and double excitations together with an a posteriori perturbative correction for connected triple excitations, is believed to provide an optimum balance between accuracy and efficiency in electron correlation studies. In this report, we analyze the computational complexity of CCSD(T) algorithms. After considering a prototypical fourth order triple excitation energy diagram in the many-body perturbation theory (MBPT) expansion for a closed-shell system, we consider the tensor contraction which arises in the evaluation of the corresponding energy component and also the use of spin-adaption and the efficiencies which follow in the computational algorithm from its effective exploitation. The CCSD(T) approximation is presented in a compact form and the algebraic complexity of algorithms for this approximation considered in detail. Reduced-complexity algorithms for CCSD(T) calculations are considered. In particular, we consider low-order scaling techniques for extended molecular systems, Laplace transform techniques, and Cholesky decomposition techniques.
NTIS
Clusters; Algorithms; Computation

20040068296 Rutherford Appleton Lab., Oxford, UK
Critical Analysis of the 'CCSD(T)' Model for the Study of Electron Correlation Effects in Atoms and Molecules
Wilson, S.; Sep. 2003; 46 pp.; In English
Report No.(s): PB2004-105656; Copyright; Avail: National Technical Information Service (NTIS)

A critical analysis of the CCSD(T) ('coupled cluster single and doubles with perturbative triples') method is presented. This method is widely regarded as possibly the best balance between efficiency and accuracy. It includes an a posteriori pertubative correction to the CCSD method for terms associated with triply excited intermediate states which can support 'chemical accuracy.' However, the CCSD method and the augmented theory CCSD(T) fails in the presence of quasidegeneracy. Recent work has shown that multireference methods give more accurate results in studies of systems in which some degree of quasidegeneracy is present. Nevertheless there is continued interest in extending the range of applicability of single reference augmented coupled cluster methods such as CCDSD(T). Renormalized CCSD(T) theory, which is based on the method such as CCSD(T). Renormalized CCSD(T) theory, which is based on the method of moments coupled cluster theory, is claimed to be a promising approach which removes the pervasive failing of the standard CCSD(T) method but destroys its 'extensivity' property.
NTIS
Clusters; Computation; Method of Moments

20040070728 NASA Lewis Research Center, Cleveland, OH, USA
The Nickel(111)/Alkaline Electrolyte Interface
Wang, Kuilong; Chottiner, G. S.; Scherson, D. A.; Reid, Margaret A.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 11; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The electrochemical properties of Ni (111) prepared and characterized in ultra high vacuum, UHV, by surface analytical techniques have been examined in alkaline media by cyclic voltammetry using an UHV-electrochemical cell transfer system designed and built in this laboratory. Prior to the transfer, the Ni(111) surfaces were exposed to saturation coverages of CO in UHV in an attempt to protect the surface from possible contamination with other gases during the transfer.
Author
Nickel; Surface Properties; Electrochemical Cells

20040070729 NASA Lewis Research Center, Cleveland, OH, USA
Impedances of Nickel Electrodes Cycled in Various KOH Concentrations
Reid, Margaret A.; Loyselle, Patricia L.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 19; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Impedances were measured of electrodes from boiler-plate cells cycled i n KOH concentrations from 21% to 36 %. These cells under accelerated conditions at 80% DOD to failure, defined discharge voltage. Cell life ranged from about 1,000 t o 40 impedances were measured at five voltages corresponding to charge. The results were analyzed using a standard circuit model including a Warburg impedance term.
Author
Nickel; Electric Potential

20040070731 Hamilton Standard, Windsor Locks, CT, USA
SPE Water Electrolyzers in Support of Mission from Planet Earth
McElroy, J. F.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 5-6; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

During the 1970's the SPE Water Electrolyzer, which uses ion exchange membranes as its sole electrolyte, was developed for nuclear submarine metabolic oxygen production. These developments included SPE water electrolyzer operation at up to 3000 psia and at current densities in excess of 1000 amps per square foot. SPE water electrolyzer systems are now fully qualified for both U.S. and U.K. Navies with tens of thousands of system hours accumulated at sea. During the 1980's the basic SPE water electrolyzer cell structure developed for the Navies was incorporated into several demonstrators for NASA's Space Station Program. Among these were SPE regenerative fuel cell for electrical energy storage; and SPE water electrolyzer for metabolic oxygen production. An overview of these programs will be provided. High Pressure SPE water electrolyzer for reboost propulsion reactant production Details of construction and performance of these demonstrators will be provided.
Author
Electrolysis; Regenerative Fuel Cells; Oxygen Production

20040070741 NASA Lewis Research Center, Cleveland, OH, USA

Raman Spectral Observation of a "New Phase" Observed in Nickel Electrodes Cycled to Failure

Loyselle, P. L.; Shan, X.; Cornilsen, B. C.; Reid, M. A.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 15; In English; See also 20040070726

Contract(s)/Grant(s): NAG3-519; No Copyright; Available from CASI only as part of the entire parent document

A "new phase" is reported in nickel electrodes from Ni/H boilerplate cells which were cycled to failure in electrolyte of variable kOH concentration. Raman spectra clearly show the presence of this phase, and these spectra have been used to quantify the amounts present in these electrodes (in the volume sampled by the laser beam) Raman spectroscopy has been found to be capable of differentiating the various phases which can be present in nickel .This differentiation is possible because of the structural variation observed for these phases.

Author

Electrodes; Phase Stability (Materials)

20040070744 Giner, Inc., Waltham, MA, USA

Oxygen Electrodes for Rechargeable Alkaline Fuel Cells - III

Swette, L.; Kackley, N.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 29; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The primary objective is the investigation and development of electrocatalysts and supports for the positive electrode of moderate-temperature single-unit rechargeable alkaline fuel cells. materials must meet the following requirements: (1) good electrical conductivity (a more demanding requirement for supports than for electrocatalysts) , (2) high resistance t o chemical corrosion and electrochemical oxidation and/or reduction, and (3) electocatalysts, i n addition, must exhibit high bifunctional electrocatalytic activity (evolution and reduction). development will require that the materials be prepared in high-surface-area forms, and may also entail integration of various candidate materials (one or two electrocatalysts distributed on a less active support material).

Author

Fuel Cells; Electrocatalysts

20040071050 Environmental Protection Agency, Ada, OK, USA

Capstone Report on the Application, Monitoring, and Performance of Permeable Reactive Barriers for Ground-Water Remediation. Volume 2: Long-Term Monitoring of PRBs, Soils and Ground Water Sampling

Paul, C. J.; McNeil, M. S.; Beck, F. P.; Clark, P. J.; Wilkin, R. T.; Aug. 2003; In English

Report No.(s): PB2004-102950; EPA/600/R-03/045B; No Copyright; Avail: National Technical Information Service (NTIS)

This report discusses soil and ground-water sampling methods and procedures used to evaluate the long-term performance of permeable reactive barriers (PRBs) at two sites, Elizabeth City, NC, and the Denver Federal Center near Lakewood, CO. Both PRBs were installed in 1996 and have been monitored and studied since installation to determine their continued effectiveness for removing contaminants from ground water. An effective monitoring program requires appropriate soil and ground-water sampling techniques. For ground-water sampling, water quality indicator parameters must be monitored to determine when formation water has been accessed. Geochemical parameters include oxidation-reduction potential (ORP), pH, specific conductance, dissolved oxygen (DO), and turbidity. Field analytical methods are discussed along with interferences and issues which may arise when using certain electrodes or instruments in the field. Detailed field analytical procedures for hexavalent chromium, ferrous iron, alkalinity, hydrogen sulfide, and dissolved oxygen are described. Also included are laboratory methods for sample analyses for organics, cations, anions, and carbon. Sample collection methods, sample containers, preservation methods, and sample storage techniques are also discussed.

NTIS

Ground Water; Water Treatment

20040071051

Capstone Report on the Application, Monitoring, and Performance of Permeable Reactive Barriers for Ground-Water Remediation. Volume 1: Performance Evaluations at Two Sites

Wilkin, R. T.; Puls, R. W.; Aug. 2003; In English

Report No.(s): PB2004-102949; EPA/600/R-03/045A; No Copyright; Avail: National Technical Information Service (NTIS)

Research results discussed in this report explore the geochemical and microbiological processes within zero-valent iron Permeable Reactive Barriers (PRBs) that may contribute to changes through time in iron reactivity and decreases in reaction

zone permeability. Two full-scale PRBs were evaluated in this study: the U. S. Coast Guard Support Center PRB located near Elizabeth City, North Carolina, and the Denver Federal Center PRB in Lakewood, Colorado. Detailed water sampling and analysis, core sampling, and solid-phase characterization studies were carried out to: evaluate spatial and temporal trends in contaminant concentrations and key geochemical parameters; characterize the type and nature of surface precipitates forming over time in the reactive barriers; and, identify the type and extent of microbiological activity within and around the reactive barriers.
NTIS
Ground Water; Water Treatment

20040071063 Oak Ridge National Lab., TN, USA
Corrosion Test Results for Inconel 600 vs Inconel-Stainless UG Bellows
Osborne, P. E.; Icenhour, A. S.; Del Cul, G. D.; Aug. 2002; In English
Report No.(s): DE2003-814069; ORNL/TM-2002/136; No Copyright; Avail: National Technical Information Service (NTIS)
The Conversion Project (CP) of the Molten Salt Reactor Experiment at Oak Ridge National Laboratory (ORNL) involves converting slightly less than 40 kg of (sup 233)U to a stable form for safe storage. The operation is performed within a few vessels interconnected by valves and 1/2-inch metal tubing. During this conversion, a particularly toxic and corrosive by-product is formed, namely aqueous hydrofluoric acid (HF). The production of HF is a result of the hydrolysis of UF(sub 6) and subsequent steam treatments of UO(sub 2)F(sub 2). For each mole of UF(sub 6) converted, 6 mole of HF are produced. The HF that forms during conversion combines with water to produce approximately 1.5 L of 33 wt% HF. As this mixture is transferred within the process system, the tubing and valves are exposed to high concentrations of HF in liquid and vapor form.
NTIS
Bellows; Corrosion Tests; Inconel (Trademark); Stainless Steels; Fabrication

20040071067 Lockheed Martin Corp., Syracuse, NY, USA
Modelling Mixed Bed Ion Exchange Kinetics for Removal of Trace Levels of Divalent Cations in Ultrapure Water
Widman, B.; Jan. 2003; 14 pp.; In English
Report No.(s): DE2004-822270; LM-03K097; No Copyright; Avail: Department of Energy Information Bridge
Ion exchanger resin fluid film mass transfer coefficients and the ionic diffusivities from which they are derived are often measured by use of ion exchange resin columns. Such tests, usually run dynamically using short resin beds, are often performed using relatively high (ppm) concentrations of ions to accurately measure output concentrations as a function of flow rate.
NTIS
Cations; Ion Exchange Resins; Kinetics; Ammonia

20040071142 NASA Glenn Research Center, Cleveland, OH, USA
[Synthesis and Characterization of a Sugar Based Electrolyte for Thin-film Polymer Batteries]
[1998]; 2 pp.; In English
Contract(s)/Grant(s): NCC3-883; No Copyright; Avail: CASI; A01, Hardcopy
The work performed during the current renewal period, March 1,1998 focused primarily on the synthesis and characterization of a sugar based electrolyte for thin-film polymer batteries. The initial phase of the project involved developing a suitable sugar to use as the monomer in the polymeric electrolyte synthesis. The monomer has been synthesized and characterized completely. Overall the yield of this material is high and it can be produced in relatively large quantity easily and in high purity. The scheme used for the preparation of the monomer is outlined along with pertinent yields.
Derived from text
Electrolytes; Sugars; Thin Films; Polymers; Synthesis (Chemistry); Electric Batteries

20040073501 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Fluctuation and Thermophysical Properties of Molten II-VI Compounds
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 22; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
The objectives of the project is to conduct ground-based experimental and theoretical research on the structural fluctuations and thermophysical properties of molten II-VI compounds to enhance the basic understanding of the existing flight

experiments in microgravity materials science programs and to study the fundamental heterophase fluctuations phenomena in these melts by: 1) Conducting neutron scattering analysis and measuring quantitatively the relevant thermophysical properties of the II-VI melts such as viscosity, electrical conductivity, thermal diffusivity and density as well as the relaxation characteristics of these properties to advance the understanding of the structural properties and the relaxation phenomena in these melts and 2) Performing theoretical analyses on the melt systems to interpret the experimental results. All the facilities required for the experimental measurements have been procured, installed and tested. A relaxation phenomenon, which shows a slow drift of the measured thermal conductivity toward the equilibrium value after cooling of the sample, was observed for the first time. An apparatus based on the transient torque induced by a rotating magnetic field has been developed to determine the viscosity and electrical conductivity of semiconducting liquids. Viscosity measurements on molten tellurium showed similar relaxation behavior as the measured diffusivity. Neutron scattering experiments were performed on the HgTe and HgZnTe melts and the results on pair distribution showed better resolution than previous reported.
Author (revised)
Thermophysical Properties; Molecular Structure; Melts (Crystal Growth)

20040073527 Lawrence Livermore National Lab., Livermore, CA
Chemical Kinetic Characterization of Combustion of Toluene
Pitz, W. J.; Seiser, R.; Bozzelli, J. W.; Da Costa, I.; Fournet, R.; Mar. 20, 2001; In English
Report No.(s): DE2004-15005660; UCRL-JC-142415; No Copyright; Avail: National Technical Information Service (NTIS)
A study is performed to elucidate the chemical kinetic mechanism of combustion of toluene. A detailed chemical kinetic mechanism for toluene was improved by adding a more accurate description of the phenyl+ O(sub 2) reaction channels. Results of the chemical kinetic mechanism are compared with experimental data obtained from premixed and nonpremixed systems. Under premixed conditions, predicted ignition delay times are compared with new experimental data obtained in shock tube. Also, calculated species concentration histories are compared to experimental flow reactor data from the literature. Critical conditions of extinction and ignition were measured in strained laminar flows under nonpremixed conditions in the counterflow configuration. Numerical calculations are performed using the chemical kinetic mechanism at conditions corresponding to those in the experiments. Critical conditions of extinction and ignition are predicted and compared with the experimental data. For both premixed and nonpremixed systems, sensitivity analysis was used to identify the reaction rate constants that control the overall rate of oxidation in each of the systems considered.
NTIS
Combustion; Reaction Kinetics; Toluene; Characterization

20040073544 State Univ. of New York, Stony Brook, NY
Intersubband Light Emission Type II Heterostructures
Mendez, Emillo E.; Oct. 31, 2003; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0270
Report No.(s): AD-A422315; ARO-40070.6-PH; No Copyright; Avail: CASI; A03, Hardcopy
We have studied the physics underlying some of the pending issues in quantum cascade lasers, with an emphasis on electronic transport across InAs/ AlSb/GaSb heterojunctions - the building block of type II quantum cascade lasers - and on its dependence on the materials' epitaxial growth conditions. We have used %sonant tunneling experiments to confirm the coexistence of electrons and holes in separate InAs and GaSb layers, to determine their density and to correlate them to interface smoothness and optimum growth conditions. We have also examined the effectiveness of a superlattice placed on the "collector?' end of a type I tunneling heterostructure device to block tunneling through the potential barrier. Finally, we have studied the interaction of photons and excitons in type I microcavities' and have devised a simple way of enhancing the coupling between photons and excitons.
DTIC
Electron Transfer; Emission Spectra; Epitaxy; Lasers; Light Emission; Quantum Theory

20040073627 Air Force Research Lab., Edwards AFB, CA
Update in Ionic Liquids Research
Drake, Greg; Hawkins, Tommy; Feb. 12, 2004; 33 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A422506; AFRL-PR-ED-VG-2004-030; No Copyright; Avail: CASI; A03, Hardcopy
Hydrogen bonding is highly important in all systems. Asymmetry can dramatically affect physical properties and modest

changes can have drastic affects. N-amino heterocycles offer a rich platform for ionic liquids. New triazole and tetrazole systems have been identified as ionic liquid precursors. X-ray crystallography continues to be a powerful tool in identifying interactions in the solid state.
DTIC
Crystallography; Hydrogen Bonds; Liquid Phases; Liquids

20040073628 Engineering Research and Consulting, Inc., Huntsville, AL
Fluorinated Polyhedral Oligomeric Silsesquioxanes (FluoroPOSS)
Mabry, J. M.; Vij, A.; Marchant, D.; Viers, B. D.; Ruth, P. N.; Schlaefer, C. E.; Apr. 2004; 55 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A422508; AFRL-PR-ED-VG-2004-102; No Copyright; Avail: CASI; A04, Hardcopy

Partical contents: Hybrid Inorganic/Organic Polymers, Anatomy of a POSS nanostructure, Poss Synthesis, FluoroPOSS Synthesis, Fluoropropyl(nTn), Fluorodecyl(8T8), Contact Angle of Water on Fluorodecyl POSS Surface, Contact Angle of Mercury on Fluorodecyl POSS Surface, AFM Image of Spin-Cast Fluorodecyl(8T8) Surface, Surface Energy of Fluorosiloxanes, Contact Angle and Chain Length, POSS Polymer Incorporation, Importance of R groups: Affect compatibility with polymer matrix, PVDF/Fluoroocytl(8T8) POSS,PVDF/ fluoroocytl(nTn) POSS, Fluorinated Ethylene/ Propylene, Poly(chlorotrifluoroethylene), Amorphous FEP, Water Contact Angle.
DTIC
Fluorohydrocarbons; Nanostructures (Devices); Organic Compounds

20040073629 Engineering Research and Consulting, Inc., Edwards AFB, CA
Polynitrogen Chemistry: Recent Development in Pentazole and Polyazide Chemistry
Vij, Ashwani; Vij, Vandan; Haiges, R.; Christe, Karl O.; Mar. 24, 2004; 18 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP
Report No.(s): AD-A422509; AFRL-PR-ED-VG-2004-088; No Copyright; Avail: CASI; A03, Hardcopy

Partial contents: Polynitrogen Chemistry: Recent Development in Pentazole and Polyazide Chemistry, Why Polynitrogen Compounds?, Geometry of the N5+ cation , (In) Compatabillty of N5+, New Polynitrogen Anions as Counterparts for N5+, Synthetic Challenge How do we make These New Anions??, Formation and Stabillty of Sllyl Diazonium Salts, Synthesis of Aryldiazonium Salts, Pentazole Formation. . Not a Trivial Chore!!!, Identification of Arylpentazoles, Cleavage of the Aryl-Pentazole Bond with Retention of the Pentazole Ring, MSMS of the Parent Ion Peak, Chemical Cleavage of the C-N Bond, Aryl-pentazole bond cleavage: N5 anion in Solution, Subsequent Decomposition of the Pentazole Anion, Pentazoles with Heterocyclic Substituents, 15N NMR of 2-pentazoly!-4, 5- dicyano- imidazole, Pentazolate Anion in Solution?, Chronology of the Pentazolate Anion, What are "normal" N-N distances in azides?, Abnormalities in azide distances: Artifacts or Structural Contaminants?, Reactivity of hexachioroantimonate (VI) - with Trimethylsilylazide, The tetraphenylarsonium antimonychioride azide case.
DTIC
Chemical Properties

20040073630 Air Force Research Lab., Edwards AFB, CA
Computational Studies of Ionic Liquids
Boatz, Jerry; Feb. 12, 2004; 13 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A422510; AFRL-PR-ED-VG-2004-036; No Copyright; Avail: CASI; A03, Hardcopy

The structures and relative energies of the six possible N-protonated structures of the 1,5-diamino-1,2,3,4- tetrazolium cation have been computed at the B3LYP(3)/6-311G(d, p) and MP2/6-311G(d,p) levels of theory. Relative energies have been refined at the B3LYP(3), MP2, and CCSD(T) levels, using the 6-311G(2df,p) and aug-cc-pvtz basis sets. Isomers 2(4H) and 3(3H) are essentially degenerate at all levels of theory. B3LYP predicts isomer 5(1H) to ring open to form an azide (NH2NHC(N3)-NH2, CCSD(T)/6-311G(2df,p)//MP2/6-311G(d,p) calculations predict structure 2 to be the most stable isomer, in agreement with the X-ray crystal structure of the perchlorate salt.
DTIC
Crystal Structure; Liquids; X Rays

20040073633 Engineering Research and Consulting, Inc., Edwards AFB, CA
Preparation of Benzophenone Modified Poly(dimethylsiloxane) Thermosets
Mabry, Joseph M.; Weber, William P.; Mar. 12, 2004; 24 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A422515; AFRL-PR-ED-VG-2004-069; No Copyright; Avail: CASI; A03, Hardcopy

While the Ru catalyzed incorporation of aromatic ketones into siloxane polymer backbones adds various properties to the polymers, the characteristic properties of poly(dimethylsiloxane) (PDMS), such as low glass transition temperature (Tg) are lost. The Ru catalyzed chemical modification of a PDMS copolymer may allow the addition of the properties of the ketones, while retaining the properties of PDMS.

DTIC
Benzene; Chemical Properties; Ketones; Siloxanes

20040073634 Engineering Research and Consulting, Inc., Edwards AFB, CA
Reactivity Ratios of Isobutyl POSS-Styrene and Styrene Monomers
Moore, Brian; Haddad, Timothy; Gonzalez, Rene; Schlaefer, Constance; Mar. 12, 2004; 18 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A422517; AFRL-PR-ED-VG-2004-067; No Copyright; Avail: CASI; A03, Hardcopy

Copolymers containing POSS(Polyhedral Oligomeric Silsesquiaxane) Generally have higher mechanical and thermal properties than polymers without POSS. The microstructure that lends to these increase may be caused by POSS nanoparticle units or aggregates of these units to farm larger POSS clusters. To help define the microstructure of the addition copolymers, the POSS macromer and organic monomer reactivity ratios (r1 and r2) need to be known. Alternating Copolymerization: r1=r2=O, Block Copolymerization: r1>1, r2>1, Random Copolymerization: r1r2=1.

DTIC
Butenes; Copolymerization; Monomers; Reactivity; Styrenes

20040073636 Engineering Research and Consulting, Inc., Edwards AFB, CA
The Specific Refractive Index Increments for POSS Polymers in Solution
Largo, Sheryl R.; Haddad, Timothy; Schlaefer, Constance; Gonzalez, Rene; Mar. 12, 2004; 17 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A422519; AFRL-PR-ED-VG-2004-068; No Copyright; Avail: CASI; A03, Hardcopy

Partial contents: Hybrid Inorganic/Organic Polymers, Introduction to POSS, Anatomy of a POSS Nanostructure, POSS Polymer Incorporation, POSS Styrene Monomer Synthesis, POSS Styrene Copolymer Synthesis, 1HNMR Cyclohexyl POSS monomer, 1HNMR-50wt% CyPOSS-PS copolymer, The Specific Refractive index increment and POSS Polymer, Why find the dn/dc Value?, RI vs. Concentration of iBuPoss-Ps copolymer, RI Vs Concentration of CyPOSS-PS copolymer, dn/dc vs wt.% and mole%, Summary and Future Work.

DTIC
Organic Compounds; Refractivity; Styrenes

20040073677 Stanford Univ., Stanford, CA
Shock Tube Measurements Of Iso-Octane Ignition Times And OH Concentration Time Histories
Davidson, D. F.; Oehlschiaeger, M. A.; Herbon, J. T.; Hanson, R. K.; Jan. 2002; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0597
Report No.(s): AD-A422570; ARO-41100.1-EG; No Copyright; Avail: CASI; A02, Hardcopy

Ignition times and OH radical concentration time histories were measured behind reflected shock waves in iso-octane/O2/Ar mixtures. Initial reflected shock conditions were in the ranges 1177 to 2009 K and 1.18 to 8.17 atm, with fuel concentrations of 100 ppm to 1% and equivalence ratios from 0. 25 to 2. Ignition times were measured using endwall emission of CH and sidewall pressure. OH concentrations were measured using narrow-linewidth ring-dye laser absorption of the R1(5) line of the OH A-X (0,0) band at 306.5 nm. The ignition time data and OH concentration time history measurements were compared to model predictions of four current iso-octane oxidation mechanisms, and the implications of these comparisons are discussed. To our knowledge, these data provide the first extensive measurements of low fuel- concentration ignition times and OH concentration time histories for iso-octane auto-ignition, and hence provide a critical contribution to the database

needed for validation of a detailed mechanism for this primary reference fuel.
DTIC
Additives; Ignition; Shock Tubes

20040073678 Aerodyne Research, Inc., Billerica, MA
Spectrally Analyzed Embedded Infrared Fiber Optic Diagnostic of Advanced Composite Propellant Combustion
Wormhoudt, Joda; Mar. 31, 2003; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-C-0095
Report No.(s): AD-A422571; ARO-41260.1-CH; No Copyright; Avail: CASI; A03, Hardcopy

This is the final report for a program to extend an embedded-infrared-fiber propellant strand burning diagnostic by replacing bandpass filter detection by spectral detection. This work builds on previous investigations into the chemical and physical processes occurring in the condensed phases of nitramine advanced composite propellants, in which we observed decomposition product gases by infrared absorption in a small volume below the flame front. Detection of infrared absorption spectra along with video camera and embedded thermocouple records allows characterization of the evolution of decomposition regions by correlating time, spatial location, temperature and decomposition species fractions. Much of the effort of the program went into optimizing the sensitivity of the FTIR spectrometer/fiber optic apparatus, and into constructing test articles. The difficulty of these tasks limited us to only a handful of successful burns. The spectra obtained clearly show N2O and CO2, thus confirming our earlier work and adding a new species to those detected previously. Evidence for other gases is less certain.
DTIC
Composite Propellants; Embedding; Fiber Optics; Infrared Radiation; Propellant Combustion; Solid Propellants

20040073699 Aerospace Corp., El Segundo, CA
Assessment of Perchlorate Releases in Launch Operations III
Lang, V. I.; Bohman, K. R.; Tooley, J. T.; Fournier, E. W.; Brady, B. B.; Sep. 18, 2003; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422600; TR-2003(1306)-2; SMC-TR-04-11; No Copyright; Avail: CASI; A04, Hardcopy

A method for predicting potential perchlorate releases from accidental launch failures has been developed for use in planning and managing launch activities where solid rocket motors are used. The method is also applicable to assessing location and quantity of perchlorate release in the event that a launch failure has already occurred. A representative hypothetical case study is presented to illustrate time scales for potential perchlorate release into bodies of water under different conditions of temperature and salinity. The report also contains an analysis of water samples (for metals and other contaminants) in which solid propellant samples were immersed for 11 months.
DTIC
Perchlorates; Spacecraft Launching; Water

20040073717 Army Natick Soldier Center, Natick, MA
Identification of Selected Fibers by Pyrolysis-Gas Chromatography-Mass Spectrometry
Riel-Bagalawis, Rosa L.; Apr. 2004; 41 pp.; In English
Report No.(s): AD-A422631; NATICK/TR-04/011; No Copyright; Avail: CASI; A03, Hardcopy

A pyrolysis-gas chromatographic method was developed in 2000 to characterize military fibers and fabrics. As the performance and durability of materials relate to their fiber composition, a sensitive and reliable method for the identification of fibers became necessary. The method was further improved by incorporating a mass spectrometer as a detector to ensure accurate component identification from the pyrolyzates. Pyrograms and gas chromatographic analysis are highly reproducible. This analytical method is reliable for the characterization of fibers.
DTIC
Gas Chromatography; Mass Spectroscopy; Pyrolysis

20040073723 State Univ. of New York, Stony Brook, NY
Dynamic Studies in Fiber Processing
Chu, Benjamin; Feb. 18, 2004; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0419
Report No.(s): AD-A422638; ARO-40436.1-CH; No Copyright; Avail: CASI; A03, Hardcopy

The structural development of a nanocomposite, containing 95 wt% isotactic polypropylene (iPP) and 5 wt% modified carbon nanofiber (MCNF), during fiber spinning was investigated by in-situ synchrotron small-angle X-ray scattering (SAXS) and wide-angle X-ray diffraction (WAXD) techniques. The modification of carbon nanofibers (CNFs) was accomplished by a chemical surface treatment using in-situ polymerization of olefin segments to enhance its compatibility with iPP. The iPP/MCNF nanocomposite was prepared by a two- step blending process in order to ensure the exfoliation of MCNF. X-ray results showed that at low spin-draw ratios, the iPP!MCNF nanocomposite fiber exhibited much higher iPP crystalline orientation than the control' pure iPP fiber. At higher spin-draw ratios, the crystalline orientation of the nanocomposite fiber and that of the pure iPP fiber was about the same. The crystallinity of the composite fiber was higher than that of the control iPP fiber, indicating the nucleating effect of the modified carbon nanofibers. The nanocomposite fiber also showed larger long periods at low spin-draw ratios. Measurements of mechanical properties indicated that the nanocomposite fiber with 5 wt% MCNF had much higher tensile strength, modulus and longer elongation to break. The mechanical enhancement can be attributed to the exfoliation of MCNF in the matrix, which was confirmed by SEM results.
DTIC
Nanocomposites; Nanofabrication; Carbon Fibers; Polypropylene; Crystal Structure

20040073725 California Univ., Davis, CA
Densification of nanocrystalline powders. Field Activated Sintering of Tantalum nanopowders
Groza, J. R.; Nov. 7, 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0182
Report No.(s): AD-A422641; ARO-40112.3-MS; No Copyright; Avail: CASI; A03, Hardcopy

This work focused on the specifics of densification of nanocrystalline powders using an externally applied pulsed electrical current. Studies were performed to characterize the surface structure of select metal nanopowders (Ni, Al and Ta) and understand differences due to handling and storage conditions. For the oxygen sensitive Ta, methods were designed to clean previously coated nanoparticle surfaces. Grain growth behavior of nanocrystalline materials was characterized by in-situ TEM with and without an externally applied electrical current. An integrated heating/electrical biasing holder was designed and built for in-situ TEM coarsening studies. For field sintering of nanomaterials, a more detailed characterization of the commercial SPS machine was required, and temperature evolution and distribution, and heating rate effects were evaluated. Based on the experience in SPS sintering of conventional parts (19 mm in diameter and 5 mm thick) from Ni nanoparticles, large specimens (thickness up to 19 mm) were sintered for mechanical testing. Ta nanopowders (40 nm) were sintered to a final density of 12.9 g/cm3 at 1200 C. The grain/crystallite size very small (2. 5 nm). This was also attributed to a phase transformation from tetragonal to cubic in Ta. Mechanical property characterization is being performed on large Ni specimens and sintered Ta at ARL, Aberdeen Proving Ground, Maryland.
DTIC
Densification; Mechanical Properties; Powder (Particles); Sintering; Tantalum; Tantalum Compounds

20040073726 Colorado Univ., Boulder, CO
Pentachlorophenol Hydroxylase: Analysis of Catalytic Abilities and Evolution of a Better Enzyme
Cople, Shelley D.; Jan. 19, 2004; 4 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0301
Report No.(s): AD-A422642; ARO-40132.1-LS; No Copyright; Avail: CASI; A01, Hardcopy

Sphingobium chlorophenolicum is a Gram-negative soil bacterium that can mineralize pentachlorophenol (PCP), although degradation is slow and the bacterium cannot tolerate high levels of PCP. The rate of degradation is limited by the first enzyme in the pathway, PCP hydroxylase, which is a very poor catalyst. We have used DNA shuffling to produce mutant enzymes with modestly improved catalytic activities. We discovered that the reason for our limited success was that our selection was based upon publications claiming that the product formed by PCP hydroxylase is tetrachlorohydroquinone (TCHQ). Since TCHQ is less toxic than PCP, cells expressing better enzymes should be able to grow in the presence of higher levels of PCP. However, we found that the product formed from PCP is actually tetrachlorobenzoquinone (TCBQ), which is more toxic than PCP. We also discovered a previously unrecognized enzyme that converts TCBQ to TCHQ. Our new knowledge about the pathway will allow us to design a more effective selection for improved PCP hydroxylase enzymes. Finally, we have used genome shuffling to generate strains of S. chlorophenolicum that have greatly increased tolerance to the toxicity of PCP and have significantly improved rates of degradation.
DTIC
Catalysts; Deoxyribonucleic Acid; Enzymes

20040073730 Stanford Univ., Stanford, CA

Interpreting Shock Tube Ignition Data

Davidson, D. F.; Hanson, R. K.; Oct. 2003; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0597

Report No.(s): AD-A422646; 03F-61; ARO-41100.4-EG; No Copyright; Avail: CASI; A03, Hardcopy

Chemical kinetic modelers make extensive use of shock tube ignition data in the development and validation of combustion reaction mechanisms. These data come from measurements using a range of diagnostics and a variety of shock tubes, fuels, and initial conditions. With the wide selection of data available, it is useful to realize that not all of the data are of all the same type or quality, nor are all the data suitable for simple, direct comparison with the predictions of reaction mechanisms. We present here a discussion of some guidelines for the comparison of shock tube ignition time data with reaction mechanism modeling. Areas discussed include: definitions of ignition time; ignition time correlations (with examples taken from recent n-heptane and iso-octane measurements); shock tube constant-volume behavior; shock tube diameter and boundary layer effects; carrier gas and impurity effects; and future needs and challenges in shock tube research.

DTIC

Ignition; Shock Tubes

20040073733 Massachusetts Inst. of Tech., Cambridge, MA

Kinetics of Chemical Agents Destruction in Supercritical Water

Tester, Jefferson W.; Sullivan, Patricia A.; Ploeger, Jason M.; Lachance, Russell P.; Dec. 31, 2003; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0211

Report No.(s): AD-A422649; ARO-39250.6-CH; No Copyright; Avail: CASI; A03, Hardcopy

The work accomplishments during this project consist of five different studies conducted by three current PhD students in the laboratory. An experimental study of methylphosphonic acid (MPA) oxidation has been completed that includes macroscopic modeling of the overall global rate law for MPA oxidation in supercritical water (SCW) and for the major pathways in MPA oxidation. Additionally, an elementary reaction rate model for supercritical water oxidation (SCWO) of MPA has been developed consisting of rate parameters from the available literature and ab initio calculations. Urea hydrolysis kinetics have been experimentally measured at sub and supercritical water conditions. Additionally, recent studies in the laboratory include a co-oxidation stud of MPA and ethanol kinetics in SCW and a methane SCWO experimental study.

DTIC

Destruction; Oxidation; Reaction Kinetics; Water

20040073746 Air Force Research Lab., Edwards AFB, CA

Polynitrogen and High Nitrogen Chemistry: A New World of Challenges

Vij, Ashwani; Mar. 25, 2004; 85 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A422668; No Copyright; Avail: CASI; A05, Hardcopy

Polynitrogen compounds contain only nitrogen atoms and are expected to have unusual properties. Most important among these are: High endothermicity Green propellant combustion product is only gaseous N2 High density High Isp values when compared to other monopropropellants or bipropellants High detonation velocity

DTIC

High Energy Propellants; Nitrogen; Synthesis (Chemistry)

20040073756 Engineering Research and Consulting, Inc., Huntsville, AL

Preparation and Characterization of the First Binary Titanium Azides, Ti(N3)4, P(C6H5)4Ti(N3)5 and P(C6H5)42Ti(N3)6 and on Linear Ti-N-NN Coordination

Christe, Karl O.; Haiges, Ralf; Schneider, Stefan; Schroer, Thorsten; Boatz, Jerry A.; Mar. 12, 2004; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP

Report No.(s): AD-A422680; No Copyright; Avail: CASI; A03, Hardcopy

Where as numerous partially azide-substituted titanium compounds had previously been reported, 1-7 no binary titanium azides were known. In a recent theoretical study the group 4 metal tetrazides M(N3)4 (M = Ti, Zr, Hf, Th) were predicted 8 to be vibrationally stable exhibiting tetrahedral structures with unique linear M-N-NN bond angles (see Figure 1). All

previously characterized covalent binary azide species possess bent M-N-NN angles. In this paper we wish to report the synthesis, isolation and characterization of the first binary titanium azide species Ti(N3)4, Ti(N3)4, Ti(N3)5- and Ti(N3)62-, and provide explanations for the observed and predicted Ti-N-NN bond angles.
DTIC
Azides (Inorganic); Azides (Organic); Coordination; Synthesis (Chemistry); Titanium

20040073757 Engineering Research and Consulting, Inc., Huntsville, AL
High Energy Density Materials
Haiges, Ralf; Schneider, Stefan; Schroer, Thorsten; Christe, Karl O.; Mar. 23, 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-DARP
Report No.(s): AD-A422681; No Copyright; Avail: CASI; A03, Hardcopy

During the past two decades, polynitrogen compounds have received increasing attention as promising candidates for High Energy Density Materials (HEDM).1-17 While most of the efforts were devoted to theoretical studies, the long-known existence of the stable azide anion (N3-)18 and the recent syntheses of stable salts of the pentanitrogen cation (N5+)1-3 have demonstrated the feasibility of experimentally pursuing such materials. The only known direct method for preparing N5+ compounds is their synthesis from an N2F+ salt with HN3 in HF solution according to Equation 1. 1, 2
DTIC
Synthesis (Chemistry)

20040073760 Engineering Research and Consulting, Inc., Edwards AFB, CA
Ultraviolet CO Chemiluminescence in CH(X2II) and CH(a4sigma-) Reactions with Atomic Oxygen at 298 K
Vaghjiani, Ghanshayam L.; Mar. 29, 2004; 38 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025
Report No.(s): AD-A422688; AFRL-PR-ED-TP-2004-046; No Copyright; Avail: CASI; A03, Hardcopy

Production of ultraviolet CO chemiluminescence has been observed for the first time in the gas-phase pulsed laser photolysis of a trace amount of CEBr3 vapor in an excess of O- atoms. O-atoms were produced by dissociation of O2 or N2O in 4 cw-microwave discharge cavity in 2.0 torr Heat 298 K. Temporal profiles of the excited state products that formed in the photo-produced precursor + O-atom (or O2) reaction were measured by recording their time-resolved chemiluminescence in discrete vibronic bands. The CO. 4th Positive transition (A1 II, v'=O -> x1sigma+, v"=2) near 165.7 nm, the CO Cameron band transition (a3H, v'=O % X1%+, v"%1) near 215.8 nm and the OH band transition (A2%+, v'=l % X211, v"=O) near 282.2 nm were monitored in this work to deduce the decay kinetics of the chemiluminescence in the presence of various' added substrates. From this the second-order rate coefficient values were determined for reactions of these substrates with the photo- produced precursors. Measured reactivity trends suggest that the prominent precursors responsible for the chemiluminescence are the methyfidyne radicals, CH(X2H) and CH(a4%-), whose production requires the absorption of at least 2 laser photons by the photolysis mixture. The 9-atom reactions with brominated precursors, which also form in the photolysis, are shown to play a minor role in the production of. the CO cherniluminescence. However, the CBr2 + 0-atom reaction was identified as a significant source for the ultraviolet Br2 chemilurninescence that was also observed in this work.
DTIC
Chemiluminescence; Oxygen Atoms

20040073766 Engineering Research and Consulting, Inc., Huntsville, AL
Effect of Ligand Coordination on Complex Formation: Synthesis and Structural Studies of Metal(I) Salts Containing the N(SO2CF3)2 and OTeF5 Groups
Vij, Ashwani; Vij, Vandana; Wilson, William W.; Tham, Fook S.; Mar. 23, 2004; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A422707; No Copyright; Avail: CASI; A03, Hardcopy

The cisoid form is less common. In the CCDC, only 6 structures show this conformation where as the transiod form occurs in 15 remaining structures The cisoid conformation results from stronger cation-anion interaction The cisoid exclusively when anion is chelated to the metal center The transoid form dominates in structures containing a free anion NO structure known with both cisoid AND transoid geometry
DTIC
Coordination; Ligands; Synthesis (Chemistry)

20040073775 Army Cold Regions Research and Engineering Lab., Hanover, NH

Field-Portable X-Ray Fluorescence (FP-XRF) Determinations of Metals in Post-Blast Ordnance Residues

Walsh, Marianne E.; Mar. 2004; 33 pp.; In English

Report No.(s): AD-A422727; ERDC/CRREL-TR-04-5; SFIM-AEC-PC-CR-2004-003; No Copyright; Avail: CASI; A03, Hardcopy

Field-portable X-ray fluorescence (FP-XRF) analyzers, such as the Niton 700, provide rapid, on-site analyses for a variety of elements. FP-XRF was used to determine metals in post-blast ordnance residue that was deposited on snow, which provided large collection surfaces that were free of soil particles. The ordnance items included M67 hand grenades, 40-mm grenades, 60-mm and 81-mm mortar projectiles, 105-mm howitzer projectiles, claymore mines, and C4 demo blocks with M6 blasting caps. For most of these items, the post-blast residue contained lead, iron, copper, and zinc. FP-XRF also was used to determine these elements in soils from training ranges where these ordnance items were used. When present above the FP-XRF limits of detection, the FP-XRF determinations of lead, zinc, and copper were not found to be significantly different from determinations by laboratory analyses.

DTIC

Fluorescence; Metals; Ordnance; Portable Equipment; Residues; X Ray Fluorescence

20040073783 California Univ., Los Angeles, CA

Final Technical Report for AFOSR Grant Number F49620-00-1-0054 (December 1, 1999 - November 30, 2002)

Carter, Emily A.; Nov. 30, 2002; 11 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0054

Report No.(s): AD-A422757; AFRL-SR-AR-TR-03-0352; No Copyright; Avail: CASI; A03, Hardcopy

The report summarizes the accomplishments by E. A. Carter during Dec. 1, 1999 to Nov. 30, 2002. New theories for describing the structure of electrons in condensed matter were developed: (i) a quantum mechanical embedding theory allows treatment of localized electronic excited states of adsorbates or impurities% on and in metals; (ii) the most advanced kinetic energy density functional was derived, which allows for a linear scaling treatment of metallic electronic structure. Of more immediate interest to the Air Force are insights into the nature of metal-ceramic and ceramic-ceramic interfaces relevant to understanding the failure of thermal barrier coatings (TBC's). Alumina-nickel interfaces in the TBC's are predicted to be the weak links in these multicomponent/multilayered coatings. These fundamental insights led to proposed changes in the composition of the alloy bond coat lying between the metal engine component and the thermal insulating ceramic. In particular, promotion of open shell/covalent character at interfaces was suggested as a design principle to increase adhesion. To this end, early transition metals doped at the alumina-nickel alloy interface were predicted dramatically increase adhesion, and replacement of alumina by silica also starkly increased adhesion to both the nickel substrate and the zirconia top coat of the TBC.

DTIC

Chemical Reactions

20040073822 North Carolina State Univ., Raleigh, NC

Grain Size Hardening and Softening in Tungsten Carbide at Low Homologous Temperatures

Conrad, Hans; Narayan, Jay; Jan. 2003; 9 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0315

Report No.(s): AD-A422872; 5-21616-2; ARO-41893.3-MS; No Copyright; Avail: CASI; A02, Hardcopy

Data in the literature on the effect of grain size d in the range from cm to nm on the flow stress of WC are evaluated, including nanocrystalline materials prepared by a special pulsed laser ablation method. Three grain size regimes were identified: (a) Regime I, d=1O(-2) to O.5x l0(-6) m, (b) Regime II, d=O.5xlO(-6).lO(-8) m and (c) Regime III, d<l0(-8) m. Grain size hardening occurred in Regimes I and II and softening in Regime III. Both straight and tangled dislocations were observed in Regime I. The major influence of grain size in Regime I could result from either its effect on the total dislocation density or the pile-up of dislocations. Insufficient data are available for Regime II to draw any positive conclusions regarding the governing mechanism. Analysis of the grain size softening in Regime III according to our grain boundary shear model yielded a reasonable activation volume. but a lower-than-expected activation energy. The lower energy could be due to the presence of the amorphous NiAl film at the grain boundaries, employed to obtain the nanocrystalline grain size.

DTIC

Grain Size; Low Temperature; Softening; Tungsten Carbides

20040074127 National Defense Univ., Washington, DC

Hydrogen as a Fuel for DOD (Defense Horizons, Number 36, Nov 2003)

Coffey, Timothy; Hardy, Dennis R.; Besenbruch, Gottfried E.; Schultz, Kenneth R.; Nov. 2003; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422701; No Copyright; Avail: CASI; A03, Hardcopy

Energy issues have been at the center of the national security debate for some time, and the current situation in the Persian Gulf underscores the strategic importance of sound energy policy. Activities or developments-- geopolitical, environmental, technological, or regulatory-- that materially change the energy security equation are, naturally, of great interest to the Department of Defense (DoD). The announcement by President George Bush in his State of the Union address that he intends to accelerate research and development (R&D) for hydrogen-powered vehicles toward the objective of total U. S. energy independence has great potential impact on DoD. This paper examines a number of technical issues connected with energy independence through hydrogen and how they might affect DoD. We conclude that the move to a hydrogen economy will be a massive undertaking, requiring large investments and decades to accomplish. We will show that, with few exceptions, pure hydrogen is not a viable fuel for DoD missions, primarily because of the DoD requirement for compact, high-volumetric energy density power sources.

DTIC

Defense Program; Energy Conversion; Fuels; Horizon; Hydrogen

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METALS AND METALLIC MATERIALS

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

20040068238 Lockheed Martin Corp., Syracuse, NY, USA

Factors Affecting the Hydrogen Embrittlement Resistance of Ni-Cr-Mn-Nb Welds

Young, G. A.; Battige, C. K.; Lewis, N.; Penik, M. A.; Kikel, J.; Mar. 2001; 12 pp.; In English

Report No.(s): DE2004-821694; LM-01K132; No Copyright; Avail: Department of Energy Information Bridge

Nickel based alloys are often welded with argon/hydrogen shielding gas mixtures to minimize oxidation and improve weld quality. However, shielding gas mixtures with (ge) 1% hydrogen additions can result in hydrogen concentrations greater than 5 wt. ppm in the weld metal and reduce ductility via hydrogen embrittlement. For the conditions investigated, the degree of hydrogen embrittlement is highly variable between 5 and 14 wt. ppm. investigation of hydrogen embrittlement of EN82H GTAW welds via tensile testing, light microscopy, transmission electron microscopy, orientation imaging microscopy, and thermal desorption spectroscopy shows that this variability is due to the inhomogeneous microstructure of the welds, the presence of recrystallized grains, and complex residual plastic strains.

NTIS

Hydrogen Embrittlement; Alloys; Welded Joints

20040068240 Lockheed Martin Corp., Syracuse, NY, USA

Optimum Thread Rolling Process that Improves SCC Resistance

Kephart, A. P.; Oct. 2001; 12 pp.; In English

Report No.(s): DE2004-821687; LM-01K107; No Copyright; Avail: Department of Energy Information Bridge

Accelerated testing in environments aggressive for the specific material have shown that fastener threads that are rolled after strengthening heat treatments have improved resistance to SCC initiation. For example, intergranular SCC was produced in one day when machined (cut) threads of high strength steel (ASTM A193 B-7 and A354 Grade 8) were exposed to an aggressive aqueous environment containing 8 weight % boiling ammonium nitrate and stressed to about 40% of the steel's yield strength (120 ksi, 827 MPa). In similar testing conditions, fasteners that had threads rolled before heat-treatment (quench and temper) had similar susceptibility to SCC.

NTIS

Alloys; Steels; Stress Corrosion

20040068246 Lockheed Martin Corp., Syracuse, NY, USA

Measurement of the Nickel/Nickel Oxide Phase Transition in High Temperature Hydrogenated Water Using the Contact Electric Resistance (CER) Technique

Attanasio, S. A.; Morton, D. S.; Ando, M. A.; Panayotou, N. F.; Thompson, C. D.; May 2001; 16 pp.; In English

Report No.(s): DE2004-821680; LM-01K035; No Copyright; Avail: Department of Energy Information Bridge

Prior studies of Alloy 600 and Alloy X-750 have shown the existence of a maximum in stress corrosion cracking (SCC) susceptibility in high temperature water (e.g., at 360 degrees C), when testing is conducted over a range of dissolved (i.e., aqueous) hydrogen (H(sub 2)) concentrations. It has also been shown that this maximum in SCC susceptibility tends to occur in proximity to the nickel/nickel oxide (Ni/NiO) phase transition, suggesting that oxide phase stability may affect primary water SCC (PWSCC) resistance. Previous studies have estimated the Ni/NiO transition using thermodynamic calculations based on free energies of formation for NiO and H(sub 2)O. The present study reports experimental measurements of the Ni/NiO transition performed using a contact electric resistance (CER) instrument.
NTIS
Nickel Alloys; Hydrogen

20040068249 Lockheed Martin Corp., Syracuse, NY, USA
Microstructural and Microchemical Characterization of Dual Step Aged Alloy X-750 and its Relationship to Environmentally Assisted Cracking
Young, G. A.; Lewis, N.; Hanson, M.; Matuszyk, W.; Wiersma, B.; May 2001; 16 pp.; In English
Report No.(s): DE2004-821679; LM-01K034; No Copyright; Avail: Department of Energy Information Bridge
When exposed to deaerated high purity water, Alloy X-750 is susceptible to both high temperature (& 249 degrees C) intergranular stress corrosion cracking (IGSCC) and intergranular low temperature (& 149 degrees C) fracture (LTF). However, the microstructural and microchemical factors that govern environmentally assisted cracking (EAC) susceptibility are poorly understood. The present study seeks to characterize the grain boundary microstructure and microchemistry in order to gain a better mechanistic understanding of stress corrosion crack initiation, crack growth rate, and low temperature fracture. Light microscopy, scanning electron microscopy, transmission electron microscopy, orientation imaging microscopy, scanning Auger microscopy, and thermal desorption spectroscopy were performed on selected heats of Alloy X-750 AH.
NTIS
Alloys; Crack Propagation

20040068264 Lockheed Martin Corp., Syracuse, NY, USA
Atomistic Modeling Study of Alloying Element, Impurity Element, and Transmutation Products on the Cohesion of a Nickel E5(l-brace)001(r-brace) Twist Grain Boundary
Young, G. A.; Najafabadi, R.; Strohmayer, W.; Baldey, D. G.; Hamm, B.; Jun. 2003; In English
Report No.(s): DE2004-821509; LM-03K047; No Copyright; Avail: National Technical Information Service (NTIS)
Atomistic modeling methods were employed to investigate the effects of impurity elements on the metallurgy, irradiation embrittlement, and environmentally assisted cracking of nickel-base alloys exposed to nuclear environments. Calculations were performed via ab initio atomistic modeling methods to ensure the accuracy and reliability of the results. A Griffith-type fracture criterion was used to quantitatively assess the effect of elements or element pairs on the grain boundary cohesive strength. In order of most embrittling to most strengthening, the elements are ranked as: He, Li, S, H, C, Zr, P, Fe, Mn, Nb, Cr, and B. Helium is strongly embrittling (-2.04 eV/atom lowering of the Griffith energy), phosphorus has little effect on the grain boundary (0.1 eV/atom), and boron offers appreciable strengthening (1.03 eV/atom increase in the Griffith energy).
NTIS
Nickel Alloys; Transmutation; Grain Boundaries

20040068268 Lockheed Martin Corp., Syracuse, NY, USA
Measurement of the Nickel/Nickel Oxide Transition in Ni-Cr-Fe Alloys and Updated Data and Correlations to Quantify the Effect of Aqueous Hydrogen on Primary Water SCC
Attanasio, S. A.; Morton, D. S.; Jun. 2003; 18 pp.; In English
Report No.(s): DE2004-821507; LM-03K049; No Copyright; Avail: Department of Energy Information Bridge
Alloys 600 and X-750 have been shown to exhibit a maximum in primary water stress corrosion cracking (PWSCC) susceptibility, when testing is conducted over a range of aqueous hydrogen (H(sub 2)) levels. Contact electric resistance (CER) and corrosion coupon testing using nickel specimens has shown that the maximum in SCC susceptibility occurs in proximity to the nickel-nickel oxide (Ni/NiO) phase transition. The measured location of the Ni/NiO transition has been shown to vary with temperature, from 25 scc/kg H(sub 2) at 360 C to 4 scc/kg H(sub 2) at 288 C. New CER measurements show that the Ni/NiO transition is located at 2 scc/kg H(sub 2) at 260 C. An updated correlation of the phase transition is provided.
NTIS
Nickel Alloys; Hydrogen

20040068282 Lawrence Livermore National Lab., Livermore, CA

Advanced NDE Techniques for Powder Metal Components

Martin, P.; Haskins, J.; Thomas, G.; Dolan, K.; May 01, 2003; In English

Report No.(s): DE2003-15004878; UCRL-JC-153084; No Copyright; Avail: National Technical Information Service (NTIS)

Nondestructive evaluation encompasses numerous technologies that assess materials and determine important properties. This paper demonstrates the applicability of several of these technologies to the field of powder metallurgy. The usual application of nondestructive evaluation is to detect and quantify defects in fully sintered product. But probably its most appealing role is to sense problems earlier in the manufacturing process to avoid making defects at all. Also nondestructive evaluation can be incorporated into the manufacturing processes to monitor important parameters and control the processes to produce defect free product. Nondestructive evaluation can characterize powders, evaluate components in the green state, monitor the sintering process, and inspect the final component.

NTIS

Nondestructive Tests; Powder Metallurgy; Powder (Particles)

20040070727 EMEC Consultants, Export, PA, USA

Electrolytic Production of Oxygen

Keller, Rudolf; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 1; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Oxygen is a valuable commodity in space, for life support and - even more so - as propellant. Substantial savings have been projected for future missions if oxygen could be produced on the Moon from local resources. Some of the most promising approaches to extract oxygen from lunar resources involve electrochemical oxygen generation. called "magma electrolysis," suitable oxides (silicates), as they are readily found on the lunar surface, are molten a t 1300-1500 C and the melt electrolyzed. Residual melt can be discarded after partial electrolysis. Alternatively, lunar soil may be dissolved in a molten salt and electrolyzed. this approach, temperatures are lower and melt conductivities higher, but oxides of the process feed need to be fully electrolyzed or otherwise eliminated from the process system to retain proper characteristics of the electrolyte. Both possibilities are being studied in the laboratory, the development of a suitable anode being a critical element of present efforts. In a straightforward concept In The reduction of ilmenite by hydrogen, to generate water from which the oxygen can be extracted, has also been studied experimentally (Carbothek Process). Thermodynamically, an attractive energy consumption can be projected for this approach. considered . Electrolysis of the water at elevated temperature is being Although know-how from terrestrial technology can be applied, many unique problems that require innovative solutions arise in the development of such an unconventional process. should not be underestimated.

Author

Electrolytes; Oxygen Production; Lunar Resources; Life Support Systems; Energy Consumption

20040070746 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Review of Sodium-Metal Chloride Battery Activity At JPL

Ratnakumar, B. V.; Attia, A. I.; Halpert, G.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 47; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Following the disclosures by Coetzer et al. on the use of transition metal chlorides in chloroaluminates as alternate cathodes to sulfur in rechargeable sodium batteries, several laboratories, including the Jet Propulsion Laboratory, focused their attention on these systems. These systems have certain distinct advantages over sodium-sulfur batteries such as increased safety, inherent overcharge capability, and lower operating temperatures. Two systems, i.e., Na/FeCl2 and NaNiCl2, were developed extensively and evaluated in various applications including electric vehicles and space. Their performance has been very encouraging and warrants a detailed fundamental study on these cathodes. At the Jet Propulsion Laboratory a program was initiated two years back to understand the electrochemical behavior of FeCl2 and NiCl2, and to identify and evaluate other transition metal chlorides of promise. The initial efforts focused on the methods of fabrication of the electrodes and their electrochemical characterization. Subsequent studies were aimed at establishing the reaction mechanism, determining the kinetics, and identifying the rate-limiting processes in te reduction of metal chloride cathodes. Nickel chloride emerged form these studies as the most promising candidate material and was taken up for further detailed study on its passivation- a rate limiting process-under different experimental conditions. Also, the feasibility of using copper chloride, which is expected to have a higher energy density, has been assessed. On the basis of the criteria established from the voltammetric response of FeCl2, NiCl2, and CuCl2, several other transition metal chlorides were screened. Of these, molybdenum and cobalt appear promising.

Author

Sodium Sulfur Batteries; Transition Metals; Fabrication; Copper Chlorides

20040070763 NASA Langley Research Center, Hampton, VA, USA, Army Research Lab., Hampton, VA, USA
Discrete Spring Model for Predicting Delamination Growth in Z-Fiber Reinforced DCB Specimens
Ratcliffe, James G.; O'Brien, T. Kevin; May 2004; 40 pp.; In English
Report No.(s): NASA/TM-2004-213019; ARL-TR-3190; L-19016; No Copyright; Avail: CASI; A03, Hardcopy

Beam theory analysis was applied to predict delamination growth in DCB specimens reinforced in the thickness direction with pultruded pins, known as Z-fibers. The specimen arms were modeled as cantilever beams supported by discrete springs, which were included to represent the pins. A bi-linear, irreversible damage law was used to represent Z-fiber damage, the parameters of which were obtained from previous experiments. Closed-form solutions were developed for specimen compliance and displacements corresponding to Z-fiber row locations. A solution strategy was formulated to predict delamination growth, in which the parent laminate mode I fracture toughness was used as the criterion for delamination growth. The solution procedure was coded into FORTRAN 90, giving a dedicated software tool for performing the delamination prediction. Comparison of analysis results with previous analysis and experiment showed good agreement, yielding an initial verification for the analytical procedure.
Author
Fiber Composites; Mathematical Models; Fracture Strength; Displacement

20040070947 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cryogenic Properties of Aluminum-Beryllium and Beryllium Materials
Gamwell, Wayne R.; McGill, Preston B.; 2003; 1 pp.; In English; Technology Days 2003, 16-18 Sep. 2004, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Ultimate tensile strength, yield strength, and elongation were obtained for the aluminum- beryllium alloy, AlBeMetl62 (38%Al-62%Be), at cryogenic (-195.5 C (-32O F) and (- 252.8 C) (-423 F)) temperatures, and for an optical grade beryllium, O-30H (99%Be), at -252.8 C. AlBeMet162 material was purchased to the requirements of SAE- AMs7912, "Aluminum-Beryllium Alloy, Extrusions". O-30H material was purchased to the requirements of Brush Wellman Inc. specification O-30H Optical Grade Beryllium. The ultimate tensile and yield strengths for extruded AlBeMet162 material increased with decreasing temperature, and the percent elongation decreased with decreasing temperature. Design properties for the ultimate tensile strength, yield strength, and percent elongation for extruded AlBeMetl62 were generated. It was not possible to distinguish a difference in the room and cryogenic ultimate strength for the hot isostatically pressed (HIP'ed) O-30H material. The O-30H elongation decreased with decreasing temperature.
Author
Beryllium Alloys; Cryogenics; Mechanical Properties; Aluminum Alloys

20040070953 NASA Marshall Space Flight Center, Huntsville, AL, USA
Pore Formation and Mobility Investigation (PFMI): Concept, Hardware Development and Initial Analysis of Experiments
Grugel, Richard N.; 2004; 1 pp.; In English; Invited Talk to the European Space Agency, 4-11 Apr. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

Porosity in the form of "bubbles and pipes" can occur during controlled directional solidification processing of metal alloys. This is a consequence that 1) precludes obtaining any meaningful scientific results and 2) is detrimental to desired material properties. Unfortunately, several Microgravity experiments have been compromised by porosity. The intent of the PFMI investigation is to conduct a systematic effort directed towards understanding porosity formation and mobility during controlled directional solidification (DS) in a microgravity environment. PFMI uses a pure transparent material, succinonitrile (SCN), as well as SCN "alloyed" with water, in conjunction with a translating temperature gradient stage so that direct observation and recording of pore generation and mobility can be made. PFMI is investigating the role of thermocapillary forces and temperature gradients in affecting bubble dynamics as well as other solidification processes in a microgravity Environment. This presentation will cover the concept, hardware development, operations, and the initial results from experiments conducted aboard the International Space Station. .
Author
Porosity; Solidification; Alloys; Directional Solidification (Crystals); Microgravity; Capillary Flow

20040070992 Lawrence Livermore National Lab., Livermore, CA
Surface Topographies of Two-Year Coupons of Titanium Grade 16 from Long-Term Testing
Bedrossian, P. J.; Dec. 28, 1999; In English
Report No.(s): DE2003-15005559; UCRL-ID-142351; No Copyright; Avail: National Technical Information Service (NTIS)

Using an Atomic Force Microscope, we have examined the surface topographies associated with crevice coupons representing the six classes of coupons of Titanium Grade 16 removed from Long-Term Corrosion testing after two years of immersion. Only on coupons removed from Simulated Concentrated Well Water do we observe features which are likely to represent embryonic pit formation. The coupons removed from the Simulated Acidified Well Water were too rough to yield representative measurements.
NTIS
Titanium; Corrosion Tests; Cracks

20040070993 Lawrence Livermore National Lab., Livermore, CA
Characterization of Nanostructural Features in Irradiated Reactor Pressure Vessel Model Alloys
Wirth, B. D.; Odette, G. R.; Asoka-Kumar, P.; Howell, R. H.; Sterne, P. A.; Aug. 01, 2001; In English
Report No.(s): DE2003-15005550; UCRL-JC-145544; No Copyright; Avail: National Technical Information Service (NTIS)
Irradiation embrittlement in nuclear reactor pressure vessel steels results from the formation of a high number density of nanometer-sized copper rich precipitates and sub-nanometer defect-solute clusters. We present results of small angle neutron scattering (SANS) and positron annihilation spectroscopy (PAS) characterization of the nanostructural features formed in binary and ternary Fe-Cu-Mn alloys irradiated at (approx) 290 degrees C. These complementary techniques provide insight into the composition and character of both types of nanoscale features. The SANS measurements indicate populations of copper-manganese precipitates and smaller vacancy-copper-manganese clusters. The PAS characterization, including both Doppler broadening and positron lifetime measurements, indicates the presence of essentially defect-free Cu precipitates in the Fe-Cu-Mn alloy and vacancy-copper clusters in the Fe-Cu alloy.
NTIS
Nanostructures (Devices); Irradiation; Pressure Vessels; Nuclear Reactors; Manganese Alloys

20040073496 NASA Marshall Space Flight Center, Huntsville, AL, USA
Studies of Nucleation and Growth, Specific Heat and Viscosity of Undercooled Melts of Quasicrystals and Polytetrehedral-Phase-Forming Alloys
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 19; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
By investigating the properties of quasicrystals and quasicrystal-forming liquid alloys, we may determine the role of ordering of the liquid phase in the formation of quasicrystals, leading to a better fundamental understanding of both the quasicrystal and the liquid. A quasicrystal is solid characterized by a symmetric but non-periodic arrangement of atoms, usually in the form of an icosahedron (12 atoms, 20 triangular faces). It is theorized that the short-range order in liquids takes this same form. The degree of ordering depends on the temperature of the liquid, and affects many of the liquid s properties, including specific heat, viscosity, and electrical resistivity. The MSFC role in this project includes solidification studies, phase diagram determination, and thermophysical property measurements on the liquid quasicrystal-forming alloys, all by electrostatic levitation (ESL). The viscosity of liquid quasicrystal-forming alloys is measured by the oscillating drop method, both in the stable and undercooled liquid state. The specific heat of solid, undercooled liquid, and stable liquid are measured by the radiative cooling rate of the droplets.
Author
Melts (Crystal Growth); Liquid Alloys

20040073508 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effects of Traveling Magnetic Field on Dynamics of Solidification
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 15; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
The Lorentz body force induced in electrically conducting fluids can be utilized for a number of materials processing technologies. An application of strong static magnetic fields can be beneficial for damping convection present during solidification. On the other hand, alternating magnetic fields can be used to reduce as well as to enhance convection. However, only special types of time dependent magnetic fields can induce a non-zero time averaged Lorentz force needed for convection control. One example is the rotating magnetic field. This field configuration induces a swirling flow in circular containers. Another example of a magnetic field configuration is the traveling magnetic field (TMF). It utilizes axisymmetric magnetostatic waves. This type of field induces an axial recirculating flow that can be advantageous for controlling axial mass transport, such as during solidification in long cylindrical tubes. Incidentally, this is the common geometry for crystal growth

research. The Lorentz force induced by TMF can potentially counter-balance the buoyancy force, diminishing natural convection, or even setting up the flow in reverse direction. Crystal growth process in presence of TMF can be then significantly modified. Such properties as the growth rate, interface shape and macro segregation can be affected and optimized. Melt homogenization is the other potential application of TMF. It is a necessary step prior to solidification. TMF can be attractive for this purpose, as it induces a basic flow along the axis of the ampoule. TMF can be a practical alloy mixing method especially suited for solidification research in space. In the theoretical part of this work, calculations of the induced Lorentz force in the whole frequency range have been completed. The basic flow characteristics for the finite cylinder geometry are completed and first results on stability analysis for higher Reynolds numbers are obtained. A theoretical model for TMF mixing is also developed. In the experimental part, measurements of flow induced by TMF in a column of mercury (Hg) are presented. Also, an alloy mixing of Bi-Sn of the eutectic composition is demonstrated. A traveling magnetic field of 4mT at 3kHz applied for 120 minutes is found to be sufficient to homogenize an alloy enclosed in a 1cm diameter and 12 cm long tube.
Author
Crystal Growth; Lorentz Force

20040073721 Michigan Technological Univ., Houghton, MI
Structure, Properties, and Processing of Two-Phase Crystalline-Glassy W-base Alloys
Courtney, Thomas H.; Plichta, Mark R.; Nov. 19, 2003; 3 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0103
Report No.(s): AD-A422635; TR-990831; ARO-40450.5-MS; No Copyright; Avail: CASI; A01, Hardcopy

Amorphous or glassy metals are a unique class of materials that typically exhibit higher strengths than their crystalline counterparts but have limited ductility. Mechanical alloying (MA) of metal powders offers the possibility of forming metallic glasses for a large range of systems. Unfortunately, consolidation of the powder to bulk form usually results in crystallization of the amorphous phase. Previous research has shown that MA can produce a W-Ni-Fe amorphous powder with remnant nanocrystalline W particles in the glassy matrix. The goal of this research was to consolidate mechanically alloyed W-Ni-Fe powders to near or full density without causing crystallization of the W-Ni-Fe glassy phase. A systematic study on the consolidation of the most thermally stable alloy was conducted using different consolidation techniques and binder materials. Experiments were designed to examine the effects of different processing parameWrs including: temperature, pressure, time, and binder amount. The experimental results showed that it was possible to consolidate the MA W-Ni-Fe to a calculated density of 98 to 99% while retaining the glassy/amorphous structure. The process involved MA elemental Cu powder with the MA W-Ni-Fe powder and consolidating the composiW powder by Rapid Sinter Forging (RSF). Pressure was identified as the dominant processing parameter for densification. Temperature's effect on densification was minimal but important for crystallization of the glass.
DTIC
Crystallinity; Crystallization; Glass; Tungsten Alloys

20040074331 NASA Glenn Research Center, Cleveland, OH, USA
Tensile Creep Fracture of Polycrystalline Near-Stoichiometric NiAl
Raj, Sai V.; May 2004; 26 pp.; In English
Contract(s)/Grant(s): WBS 708-31-20
Report No.(s): NASA/TM-2004-213051; E-14487; No Copyright; Avail: CASI; A03, Hardcopy

Tensile creep fracture behavior of polycrystalline near-stoichiometric NiAl has been studied between 700 and 1200 K under initial applied stresses varying between 10 and 200 MPa. The stress exponent for fracture varied between 5.0 and 10.7 while the activation energy for fracture was 250 +/- 22 kJ/mol. The fracture life was inversely proportional to the secondary creep rate in accordance with the Monkman-Grant relation although there was extensive scatter in the data. This observation suggests that the fracture life for near-stoichiometric NiAl was influenced by creep under these stress and temperature conditions. Several different fracture morphologies were observed. Transgranular ductile cleavage fracture occurs at 700 K and at the higher stresses at 800 K. The fracture mode transitions to transgranular creep fracture at 900 and 1000 K and at lower stresses at 800 K, while plastic rupture and grain boundary cavitation occur at 1100 and 1200 K. An experimental fracture mechanism map is constructed for near-stoichiometric NiAl.
Author
Creep Properties; Tensile Creep; Nickel Aluminides; Polycrystals; Stoichiometry; Fracture Mechanics; Cleavage

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*.

20040068292 Environmental Protection Agency, Cincinnati, OH, USA
Nickel Plating: Industry Practices Control Technology and Environmental Management
Apr. 2003; 44 pp.; In English
Report No.(s): PB2004-105477; EPA/625/R-03/005; No Copyright; Avail: CASI; A03, Hardcopy

This capsule report, entitled 'Nickel Plating: Industry Practices, Control Technologies, and Environmental Management,' was prepared under the direction of EPA's Office of Research and Development (ORD) to assist the metal finishing community with the management of nickel plating environmental issues. Information provided by the capsule report provides the rationale for developing the document, identifies the intended user audience, and presents the framework for the evaluating nickel plating management practices from case studies that incorporate cost-effective solutions to solving persistent nickel plating problem. The capsule report provides a current analysis of the nickel plating industry from a technical, economic, and regulatory perspective. This capsule report includes five major recommendations. The first recommendation is for facilities to continue the conduct of environmental audits and pollution prevention opportunity assessments.
NTIS
Environment Management; Environment Pollution

20040070787 NASA Glenn Research Center, Cleveland, OH, USA
Atomic Oxygen Durability Evaluation of a UV Curable Ceramer Protective Coating
Banks, Bruce A.; Karniotis, Christina A.; Dworak, David; Soucek, Mark; April 2004; 27 pp.; In English; Seventh International Conference Protection of Materials and Structures from Space Environment, 10-13 May 2004, Toronto, Canada
Contract(s)/Grant(s): WBS 22-319-20-E1
Report No.(s): NASA/TM-2004-213098; E-14573; No Copyright; Avail: CASI; A03, Hardcopy

The exposure of most silicones to atomic oxygen in low Earth orbit (LEO) results in the oxidative loss of methyl groups with a gradual conversion to oxides of silicon. Typically there is surface shrinkage of oxidized silicone protective coatings which leads to cracking of the partially oxidized brittle surface. Such cracks widen and branch crack with continued atomic oxygen exposure ultimately allowing atomic oxygen to reach any hydrocarbon polymers under the silicone coating. A need exists for a paintable silicone coating that is free from such surface cracking and can be effectively used for protection of polymers and composites in LEO. A new type of silicone based protective coating holding such potential was evaluated for atomic oxygen durability in an RF atomic oxygen plasma exposure facility. The coating consisted of a UV curable inorganic/organic hybrid coating, known as a ceramer, which was fabricated using a methyl substituted polysiloxane binder and nanophase silicon-oxo-clusters derived from sol-gel precursors. The polysiloxane was functionalized with a cycloaliphatic epoxide in order to be cured at ambient temperature via a cationic UV induced curing mechanism. Alkoxy silane groups were also grafted onto the polysiloxane chain, through hydrosilation, in order to form a network with the incorporated silicon-oxo-clusters. The prepared polymer was characterized by H-1 and Si-29 NMR, FT-IR, and electrospray ionization mass spectroscopy. The paper will present the results of atomic oxygen protection ability of thin ceramer coatings on Kapton H as evaluated over a range of atomic oxygen fluence levels.
Author
Protective Coatings; Ultraviolet Radiation; Durability; Ceramics; Oxygen Atoms; Curing; Fabrication

20040070985 National Inst. of Standards and Technology, Gaithersburg, MD
Preliminary Concept Trial of the Semi-Automated Paint Containment System
Norcross, R. J.; Nov. 2002; 26 pp.; In English
Report No.(s): PB2004-105014; NISTIR-7095; No Copyright; Avail: CASI; A03, Hardcopy

The Carderock Division of the Naval Surface Warfare Center (NSWC-CD) is developing the Automated Paint Application, Containment, and Treatment System (APACTS) to apply anti-corrosive and anti-fouling paints in an environmentally sound manner, NSWC-CD commissioned the Intelligent Systems Division of the National Institute of Standards and Technology (NIST) to construct a concept prototype of a Semi-Automated Paint Containment System (SAPACS) utilizes a portion of the APACTS technologies to provide an intermediary system that can reduce shipyard hazardous material emissions with less capital investment. NIST assembled SAPACS from an existing Coordinated Aerial Work Platform (CAWP) and an existing lift capable environmental tank (E-Tank). NIST modified the E-Tank to detect the

ship's hull, to generate pitch motion, and to command the CAWP in accordance with conventional hierarchical control. SAPACS is able to move along the ship hull with operator supervision but without operator direction.
NTIS
Antifouling; Containment; Corrosion; Paints

20040071048 Battelle Columbus Labs., OH
Evaluation of Chemically Bonded Phosphate Ceramics for Mercury Stabilization of a Mixed Synthetic Waste
Chattopadhyay, S.; Randall, P. M.; Mar. 2003; In English
Report No.(s): PB2004-103500; EPA/600/R-03/113; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Waste Treatment; Mercury (Metal)

20040073448 NASA Langley Research Center, Hampton, VA, USA
Modeling the VARTM Composite Manufacturing Process
Song, Xiao-Lan; Loos, Alfred C.; Grimsley, Brian W.; Cano, Roberto J.; Hubert, Pascal; [2004]; 13 pp.; In English; SAMPE 2004 Symposium and Exhibition, 16-20 May 2004, Long Beach, CA, USA
Contract(s)/Grant(s): NCC1-01037; 719-55-TB; No Copyright; Avail: CASI; A03, Hardcopy
A comprehensive simulation model of the Vacuum Assisted Resin Transfer Modeling (VARTM) composite manufacturing process has been developed. For isothermal resin infiltration, the model incorporates submodels which describe cure of the resin and changes in resin viscosity due to cure, resin flow through the reinforcement preform and distribution medium and compaction of the preform during the infiltration. The accuracy of the model was validated by measuring the flow patterns during resin infiltration of flat preforms. The modeling software was used to evaluate the effects of the distribution medium on resin infiltration of a flat preform. Different distribution medium configurations were examined using the model and the results were compared with data collected during resin infiltration of a carbon fabric preform. The results of the simulations show that the approach used to model the distribution medium can significantly effect the predicted resin infiltration times. Resin infiltration into the preform can be accurately predicted only when the distribution medium is modeled correctly.
Author
Manufacturing; Composite Materials; Resins; Technology Assessment

20040073457 NASA Langley Research Center, Hampton, VA, USA
Flame Retardant Epoxy Resins
Thompson, C. M.; Smith, J. G., Jr.; Connell, J. W.; Hergenrother, P. M.; Lyon, R. E.; [2004]; 13 pp.; In English; SAMPE 2004 Symposium and Exhibition, 16-20 May 2004, Long Beach, CA, USA
Contract(s)/Grant(s): 23-755-06-00; No Copyright; Avail: CASI; A03, Hardcopy
As part of a program to develop fire resistant exterior composite structures for future subsonic commercial aircraft, flame retardant epoxy resins are under investigation. Epoxies and their curing agents (aromatic diamines) containing phosphorus were synthesized and used to prepare epoxy formulations. Phosphorus was incorporated within the backbone of the epoxy resin and not used as an additive. The resulting cured epoxies were characterized by thermogravimetric analysis, propane torch test, elemental analysis and microscale combustion calorimetry. Several formulations showed excellent flame retardation with phosphorous contents as low as 1.5% by weight. The fracture toughness of plaques of several cured formulations was determined on single-edge notched bend specimens. The chemistry and properties of these new epoxy formulations are discussed.
Author
Chemical Analysis; Combustion; Composite Structures; Epoxy Resins; Fires; Flame Retardants

20040073473 NASA Glenn Research Center, Cleveland, OH, USA
Oxidation of Ultra High Temperature Ceramics in Water Vapor
Nguyen, QuynhGiao N.; Opila, Elizabeth J.; Robinson, Raymond C.; April 2004; 20 pp.; In English; 203rd Meeting of the Electrochemical Society, Inc., 27 Apr. - 2 May 2003, Paris, France
Contract(s)/Grant(s): WBS 714-04-34
Report No.(s): NASA/TM-2004-212923; E-14363; No Copyright; Avail: CASI; A03, Hardcopy
Ultra High Temperature Ceramics (UHTCs) including HfB2 + 20v/0 SiC (HS), ZrB2 + 20v/0 SiC (ZS), and ZrB2 + 30v/0 C + 14v/0 SiC (ZCS) have been investigated for use as potential aeropropulsion engine materials. These materials were

oxidized in water vapor (90 percent) using a cyclic vertical furnace at 1 atm. The total exposure time was 10 h at temperatures of 1200, 1300, and 1400 C. CVD SiC was also evaluated as a baseline for comparison. Weight change, X-ray diffraction analyses, surface and cross-sectional SEM and EDS were performed. These results are compared with tests ran in a stagnant air furnace at temperatures of 1327 C for 100 min, and with high pressure burner rig (HPBR) results at 1100 and 1300 C at 6 atm for 50 h. Low velocity water vapor does not make a significant contribution to the oxidation rates of UHTCs when compared to stagnant air. The parabolic rate constants at 1300 C, range from 0.29 to 16.0 mg(sup 2)cm(sup 4)/h for HS and ZCS, respectively, with ZS results between these two values. Comparison of results for UHTCs tested in the furnace in 90 percent water vapor with HPBR results was difficult due to significant sample loss caused by spallation in the increased velocity of the HPBR. Total recession measurements are also reported for the two test environments.
Author
Ceramics; Water Vapor; Refractory Materials; Oxidation; Combustion

20040073511 NASA Marshall Space Flight Center, Huntsville, AL, USA
Reduction of Defects in Germanium-Silicon
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 14; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Crystals grown without contact with a container have far superior quality to otherwise similar crystals grown in direct contact with a container. In addition to float-zone processing, detached- Bridgman growth is a promising tool to improve crystal quality, without the limitations of float zoning or the defects introduced by normal Bridgman growth. Goals of this project include the development of the detached Bridgman process to be reproducible and well understood and to quantitatively compare the defect and impurity levels in crystals grown by these three methods. Germanium (Ge) and germanium-silicon (Ge-Si) alloys are being used. At MSFC, we are responsible for the detached Bridgman experiments intended to differentiate among proposed mechanisms of detachment, and to confirm or refine our understanding of detachment. Because the contact angle is critical to determining the conditions for detachment, the sessile drop method was used to measure the contact angles as a function of temperature and composition for a large number of substrates made of potential ampoule materials. Growth experiments have used pyrolytic boron nitride (pBN) and fused silica ampoules with the majority of the detached results occurring predictably in the pBN. Etch pit density (EPD) measurements of normal and detached Bridgman-grown Ge samples show a two order of magnitude improvement in the detached-grown samples. The nature and extent of detachment is determined by using profilometry in conjunction with optical and electron microscopy. The stability of detachment has been analyzed, and an empirical model for the conditions necessary to achieve sufficient stability to maintain detached growth for extended periods has been developed. We have investigated the effects on detachment of ampoule material, pressure difference above and below the melt, and Si concentration; samples that are nearly completely detached can be grown repeatedly in pBN. Current work is concentrated on developing a method to make in situ pressure measurements in the growth ampoules.
Author
Crystal Growth; Bridgman Method

20040073515 NASA Marshall Space Flight Center, Huntsville, AL, USA
Succinonitrile Purification Facility
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 20; In English; See also 20040073490; No Copyright; A01, Hardcopy; Abstract only; available from CASI only as part of the entire parent document.

The Succinonitrile (SCN) Purification Facility provides succinonitrile and succinonitrile alloys to several NRA selected investigations for flight and ground research at various levels of purity. The purification process employed includes both distillation and zone refining. Once the appropriate purification process is completed, samples are characterized to determine the liquidus and/or solidus temperature, which is then related to sample purity. The lab has various methods for measuring these temperatures with accuracies in the milliKelvin to tenths of milliKelvin range. The ultra-pure SCN produced in our facility is indistinguishable from the standard material provided by NIST to well within the stated +/- 1.5mK of the NIST triple point cells. In addition to delivering material to various investigations, our current activities include process improvement, characterization of impurities and triple point cell design and development. The purification process is being evaluated for each of the four vendors to determine the efficacy of each purification step. We are also collecting samples of the remainder from distillation and zone refining for analysis of the constituent impurities. The large triple point cells developed will contain SCN with a melting point of 58.0642 C +/- 1.5mK for use as a calibration standard for Standard Platinum Resistance Thermometers (SPRTs).
Author
Succinonitrile; Purification

20040073644 Stevens Inst. of Tech., Hoboken, NJ

Quantitative High Resolution Electron Scattering From Polymers

Libera, Matthew R.; Jan. 5, 2004; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-00-11-0481

Report No.(s): AD-A422528; ARO-41114.13-MS; No Copyright; Avail: CASI; A02, Hardcopy

This project developed and applied quantitative methods to determine the structure of polymers and polymer- based materials using high spation resolution electron- scattering techniques. The traditional approach to studying polymer morphology using the electron microscope has involved preferential scattering using heavy element stains. We and others have shown that such staining approaches introduce artifactual structure which interferes with the study of intrinsic polymer morphology at length scales of order 5 nm and finer. This project focused on: (i) the development and application of phase-contrast imaging via electron holography and chemical imaging via electron energy-loss spectroscopy to study the structure of polymers and polymer-based nanoparticles. The present report summarizes advances primarily in the area of chemical imaging of dry two-phase polymers. With ongoing ARO support we are currently concentrating on the development and application of EELS-based methods to map water and other solvents in frozen- polymers and organic materials using chemical imaging combined with cryomicroscopy.

DTIC

Electron Microscopes; Electron Scattering; Electron Spectroscopy; High Resolution

20040073673 Air Force Research Lab., Edwards AFB, CA

SEM Study of Deformation and Failure Mechanisms in Strained Elastomers

Liu, C. T.; Hawkins, T. W.; Brand, A.; Chiang, Fu-Peng; Mar. 8, 2004; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A422565; No Copyright; Avail: CASI; A02, Hardcopy

In this study, the deformation and damage mechanisms on meso and macro scales in a particulate composite and a polyurethane material, Solithane 113, were investigated. The particulate composite contains 87% by weight of hard particles embedded in a rubbery matrix. Experimental data were analyzed and the effect of material's microstructure on the deformation and failure mechanisms are discussed.

DTIC

Deformation; Elastomers; Failure; Microstructure

20040073715 Michigan State Univ., East Lansing, MI

Styrene-butadiene-styrene Tri-block Copolymers Modified wit Polyhedral Oligomeric Silsesquioxanes

, Bruce X; Lee, Andre; Haddad, Timothy; Mar. 12, 2004; 33 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303

Report No.(s): AD-A422626; No Copyright; Avail: CASI; A03, Hardcopy

A novel hybrid organic/inorganic tri-block copolymer of polystyrene-butadiene-polystyrene (SBS) containing grafted polyhedral oligomeric silsesquioxane (POSS) molecules was synthesized by a hydrosilation method. The POSS molecules were designed to contain a single silane functional group, which was used to graft onto the dangling 1,2 butadienes in the polybutadiene soft block. Unlike typical free radical copolymerizations commonly used for many other POSS incorporations investigated, this synthesis method allows us to make a series of polymers with varying amounts of POSS without any change to the overall degree of polymerization or structure of the main SBS backbone. This gives us a unique opportunity to study the POSS behavior in the matrix and know that all differences are solely due to the POSS grafted to the soft continuous butadiene phase. X-ray diffraction revealed that the grafted POSS are very well dispersed in the matrix of the hybrid polymer, which is compared to the strong phase segregation observed in a POSS physical blend. Small-angle X- ray scattering indicates that although the cylindrical morphology attributed to the styrene component was not altered by the presence of POSS, but attachment of POSS to the continuous phase (polybutadiene block) causes the packing of discrete phase (polystyrene blocks) to lack long-range features. Results of dynamic mechanical analysis showed that the POSS has sterically hindered the motion of the polybutadiene blocks. More interestingly, the presence of POSS in the soft segments also resulted in a tapered tan peak associated with the glass transition of polystyrene and a higher tensile strength when deformed at temperature near Tg of polystyrene without affecting the elongational behavior of SBS at temperatures above Tg of polybutadiene.

DTIC

Block Copolymers; Butadiene; Oligomers; Styrenes

20040073722 Engineering Research and Consulting, Inc., Edwards AFB, CA

Developments in Nanoscience: Polyhedral Oligomeric Silsesquioxane (POSS) -Polymers

Phillips, Shawn H.; Haddad, Timothy S.; Tomczak, Sandra J.; Mar. 8, 2004; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303

Report No.(s): AD-A422636; No Copyright; Avail: CASI; A03, Hardcopy

This review is intended to cover the more recent advances in both structure-property relationships of polymers incorporating Polyhedral Oligomeric Silsesquioxane(s) (POSS) nanostructured chemicals as well as space-survivability testing of POSS-polymers. The strategy employed for using POSS as building blocks is discussed in addition to current models and predictions pertaining to the ideal crystallite/aggregate size of the nanocomposite within the polymer matrix to provide maximum mechanical improvements. The oxidation and rapid formation of SiO2 during atomic oxygen testing leads to a passivating layer and conclusive proof of these phenomena is presented. Also a brief history of POSS is outlined to help readers understand how they relate to the recent boom in nanotechnology and their position in nanomaterials R&D.

DTIC

Nanocomposites; Nanocrystalline Materials; Polymers; Silicon Dioxide

20040073755 Engineering Research and Consulting, Inc., Huntsville, AL

Gas Phase Structural Characterization of Polyhedral Oligomeric Silsesquioxanes (POSS) with Styryl and Epoxy Phenyl Capping Agents

Baker, Erin S.; Gidden, Jennifer; Anderson, Stanley E.; Haddad, Timothy S.; Bowers, Michael T.; Feb. 23, 2004; 27 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303

Report No.(s): AD-A422679; AFRL-PR-ED-TP-2004-045; No Copyright; Avail: CASI; A03, Hardcopy

This document is a report of the Gas Phase Structural Characterization of Polyhedral Oligomeric Silsesquioxanes (POSS) with Styryl and Epoxy Phenyl Capping Agents.

DTIC

Epoxy Resins; Phenyls; Synthesis (Chemistry); Vapor Phases

20040074181 Pennsylvania State Univ., State College, PA, USA

Shearography for Non-Destructive Evaluation with Applications to BAT Mask Tile Adhesive Bonding and Specular Surface Honeycomb Panels

Lysak, Daniel B.; December 2003; 24 pp.; In English

Contract(s)/Grant(s): NCC5-508

Report No.(s): NASA/CR-2003-212231; No Copyright; Avail: CASI; A03, Hardcopy

In this report we examine the applicability of shearography techniques for nondestructive inspection and evaluation in two unique application areas. In the first application, shearography is used to evaluate the quality of adhesive bonds holding lead tiles to the BAT gamma ray mask for the NASA Swift program. By exciting the mask with a vibration, the more poorly bonded tiles can be distinguished by their greater displacement response, which is readily identifiable in the shearography image. A quantitative analysis is presented that compares the shearography results with a destructive pull test measuring the force at bond failure. Generally speaking, the results show good agreement. Further investigation would be useful to optimize certain test parameters such as vibration frequency and amplitude. The second application is to evaluate the bonding between the skin and core of a honeycomb structure with a specular (mirror-like) surface. In standard shearography techniques, the object under test must have a diffuse surface to generate the speckle patterns in laser light, which are then sheared. A novel configuration using the specular surface as a mirror to image speckles from a diffuser is presented, opening up the use of shearography to a new class of objects that could not have been examined with the traditional approach. This new technique readily identifies large scale bond failures in the panel, demonstrating the validity of this approach. For the particular panel examined here, some scaling issues should be examined further to resolve the measurement scale down to the very small size of the core cells. In addition, further development should be undertaken to determine the general applicability of the new approach and to establish a firm quantitative foundation.

Derived from text

Nondestructive Tests; Evaluation; Adhesion Tests; Bonding; Adhesive Bonding; Honeycomb Structures; Shearography

28
PROPELLANTS AND FUELS

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

20040073823 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Analysis of Air Force Compliance with Executive Order 13149
Kirkwood, John C.; Mar. 23, 2004; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422876; AFIT/GLM/ENS/04-09; No Copyright; Avail: CASI; A04, Hardcopy

The Air Force must comply with Executive Order (E. 0.) 13149: Greening The Government Through Federal Fleet and Transportation Efficiency. This order focuses on the reduction of petroleum consumption in an effort to reduce dependence on foreign oil and preserve the environment. Specifically, it directs federal agencies (such as the Air Force) to reduce fuel use in the vehicle fleet 20 percent between Fiscal Years (FY) 1999 and 2005. This thesis examines the Air Force's current alternative fuel vehicle (AFV) program and its evolution to determine how effective it is and how it should be adjusted to promote compliance with E.O. 13149. The results of this thesis look at steps that the Air Force should consider in an effort to increase the program's impact on petroleum consumption. Analysis shows that the Air Force is working to adopt new technology. However, the availability of such technology in a timely fashion may make it difficult for the Air Force to meet the 2005 goal. Additionally, in instances where the technology is currently available, alternative fuel and the appropriate refueling infrastructure frequently are not. Finding the financial resources to support these improvements would greatly improve the effectiveness of the Air Force's program.
DTIC
Automobile Fuels; Natural Gas

20040074170 Tulane Univ., New Orleans, LA, USA
Small Signal Modeling and Control of the Hydrogen Mixer for Facility E1
Barbieri, Enrique; August 10, 2001; 19 pp.; In English
Report No.(s): NASA/NP-2002-02-00005-SSC; No Copyright; Avail: CASI; A03, Hardcopy

We have undertaken the theoretical modelling of an existing liquid hydrogen (LH2) and gas hydrogen (GH2) mixer subsystem of the E1 Ground Test Facility at NASA John C. Stennis Space Center. The E1 test facility carries out comprehensive ground-based testing and certification of various liquid rocket engines and their components. The mixer described in this work is responsible for combining high pressure before it is fed into a test article. The desired properties are maintained by precise control of the mixture of LH2 and GH2 flows. The mixer is modelled as a general multi-flow lumped volume for single constituent fluids using density and internal energy as states. The set of nonlinear differential equations is linearized about an equilibrium point and the resulting two-state, 3-input linear model is analyzed as a possible candidate for control design.
Author
Liquid Propellant Rocket Engines; Test Facilities; Mathematical Models; Control Systems Design; Liquid Hydrogen

29
SPACE PROCESSING

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

20040070739 Life Systems, Inc., Cleveland, OH, USA
Space Water Electrolysis: Space Station Through Advanced Missions
Davenport, Ronald J.; Schubert, Franz H.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 7; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Static Feed Electrolysis technology has long been recognized as being important in meeting the National Aeronautics and Space Administration's requirements for life support within the Space Station Freedom Program and future, advanced missions. The Static Feed Electrolysis technology makes it possible to very efficiently generate oxygen to sustain the crew, and hydrogen for the efficient and economical operation of other space systems. More recently, additional applications for the

Static Feed Electrolysis technology have been evaluated and tested. This paper summarizes the results of those studies. storage, propulsion, extravehicular activity, and other specialized applications, such as providing support for experimentation and manufacturing. The Environmental Control and Life Support System application is included for comparison.
Author
Electrolysis; Water; Oxygen; Materials Recovery

20040070933 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Processing in Space: Model Experiments aboard the International Space Station
Grugel, Richard; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Direct observation of fluid flow, bubble movement and solidification during controlled melting and solidification of succinonitrile were conducted in the glovebox facility of the International Space Station (ISS). The samples were processed in the Pore Formation and Mobility Investigation (PFMI) apparatus in the glovebox facility (GBX) on board the ISS. Experimental processing parameters of temperature gradient and translation speed, as well as camera settings, were remotely monitored and manipulated from the ground Telescience Center (TSC) at the Marshall Space Flight Center. Real time visualization of the controlled directional melt back and resolidification reveals a number of microgravity dependent phenomena otherwise masked by Earth s gravity. These and some initial analysis of the observed events is presented.
Author
Fluid Flow; International Space Station; Space Processing; Spaceborne Experiments

20040073490 NASA Marshall Space Flight Center, Huntsville, AL, USA
Biological and Physical Space Research Laboratory 2002 Science Review
Curreri, P. A., Editor; Robinson, M. B., Editor; Murphy, K. L., Editor; December 2003; 406 pp.; In English; See also 20040073491 - 20040073521
Report No.(s): NASA/TM-2003-212932; M-1097; No Copyright; Avail: CASI; A18, Hardcopy

With the International Space Station Program approaching core complete, our NASA Headquarters sponsor, the new Code U Enterprise, Biological and Physical Research, is shifting its research emphasis from purely fundamental microgravity and biological sciences to strategic research aimed at enabling human missions beyond Earth orbit. Although we anticipate supporting microgravity research on the ISS for some time to come, our laboratory has been vigorously engaged in developing these new strategic research areas.This Technical Memorandum documents the internal science research at our laboratory as presented in a review to Dr. Ann Whitaker, MSFC Science Director, in July 2002. These presentations have been revised and updated as appropriate for this report. It provides a snapshot of the internal science capability of our laboratory as an aid to other NASA organizations and the external scientific community.
Derived from text
Microgravity; Biotechnology; Space Processing

20040073492 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Biology of Proteins of the Multi-enzyme Assembly Human Pyruvate Dehydrogenase Complex
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 31; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Objectives and research challenges of this effort include: 1. Need to establish Human Pyruvate Dehydrogenase Complex protein crystals; 2. Need to test value of microgravity for improving crystal quality of Human Pyruvate Dehydrogenase Complex protein crystals; 3. Need to improve flight hardware in order to control and understand the effects of microgravity on crystallization of Human Pyruvate Dehydrogenase Complex proteins; 4. Need to integrate sets of national collaborations with the restricted and specific requirements of flight experiments; 5. Need to establish a highly controlled experiment in microgravity with a rigor not yet obtained; 6. Need to communicate both the rigor of microgravity experiments and the scientific value of results obtained from microgravity experiments to the national community; and 7. Need to advance the understanding of Human Pyruvate Dehydrogenase Complex structures so that scientific and commercial advance is identified for these proteins.
Derived from text
Enzymes; Proteins; Pyruvates; Molecular Structure

20040073494 NASA Marshall Space Flight Center, Huntsville, AL, USA
Growth Defects in Biomacromolecular Crystals

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 33; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

NASA's ground based program confirmed close similarity between protein and small molecules crystal growth, but also revealed essential differences. No understanding exists as to why and when crystals grown in space are, in approx. 20 percent of cases, of higher quality. More rationale is needed in flight experiments. Ferritin crystals grown in space are 2.5 times cleaner than their terrestrial counterparts. This may occur because of the existence of a zone depleted with respect to impurities around a crystal growing in stagnant solution. This zone should appear since the distribution coefficient for homologous impurities exceeds unity. This impurity depletion zone hypothesis requires verification and development. Thorough purification from homologous impurities brought about resolution improvement from 2.6 to 1.8 angstroms for ferritin and from 2.6 to 2.0 angstroms for canavalin.

Author (revised)

Protein Crystal Growth; Macromolecules; Crystal Defects

20040073498 NASA Marshall Space Flight Center, Huntsville, AL, USA

New Directions in Biotechnology

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 34; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The macromolecule crystallization program within NASA is undergoing considerable pressure, particularly budgetary pressure. While it has shown some successes, they have not lived up to the expectations of others, and technological advances may rapidly overtake the natural advantages offered by crystallization in microgravity. Concomitant with the microgravity effort has been a research program to study the macromolecule crystallization process. It was believed that a better understanding of the process would lead to growth of improved crystals for X-ray diffraction studies. The results of the various research efforts have been impressive in improving our understanding of macromolecule crystallization, but have not led to any improved structures. Macromolecule crystallization for structure determination is "one of", the job being unique for every protein and finished once a structure is obtained. However, the knowledge gained is not lost, but instead lays the foundation for developments in new areas of biotechnology and nanotechnology. In this it is highly analogous to studies into small molecule crystallization, the results of which have led to our present day microelectronics-based society. We are conducting preliminary experiments into areas such as designed macromolecule crystals, macromolecule-inorganic hybrid structures, and macromolecule-based nanotechnology. In addition, our protein crystallization studies are now being directed more towards industrial and new approaches to membrane protein crystallization.

Author

Biotechnology; Macromolecules; Nanotechnology; Microelectronics; Microgravity

20040073500 NASA Marshall Space Flight Center, Huntsville, AL, USA

Flight Hardware Development and Research at MSFC for Optimizing Success on the International Space Station

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 30; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To optimize biological crystallization success in microgravity in-house personnel at the MSFC are working on the development of innovative flight hardware such as Delta-L and the Iterative Biological Crystallization (IBC) apparatus as well as troubleshooting the performance of existing hardware. Delta-L will provide a diagnostic hardware to examine the relationship between crystal growth characteristics and crystal quality improvement in microgravity. IBC is a new hardware being designed to allow iteration of crystal growth experiments in microgravity using innovative lab on a chip technology. While being built to obtain scientific data of benefit to the scientific community, the design methods involved in the development of these hardware have directly benefited other groups within NASA and keep NASA at the forefront of innovation.

Author

Hardware; International Space Station; Research and Development; Microgravity

20040073516 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Role of Convection and Growth Competition on Phase Selection in Microgravity

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 18; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For a wide range of compositions, Fe-Cr-Ni alloys can solidify by a two-step process: a metastable solid forms first,

subsequently transforming into the stable solid phase. This two-step solidification produces a profoundly different microstructure, and therefore different properties, in the final solid. The delay time between the two steps of the solidification process varies from microseconds to seconds. This delay time is a strong function of composition and a weak function of the undercooling of the melt below the metastable liquidus. From the results obtained during the MSL-1 mission and in ground based electrostatic levitation testing at NASA MSFC, we know that convection also has a significant effect on the delay time. By examining the effect of convection on delay time over a wide range of convection, for several different alloys, we can gain a better understanding and better control of the microstructural evolution and final structure of stainless steel alloys. MSFC provides ESL for ground-based testing in a low-convection state, and the numerical modeling that enables estimation of the convection levels under the different process conditions.
Author
Convection; Microgravity; Solid Phases; Crystal Growth

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*.

20040068202 NASA Ames Research Center, Moffett Field, CA, USA
Cryocoolers for Space
Kittel, Peter; Feller, Jeff; Roach, Pat; Kashani, Ali; Helvensteijn, Ben; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P3; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Many planetary and Earth science missions require cooling to increase sensitivity and reduce thermal noise of detectors, for preserving high Isp propellants, or for protecting instruments from hostile environments. For space applications, such cooling requires reliable, efficient, long-life coolers that are relatively compact, lightweight, and have low vibration. We have developed and are developing coolers that meet these requirements over a wide range of temperatures. These include pulse tube coolers cooling from 300 K to below 6 K, a magnetic cooler cooling from 10 K to 2 K, a 3He sorption cooler cooling from 2 K to 0.3 K and a helium dilution cooler cooling from 0.3 K to 0.05 K. Details of these coolers and their advantages are presented.
Author
Cryogenic Cooling; Thermal Noise

20040068207 NASA Goddard Space Flight Center, Greenbelt, MD, USA
In-flight Far-Infrared Performance of the CIRS Instrument on Cassini
Nixon, Conor A.; Brasunas, John C.; Lakew, Brook; Fettig, Rainer; Jennings, Donald E.; Carlson, Ronald; Kunde, Virgil G.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 1-12 - 1-15; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The Composite Infrared Spectrometer (CIRS) on-board Cassini consists of two interferometers: a conventional Michelson for the mid-infrared; and a Martin-Puplett type in the far-infrared employing wire grid polarizers to split, recombine and analyze the radiation. The far-IR focal plane (FP1) assembly uses two thermopile detectors to measure the final transmitted and reflected beams at the polarizer-analyzer: if one fails, the interferometer can still operate, albeit with a lower efficiency. The combined effect is for good response from 10 to 300/cm, and declining response to 600/cm. This paper will examine in-flight performance of the far-IR interferometer, including NESR and response. Regular noise spikes, resulting from pickup from other electrical sub-systems has been found on the CIRS interferograms, and the removal of these effects is discussed. The radiometric calibration is described, and then we show how the calibration was applied to science data taken during the Jupiter flyby of December 2000. Finally, we discuss signal-to-noise on the calibrated spectra, emphasizing limitations of the current instrument and the potential for improvement in future missions.
Author
Infrared Spectrometers; Far Infrared Radiation; In-Flight Monitoring

20040071043 NASA Langley Research Center, Hampton, VA, USA

Development and Ground Testing of a Compactly Stowed Scalable Inflatably Deployed Solar Sail

Lichodziejewski, David; Derbes, Billy; Reinert, Rich; Belvin, Keith; Slade, Kara; Mann, Troy; April 19, 2004; 16 pp.; In English; AIAA Gossamer Spacecraft Forum, 10-23 Apr. 2004, Palm Springs, CA, USA

Contract(s)/Grant(s): NAS8-03046

Report No.(s): AIAA Paper 2004-4659; Copyright; Avail: CASI; A03, Hardcopy

This paper discusses the solar sail design and outlines the interim accomplishments to advance the technology readiness level (TRL) of the subsystem from 3 toward a technology readiness level of 6 in 2005. Under Phase II of the program many component test articles have been fabricated and tested successfully. Most notably an unprecedented section of the conically deployed rigidizable sail support beam, the heart of the inflatable rigidizable structure, has been deployed and tested in the NASA Goddard thermal vacuum chamber with good results. The development testing validated the beam packaging and deployment. The inflatable conically deployed, Sub Tg rigidizable beam technology is now in the TRL 5-6 range. The fabricated masses and structural test results of our beam components have met predictions and no changes to the mass estimates or design assumptions have been identified adding great credibility to the design. Several quadrants of the Mylar sail have also been fabricated and successfully deployed validating our design, manufacturing, and deployment techniques.

Author (revised)

Product Development; Solar Sails; Ground Tests

20040073445 NASA Glenn Research Center, Cleveland, OH, USA

An Introduction to Logic for Students of Physics and Engineering

Kolecki, Joseph C.; May 2004; 32 pp.; In English

Contract(s)/Grant(s): WBS-22-755-60-04

Report No.(s): NASA/TP-2004-212491; E-14037; No Copyright; Avail: CASI; A03, Hardcopy

A physicist with an engineering background, the author presents a brief tutorial on logic. In his work at NASA and in his encounters with students, he has often found that a firm grounding in basic logic is lacking - perhaps because there are so many other demands on people that time simply cannot be taken to really examine the roots of human reasoning. This report provides an overview of this all-too-important subject with the dual hope that it will suffice insofar as it goes and that it will spur at least some to further study.

Author

Logic; Hypothetical Particles; Equivalence; Mathematics; Algebra

20040074263 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cryogenic Technology: Ongoing Developments for the Next Decade

DiPirro, Michael; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 447-453; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

To obtain optimum sensitivity a submillimeter space observatory will require low temperature mirrors (approx. 3K) and very low temperature detectors (< or approx. 0.1 K). Both of these temperatures have been achieved by space cryogenic systems, but neither for a 10 year duration. Past systems used superfluid helium to provide direct cooling in the 1 to 2 K range (IRAS, COBE, IRTS, ISO) or as an upper stage for an adiabatic demagnetization refrigerator to achieve temperatures down to 0.06 K (Astro-E/XRS). Boiloff vapor may be used to cool an otherwise warm telescope as in the Space InfraRed Telescope Facility (SIRTF). In SIRTF a 0.85 m telescope is cooled to 5.5 K by absorbing about 6 mW in the cold vapor. This residual heat is due to both radiation from a helium vapor cooled outer shield at about 20 K and from conduction through a structure mounting the cold telescope and instruments to the warm spacecraft. The boil off rate required to cool the telescope results in a 2.6 to 5 year lifetime, depending on whether other parasitic heat sources such as thermoacoustic oscillations are also present. A helium dewar results in a very heavy system to achieve 2 to 5 year lifetimes. For example it takes roughly 400 kg for XRS to achieve 0.06 K for two year life with a 250 K boundary temperature, and approx. 300 kg (including thermal shielding) for SIRTF to achieve 1.3 K for 5 year life with a 35 K boundary temperature. To go to longer duration and to lower the weight, active cooling methods are required combined with more aggressive passive cooling techniques. It is possible, with some development, to provide cooling for detectors to 0.05 K and telescopes and instruments to < 4 K for a 10 year mission with a 100 kg system including power sources, structural support, and vacuum enclosures for critical portions of the instruments.

Author

Cryogenic Equipment; Cryogenic Cooling; Astronomical Satellites

20040074264 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Continuous Adiabatic Demagnetization Refrigerator for Far-IR/Sub-mm Astronomy

Shirron, Peter; Canavan, Edgar; DiPirro, Michael; Jackson, Michael; King, Todd; Tuttle, James; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 454-460; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

We report on recent progress in the development of a continuous adiabatic demagnetization refrigerator (CADR). Continuous operation avoids the constraints of long hold times and short recycle times that lead to the generally large mass of single-shot ADRs, allowing us to achieve an order of magnitude larger cooling power per unit mass. Our current design goal is 10 microW of cooling at 50 mK using a 6-10 K heat sink. The estimated mass is less than 10 kg, including magnetic shielding of each stage. The relatively high heat rejection capability allows it to operate with a mechanical cryocooler as part of a cryogen-free, low temperature cooling system. This has the advantages of long mission life and reduced complexity and cost. We have assembled a three-stage CADR and have demonstrated continuous cooling using a superfluid helium bath as the heat sink. The temperature stability is 8 microK rms or better over the entire cycle, and the cooling power is 2.5 microW at 60 mK rising to 10 microW at 100 mK.

Author

Adiabatic Conditions; Demagnetization; Refrigerators; Cryogenic Cooling; Infrared Astronomy

20040074276 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Cryo-Infrared Optical Characterization at NASA GSFC

Boucarut, Ray; Quijada, Manuel A.; Henry, Ross M.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 428-437; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The development of large space infrared optical systems, such as the Next Generation Space Telescope (NGST), has increased requirements for measurement accuracy in the optical properties of materials. Many materials used as optical components in infrared optical systems, have strong temperature dependence in their optical properties. Unfortunately, data on the temperature dependence of most of these materials is sparse. In this paper, we provide a description of the capabilities existing in the Optics Branch at the Goddard Space Flight Center that enable the characterization of the refractive index and absorption coefficient changes and other optical properties in infrared materials at cryogenic temperatures. Details of the experimental apparatus, which include continuous flow liquid helium optical cryostat, and a Fourier Transform Infrared (FTIR) spectrometer are discussed.

Author

Cryogenics; Optical Equipment; Optical Properties; Infrared Spectrometers

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*.

20040068233 Federal Trade Commission, Washington, DC, USA

False Claims in SPAM. A Report by the FTC's Division of Marketing Practices

Apr. 30, 2003; In English

Report No.(s): PB2004-103731; No Copyright; Avail: National Technical Information Service (NTIS)

In this report, staff of the Federal Trade Commission's ('FTC') Division of Marketing Practices describes the results of its review of approximately 1,000 pieces of unsolicited commercial email (UCE), commonly known as 'spam.' This random sample was drawn from a pool of over 11,000,000 pieces of spam. This study, which focuses on the likely truth or falsity of claims contained in the messages, supplements two previous FTC studies of spam - the 'Spam Harvest' (finding that 86% of addresses posted to web pages and newsgroups received spam) and the 'Remove Me Surf' (finding that 63% of email list removal requests were not honored). This study represents the first extensive review of false claims appearing in UCE.

NTIS

Electronic Mail; World Wide Web; Information Dissemination

20040068297 National Telecommunications and Information Administration, Washington, DC, USA
Proceedings of the International Symposium on Advanced Radio Technologies, March 2-4, 2004
Allen, J. W.; Brown, T. X.; Sicker, D. C.; Ratzloff, J.; Mar. 2004; In English
Report No.(s): PB2004-105434; NTIA-SP-04-409; No Copyright; Avail: National Technical Information Service (NTIS)

Contents: Accuracy Enhancements for TDOA Estimation on Highly Resource Constrained Mobile Platforms; Enhanced Location Estimation via Pattern Matching and Motion Modeling; Mobile Transmitters Tracking Using Geodetic Models with Multiple Receivers; IP Wireless Networks for Digital Video and Data Along Highway Right of Way; Local Spectrum Sovereignty: An Inflection Point in Allocation; Channel Usage Classification Using Histogram-Based Algorithms for Fast Wideband Scanners; Measurement and Analysis of Urban Spectrum Usage; Analog Front-End Cost Reduction for Multi-Antenna Transmitter; Satellite Communications using Ultra Wideband (UWB) Signals; Spectrum Agile Radio: Detecting Spectrum Opportunities; Alternative Communication Networking in Polar Regions; Signal Capacity Modeling for Shared Radio System Planning; Rapidly Deployable Broadband Communications for Disaster Response; Trends in Telecom Development Globally: A Perspective from Washington; Mesh Networks: The Next Generation of Wireless Communications; Performance Analysis of Dynamic Source Routing Using Expanding Ring Search for Ad-Hoc Networks; Label-based Multipath Routing (LMR) in Wireless Sensor Networks; Low Cost Broadband Wireless Access - Key Research Problems and Business Scenarios.

NTIS
Spectra; Satellite Communication; Augmentation; Wireless Communication

20040070836 Integrated Systems Consultants, USA
TAXI Direct-to-Disk Interface Demultiplexes Proprietarily Formatted Data
Newnan, Bruce G.; Ahlport, Steven F.; [2001]; 1 pp.; In English; Original contains color illustrations
Report No.(s): NASA/NP-2001-10-00018-SSC; SSC-00141; No Copyright; Avail: CASI; A01, Hardcopy

The TAXI Direct-to-Disk interface is a special-purpose interface circuit for demultiplexing of data from a Racal Storeplex (or equivalent) multichannel recorder onto one or more hard disks that reside in, and/or are controlled by, a personal computer (PC). (The name TAXI as used here is derived from the acronym TAXI, which signifies transparent asynchronous transceiver interface.) The TAXI Direct-to-Disk interface was developed for original use in capturing data from instrumentation on a test stand in a NASA rocket-testing facility. The control, data-recording, and data-postprocessing equipment of the facility are located in a control room at a safe distance from the test stand. Heretofore, the transfer of data from the instrumentation to the postprocessing equipment has entailed post-test downloading via software, requiring many hours to days of post-test reduction before the data could be viewed in a channelized format. The installation of the TAXI Direct-to-Disk interface, in conjunction with other modifications, causes the transfer of data to take place in real time, so that the data are immediately available for review during or after the test. The instrumentation is connected to the input terminals of the signal-processing unit of multichannel recorder by standard coaxial cables. The coaxial output of the signal processing unit is converted to fiber-optic output by means of a commercial coaxial-cable/fiber-optic converter (that is, a fiber-optic transceiver) designed specifically for this application. The fiber-optic link carries the data signals to an identical fiber-optic transceiver in the control room. On the way to the TAXI Direct-to-Disk interface that is the focus of this article, the data signals are processed through a companion special purpose circuit denoted by the similar name parallel TAXI interface.

Author (revised)
Demultiplexing; Circuits; Data Transfer (Computers); Interfaces; Transmitter Receivers

20040073484 NASA Glenn Research Center, Cleveland, OH, USA
Evolutionary Space Communications Architectures for Human/Robotic Exploration and Science Missions
Bhasin, Kul; Hayden, Jeffrey L.; April 2004; 20 pp.; In English; Space Technology and Applications International Forum (STAIF-2004), 8-12 Feb. 2004, Albuquerque, NM, USA
Report No.(s): NASA/TM-2004-213074; E-14550; No Copyright; Avail: CASI; A03, Hardcopy

NASA enterprises have growing needs for an advanced, integrated, communications infrastructure that will satisfy the capabilities needed for multiple human, robotic and scientific missions beyond 2015. Furthermore, the reliable, multipoint infrastructure is required to provide continuous, maximum coverage of areas of concentrated activities, such as around Earth and in the vicinity of the Moon or Mars, with access made available on demand of the human or robotic user. As a first step, the definitions of NASA's future space communications and networking architectures are underway. Architectures that describe the communications and networking needed between the nodal regions consisting of Earth, Moon, Lagrange points, Mars, and the places of interest within the inner and outer solar system have been laid out. These architectures will need the modular flexibility that must be included in the communication and networking technologies to enable the infrastructure to

grow in capability with time and to transform from supporting robotic missions in the solar system to supporting human ventures to Mars, Jupiter, Jupiter's moons, and beyond. The protocol-based networking capability seamlessly connects the backbone, access, inter-spacecraft and proximity network elements of the architectures employed in the infrastructure. In this paper, we present the summary of NASA's near and long term needs and capability requirements that were gathered by participative methods. We describe an integrated architecture concept and model that will enable communications for evolutionary robotic and human science missions. We then define the communication nodes, their requirements, and various options to connect them.
Author
Robotics; Space Communication; Solar System; Manned Space Flight; NASA Space Programs; Architecture (Computers)

20040073539 Naval Postgraduate School, Monterey, CA
Analysis of the Effects of Phase Noise and Frequency Offset in Orthogonal Frequency Division Multiplexing (OFDM) Systems
Erdogan, Ahmet Y.; Mar. 2004; 151 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422290; No Copyright; Avail: CASI; A08, Hardcopy
Orthogonal frequency division multiplexing (OFDM) is being successfully used in numerous applications. It was chosen for IEEE 802.1 la wireless local area network (WLAN) standard, and it is being considered for the fourth-generation mobile communication systems. Along with its many attractive features, OFDM has some principal draw-backs. Sensitivity to frequency errors is the most dominant of these drawbacks. In this thesis, the frequency offset and phase noise effects on OFDM based communication systems are investigated under a variety of channel conditions covering both indoor and outdoor environments. The simulation performance results of the OFDM system for these channels are presented.
DTIC
Frequencies; Frequency Division Multiplexing

20040073597 Space and Naval Warfare Systems Center, San Diego, CA
Flying Plug: A Small UUV Designed for Submarine Data Connectivity
Cowen, Steve; May 1997; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422442; No Copyright; Avail: CASI; A03, Hardcopy
In the context of an information-based society the ability to reliably retrieve, transfer and process large quantities of data in a timely fashion becomes a critical technology issue. In the context of integrating submarine offboard sensors and physically supporting data connectivity with terrestrial networks: reliable, high bandwidth communications ranks as an extremely difficult technical problem. Few operating environments place more limitations on the ability to transfer high bandwidth data than underwater. The conductive medium places strict limits upon RF propagation, visibility greatly restricts the bounds of optical transmission and noise, ray-bending and multipath dominate the acoustic environment. Data transfer rates are usually limited to at most a few kilobits per second unless a hard connection via a cable is established. But adverse logistics inherent with underwater cables and their associated infrastructure often renders a cabled system totally impractical from a technical or economic standpoint.
DTIC
Satellite Communication; Submarines

20040073599 Massachusetts Inst. of Tech., Lexington, MA
The Relationship Between Detection Algorithms for Hyperspectral and Radar Applications
Keshava, Nirmal; Kogon, Stephen M.; Manolakis, Dimitris; Mar. 14, 2001; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422450; ASAP-2001; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Adaptation; Algorithms; Countermeasures; Imagery; Radar Detection

20040073742 Naval War Coll., Newport, RI
Operational Maneuver from the Sea and Amphibious Command Relationships: Is It time for a Joint Force Amphibious Component Commander?
Bennett, Michael L.; Feb. 9, 2004; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422662; No Copyright; Avail: CASI; A03, Hardcopy

The Navy-Marine Corps team envisioned in Sea Power 21 has the potential to offer the future Joint Force Commander (JFC) a significant capability with the application of Operational Maneuver From the Sea (OMFTS). In order to realize this potential however, the appropriate command and control structure must he available to the JFC. In a joint community that is becoming increasingly dependant on the use of functional component commanders in the execution of major operations, the need for a Joint Force Amphibious Component Commander (JFAMCC) is worthy of consideration as an organizational option. As amphibious command relationships continue to evolve, the need for a JFAMCC in addition to the Navy's Joint Force Maritime Component Commander (JFMCC) will he dependent on the size of the conflict, the geography of the theatre, and the capabilities of emergent weapons systems. The employment of an amphibious functional component commander offers significant benefits, however it also carries substantial costs. Considering those costs, the command relationships that are available for the planning and execution of amphibious operations are currently adequate. As the technology and procedures required for the execution of OMFTS mature, however, and amphibious forces are able to offer a truly operational capability to the JFC, a JFAMCC acting in concert with a JFMCC and the other standing functional component commanders will he an asset well worth the cost.
DTIC
Command and Control; Military Operations; Seas

20040073777 Naval War Coll., Newport, RI
Effect of Modern C2 Assets on Risk Management of Joint Operational Warfare
Sardiello, Carlos A.; Feb. 9, 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422731; No Copyright; Avail: CASI; A03, Hardcopy

Technology has influenced the way Operational commanders approach Command and Control (C2) of fielded forces within a battlespace. Advances in technology particularly information related technologies offer military organizations unprecedented opportunities to significantly reduce the fog and friction additionally associated with conflict. This Clausewitzian reference to "fog" refers to the uncertainties of the battlespace and most directly translates into risk to success of an operation. How a commander might leverage the benefits of C2 technology to control risk can have a profound effect on how effectively the operation is executed. The warfare concept of Network Centric Warfare (NCW) emphasizes a leveraging of advances in Information Technology (IT) to herald in "a new era in warfare". But at the core of this new era, the human dimension should remain central since it largely distinguishes C2. Judicious use of ever-advancing C2 assets (technologically) will contribute to the effective use of the devastating power of modern military force in support of a Joint (Coalition) operation to the fullest extent. The human element is key to success and needs to be preserved at all levels. Strategic and Operational commanders must focus on setting the conditions for success at their level and trust their component commanders and subordinate commanders whose role it is to be in contact with the adversary to utilize their situational awareness and professional experience in the most effective manner.
DTIC
Command and Control; Military Operations; Risk; Warfare

20040073795 Naval War Coll., Newport, RI
Joint Force Headquarters - Global Strike: Preserving, Advancing, and Accelerating Operational Art for the Joint Force Commander
Kruse, Jeffrey A.; Feb. 9, 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422787; No Copyright; Avail: CASI; A03, Hardcopy

On 10 January 2003, President Bush assigned the newly created mission of "global strike" to U.S. Strategic Command. While streamlining the nation's crisis planning and execution capabilities, this innovative change to the Unified Command Plan presents several organizational and cultural challenges for the regional combatant commanders. It can be viewed as infringing upon theater unity of command, a potential avenue for increased national level control and interference, and a competitor for finite warfighting resources. Balancing these competing needs is both challenging and imperative, particularly in the era of smaller force structures and potentially devastating threats such as terrorism and weapons of mass destruction. To meet the needs of both the President and regional combatant commanders, U.S. Strategic Command should establish a subordinate element, Joint Force Headquarters - Global Strike (JFHQ-GS), comprised of a standing crisis action planning staff and a small number of assigned joint and service capabilities to provide accelerated, specialized, and integrated global strike operations for the Joint Force Commander. (33 refs.)
DTIC
Command and Control; Military Operations; Systems Integration; Warfare

20040073796 Naval War Coll., Newport, RI
Embedded Media and the Operational Commander
Lehman, Patrick R.; Feb. 9, 2004; 22 pp.; In English
Report No.(s): AD-A422789; No Copyright; Avail: CASI; A03, Hardcopy

Embedded media, effectively employed, can be an operational commander's most effective means to gain American public support and counter enemy propaganda. By employing embedded media, an operational commander is not only carrying out an assigned task from a higher authority, but also making use of a powerful asset. Embedded media have proven to be extremely successful in widely distributing information. This same information is the major source of news most Americans use to form their opinions concerning the nation's conflicts. Since public opinion has considerable leverage on leadership and national decision makers, overall mission success is critically linked to an operational commander's ability to accurately inform the public of current military actions. Embedded media have become considerably more potent in recent years, partly due to increased access to military operations and partly due to advances in technology. Live media coverage is now available from even some of the most remote locations in the world. Operation Iraqi Freedom will be used as an illustrative example to outline the operational commander's benefits of employing the embedded media to gain public support and counter enemy propaganda. This paper will sequentially show that embedded media have a significant impact on the operational commander, that embedded media can provide a valuable service for the operational commander, and that the embedded media program is the most effective asset available for both increasing public support and countering enemy propaganda. Proper employment and cautious treatment of embedded media can yield a powerful return for minimal investment, while failure to devote sufficient attention to embedded media may result in detrimental press coverage that ultimately affects the accomplishment of an operational commander's objectives. (28 refs.)
DTIC
Embedding; News Media

20040073800 Naval War Coll., Newport, RI
Stop The Phasing: A Single Integrated Navy and Marine Air Command and Control System for Sea-Based Operations
Hague, Michael E.; Feb. 9, 2004; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422809; No Copyright; Avail: CASI; A03, Hardcopy

In order to maximize the benefits of the Sea Basing concept, sea-based forces must have air command and control agencies which are organized, trained and equipped to seamlessly project power from the sea-base to the objective. Current amphibious air command and control doctrine and organization, which is predicated on the cumbersome process of phasing control from sea-based to land-based agencies, does not fully support the Sea Basing concept. This paper advocates the development of a single, fully-integrated Navy and Marine air command and control system, which is primarily sea-based and has the capability to effectively provide services throughout the battlespace, both over-land and over-water. This integrated system must be fully compatible with Joint aviation command and control systems and have the ability to maximize the operational flexibility and freedom of action envisioned in the Sea Basing concept. Successes encountered in the integration of Navy and Marine air command and control systems should serve as the model for the development of a Joint air command and control system, which would allow a Joint Force to effectively operate from the sea-base. The Sea Basing concept, as currently envisioned, provides an unprecedented level of operational flexibility to the Joint Force Commander, and a fully integrated Joint air command and control system will be critical to enabling this flexibility.
DTIC
Command and Control; Military Operations; Navy; Seas

20040073802 Naval War Coll., Newport, RI
Can Decentralized Command And Control Complement Network-Centric Warfare?
Hansen, Donald K.; Feb. 9, 2004; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422815; No Copyright; Avail: CASI; A03, Hardcopy

Future technology will allow the Joint Force Commander unprecedented access to the tactical level of war. Depending on his personality, he may chose to directly control events unfolding at the tactical level or leave the fighting to individuals charged with employing their weapon systems. The ability of a pilot, tank driver or infantry battalion commander in the future to share his operational picture with the entire chain of command (shared situational awareness) and vice versa, begs the need for sound, authoritative command and control doctrine to maximize the inherent benefits of this information advantage. All players in this future system must share a common rule set in order to exploit the war fighting advantages described in Joint Vision 2020 (JV 2020). Command and control doctrine must now outline this new rule set. With a common rule set, reorganization, training and education of staffs and combat units can begin. Overcoming old paradigms will be difficult, but

by applying the doctrine of maneuver warfare to Network-centric Warfare (NCW) and JV 2020 concepts, a better command and control method can be implemented. The purpose of this paper is to reconcile the conflicts between maneuver warfare doctrine and the warfighting concepts currently being developed under JV 2020 and NCW by establishing a strong case for decentralized command and control.
DTIC
Command and Control; Warfare

20040073808 Naval War Coll., Newport, RI
The Unspoken Consequence of Command, Control Communications Technology: Enhanced Micromanagement by Risk- Averse Commanders
Carozza, John L.; Feb. 9, 2004; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422827; No Copyright; Avail: CASI; A03, Hardcopy

Technological advancements in communications provide the operational commander with a significantly enhanced real-time understanding of the battlespace, enabling more robust employment of centralized control. However, along with its benefits, this command, control and communications (C3) network includes the dangerous consequence of eroding the autonomy of tactical command through enhanced micromanagement by risk-averse operational commanders. Selected historical examples demonstrate that advances in C3 technology have been a force multiplier that enables the implementation of broader strategies by drastically improving the operational commander's understanding and control of the battlespace and battleforce. However, as exemplified by operations in Kosovo, technological advancement when put in the hands of risk-averse operational commanders also can serve as an enabler of potentially damaging micromanagement. Ultimately, training, doctrine and incentives will enhance the effectiveness of C3 integration, but the personality and leadership traits of the operational commander will ultimately determine how effectively this technology is integrated into the operational art of warfare toward the achievement of military objectives. The forgiving battlefields of recent conflicts have afforded commanders the opportunity to experiment with the application and misapplication of C3 in a relatively low-risk environment. Failure to maximize the effective employment of C3 in future conflicts against more formidable, multi-dimensional adversaries, would likely prove detrimental to achieving U.S. objectives. (29 refs.)
DTIC
Command and Control; Risk

20040074134 National Defense Univ., Washington, DC
Transforming NATO Command and Control for Future Missions (Defense Horizons, Number 28, June 2003)
Barry, Charles L.; Jun. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422451; No Copyright; Avail: CASI; A03, Hardcopy

No military function is more critical to operational success than effective command and control (C2). There also is no more daunting military function to get right when it comes to the employment of complex multinational formations in the fast paced arena of crisis response. Since the Cold War, the North Atlantic Treaty Organization (NATO)-- unique as an alliance with a permanent standing C2 structure-- has ventured into a broader spectrum of missions and across a wider geographical area of operations, posing far greater C2 challenges than the single-mission, fixed territory defense of the past. Threats to NATO interests have increased, demanding military structures and capabilities that can be employed on shorter notice and further outside NATO territory. At the same time, more sophisticated information-based battle systems and technologies are driving the need for increasingly interoperable forces. A key factor for success in this new environment will be a more agile, flexible, and responsive NATO C2 architecture for the 21st century.
DTIC
Command and Control; Horizon; North Atlantic Treaty Organization (NATO)

20040074157 National Defense Univ., Washington, DC
Defense Horizons. Number 29, July 2003. Beyond the Mainland: Chinese Telecommunications Expansion
Fonow, Robert C.; Jul. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422394; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
China; Communication Networks; Horizon; Telecommunication

20040074217 NASA Dryden Flight Research Center, Edwards, CA, USA
Mobile Aerial Tracking and Imaging System (MATRIS) for Aeronautical Research
Banks, Daniel W.; Blanchard, R. C.; Miller, G. M.; [2004]; 12 pp.; In English; 11th International Symposium on Flow Visualization, 9-12 Aug. 2004, Notre Dame, IN, USA
Contract(s)/Grant(s): NAC4-156; NASA Order EO-5557-D; No Copyright; Avail: CASI; A03, Hardcopy

A mobile, rapidly deployable ground-based system to track and image targets of aeronautical interest has been developed. Targets include reentering reusable launch vehicles (RLVs) as well as atmospheric and transatmospheric vehicles. The optics were designed to image targets in the visible and infrared wavelengths. To minimize acquisition cost and development time, the system uses commercially available hardware and software where possible. The conception and initial funding of this system originated with a study of ground-based imaging of global aerothermal characteristics of RLV configurations. During that study NASA teamed with the Missile Defense Agency/Innovative Science and Technology Experimentation Facility (MDA/ISTEF) to test techniques and analysis on two Space Shuttle flights.
Author
Imaging Techniques; Mobile Communication Systems; Infrared Spectra

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*.

20040068162 Computer Sciences Corp., Moffett Field, CA, USA
Conductance Oscillations in Squashed Carbon Nanotubes
Mehrez, H.; Anantram, M. P.; Svizhenko, A.; December 11, 2003; 9 pp.; In English
Report No.(s): DTTS59-99-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; A02, Hardcopy

A combination of molecular dynamics and electrical conductance calculations are used to probe the electromechanical properties of squashed metallic carbon nanotubes. We find that the conductance and bandgap of armchair nanotubes show oscillations upon squashing. The physical origin of these oscillations is attributed to interaction of carbon atoms with a fourth neighbor. Squashing of armchair and zigzag nanotubes ultimately leads to metallic behavior.
Author
Carbon Nanotubes; Oscillations; Electrical Resistance

20040068189 Naval Research Lab., Washington, DC, USA
Metal Mesh Filters for Infrared Applications
Sternberg, Oren; Fischer, Jacqueline; Stewart, Kenneth P.; Rebbert, Milton L.; Moeller, Karl D.; Grebel, Haim; Smith, Howard; Fettig, Rainer; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 5-6 - 5-9; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The transmittance peaks of inductive and capacitive metal meshes have been assigned to a number of modes and their interaction. Single thin meshes show resonance modes depending on the periodic structure of the mesh and slab modes when in touch with dielectric layers. Two and four meshes show stacking modes depending on separation similar to photonic crystals.
Author
Mesh; Electric Filters; Infrared Radiation

20040068197 SunPower, Inc., Athens, OH, USA
Sunpower Cooling Solutions
Keiter, Douglas E.; Wilson, Kyle B.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 6-8 - 6-10; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

Sunpower specializes in free-piston Stirling engines and cryocoolers, pulse tube cryocoolers, and free-piston linear compressors. Sunpower offers four different Stirling cryocoolers to meet varying performance, environmental and cost targets. All of Sunpower s cryocoolers are hermetically sealed, contain no HCFC s, and are designed for high performance with maintenance-free, long-life operation. Sunpower is also developing pulse tube cryocoolers as another option for cooling

solutions. Single and multi-stage pulse tube cryocoolers are currently at the laboratory prototype level. Figure 1 shows the thermodynamic performance of each cryocooler discussed in this paper.
Author
Cryogenic Cooling; Free-Piston Engines; Prototypes; Thermodynamics

20040068221 NASA Glenn Research Center, Cleveland, OH, USA
Electrical Devices and Circuits for Low Temperature Space Applications
Patterson, R. L.; Hammoud, A.; Dickman, J. E.; Gerber, S.; Elbuluk, M. E.; Overton, E.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 4-11 - 4-15; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The environmental temperature in many NASA missions, such as deep space probes and outer planetary exploration, is significantly below the range for which conventional commercial-off-the-shelf electronics is designed. Presently, spacecraft operating in the cold environment of such deep space missions carry a large number of radioisotope or other heating units in order to maintain the surrounding temperature of the onboard electronics at approximately 20 C. Electronic devices and circuits capable of operation at cryogenic temperatures will not only tolerate the harsh environment of deep space but also will reduce system size and weight by eliminating or reducing the heating units and their associate structures; thereby reducing system development cost as well as launch costs. In addition, power electronic circuits designed for operation at low temperatures are expected to result in more efficient systems than those at room temperature. This improvement results from better behavior in the electrical and thermal properties of some semiconductor and dielectric materials at low temperatures. An on-going research and development program on low temperature electronics at the NASA Glenn Research Center focuses on the development of efficient electrical systems and circuits capable of surviving and exploiting the advantages of low temperature environments. An overview of the program will be presented in this paper. A description of the low temperature test facilities along with selected data obtained from in-house component testing will also be discussed. On-going research activities that are being performed in collaboration with various organizations will also be presented.
Author
Commercial Off-the-Shelf Products; Deep Space; Low Temperature Environments; Low Temperature Tests; Semiconductors (Materials); Technology Utilization; Test Facilities

20040068223 TRW, Inc., USA
Superconducting Electronics for Detector Readouts
Luine, Jerome; Durand, Dale; Eaton, Larry; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P1; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Spacecraft subsystems that support thermal detector imaging arrays that operate at temperatures below 80 K can be benefited by the use of superconducting electronics (SCE). SCE can greatly simplify spacecraft complexity, thereby reducing costs, and significantly enhance the performance of science instruments and control electronics. For example, by integrating an analog signal processor and analog-to-digital converter with an imaging sensor array, cryogenic system complexity is reduced and instrument performance is increased. The number of signal wires leading from the cryogenic detector environment to higher temperature electronics is reduced thereby reducing cryogenic system complexity. Reduced signal line count not only simplifies the cryogenic package but also reduces the cryogenic heat load. Cryogenic package simplification and reduced heat load result in lower cost and increased reliability. Instrument performance is enhanced by executing as much signal processing at the sensor array as possible. Multiplexing and digitizing the signals in the very low-noise cryogenic environment increases signal-to-noise ratio. These benefits can also be used to dramatically increase the number of sensor elements thereby increasing resolution to levels that are extremely difficult or impossible to achieve with today s technology. Furthermore, materials used for SCE have been found to have orders of magnitude greater radiation hardness than any other electronics materials. SCE is ideal for cryogenic instruments as well as other spacecraft electronic systems. The status of SCE technologies for thermal detector readout and signal processing will be presented.
Author
Superconductivity; Signal Processing; Cryogenics; Thermal Mapping; Signal to Noise Ratios

20040068225 Raytheon Co., El Segundo, CA, USA
Integration of Oxford Class Cryocoolers with Thermal Detectors
Kirkconnell, Carl S.; Price, Kenneth D.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 6-11 - 6-15; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

Mechanical cryocoolers are generally preferable to stored cryogen dewar systems for space applications because they are more than an order of magnitude smaller in size and lighter in weight. Successful flight qualification, endurance testing, and on orbit performance of mechanical cryocoolers over the past ten years have made the use of cryocoolers viable from a lifetime and system reliability perspective. However, the size and weight advantage is partially offset by the introduction of operational vibrations, the possibility of temperature fluctuations at the cooler mounting interface and cold tip, and power draw on the spacecraft bus. The first two can directly affect detector performance. These inherent technical challenges are met through the combination of cryocooler-level and system-level design features and accommodation. For example, adaptive feed forward (AFF) active vibration control provided by the cryocooler control electronics significantly reduces vibration output at the cold tip. Using a flexible thermal strap to connect the detector to the cold tip further attenuates vibrations transmitted from cold tip to detector. Unfortunately, thermal strap efficiency and mechanical strap compliance react in opposite directions with respect to strap cross-sectional area, so a system-level design optimum must be found. Lower cryocooler vibration output and/or higher cryocooler efficiency facilitate the identification of an optimum strap design that meets the detector thermal and jitter requirements. The pages that follow discuss these and other examples of system-level issues that arise in the integration of Stirling-cycle, Oxford-class cryocoolers, and more importantly, how those challenges can be overcome.
Author
Cryogenic Equipment; Performance Tests; Technology Utilization; Cryogenic Cooling; Active Control

20040068227 Creare, Inc., Hanover, NH, USA
On-Orbit Operating Experience with the NICMOS Cryocooler: First Year
Swift, Walter; Cheng, Ed; Zagarola, Mark; Dolan, Frank; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 6-17 - 6-20; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A mechanical cryocooler was installed on the Hubble Space Telescope (HST) in March 2002. The turbo-Brayton cooler uses miniature high-speed rotors in gas bearings to provide vibration-free refrigeration. It is designed to re-cool the detectors on the Near Infrared Camera and Multi-Object Spectrometer (NICMOS). The cryocooler system has been operating continuously since March 19, 2002. In May 2002, the setpoint temperature was set to provide a detector temperature of 77.1 K. Detector temperatures have been maintained within +/- 0.1 K by a control loop that continually adjusts compressor speed around a nominal value of 426,600 rpm. An important feature of the turbo-Brayton cryocooler is its exclusive use of self-acting gas bearings to support the miniature, low mass rotors. This approach results in extremely low vibration levels and wear-free operation. When combined with suitable decontamination procedures, the resulting hermetic system can be contamination free, resulting in un-degraded operation for periods of 5 10 years. This paper reviews the first year on-orbit operating experience with the NICMOS cryocooler and presents additional laboratory results with a version of the system ultimately designed for cooling at 6 K.
Author
Coolers; Cryogenic Cooling; Miniaturization; Near Infrared Radiation

20040068230 Lockheed Martin Corp., Syracuse, NY, USA
Frequency Selective Surfaces as Near Infrared Electro-Magnetic Filters for Thermophotovoltaic Spectral Control
Kristensen, R. T.; Beausang, J. F.; DePoy, D. M.; Dec. 2003; 32 pp.; In English
Report No.(s): DE2004-822277; LM-03K128; No Copyright; Avail: Department of Energy Information Bridge

Frequency selective surfaces (FSS) effectively filter electromagnetic radiation in the microwave band (1mm to 100mm). Interest exists in extending this technology to the near infrared (1(micro)m to 10(micro)m) for use as a filter of thermal radiation in thermophotovoltaic (TPV) direct energy conversion. This paper assesses the ability of FSS to meet the strict spectral performance requirements of a TPV system. Inherent parasitic absorption, which is the result of the induced currents in the FSS metallization, is identified as a significant obstacle to achieving high spectral performance.
NTIS
Selective Surfaces; Control Surfaces; Infrared Filters; Energy Conversion

20040068244 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Novel Metal-Ferroelectric-Semiconductor Field-Effect Transistor Memory Cell Design
Phillips, Thomas A.; Bailey, Mark; Ho, Fat Duen; 2004; 2 pp.; In English; 16th International Symposium on Integrated Ferroelectrics, 5-8 Apr. 2004, Gyeongyu, Korea, Republic of; Copyright; Avail: CASI; A01, Hardcopy

The use of a Metal-Ferroelectric-Semiconductor Field-Effect Transistor (MFSFET) in a resistive-load SRAM memory cell has been investigated A typical two-transistor resistive-load SRAM memory cell architecture is modified by replacing one

of the NMOS transistors with an n-channel MFSFET. The gate of the MFSFET is connected to a polling voltage pulse instead of the other NMOS transistor drain. The polling voltage pulses are of sufficient magnitude to saturate the ferroelectric gate material and force the MFSFET into a particular logic state. The memory cell circuit is further modified by the addition of a PMOS transistor and a load resistor in order to improve the retention characteristics of the memory cell. The retention characteristics of both the "1" and "0" logic states are simulated. The simulations show that the MFSFET memory cell design can maintain both the "1" and "0" logic states for a long period of time. Author

Field Effect Transistors; Ferroelectricity; Metal Oxide Semiconductors; Computer Storage Devices; Memory (Computers); Electric Potential; Transistors

20040068321 Lawrence Livermore National Lab., Livermore, CA

Investigation of Fluorescence Microscope as a Tool for Noninvasive Detection and Imaging of Damage Precursors at 351-nm

Demos, S. G.; Nostrand, M. C.; Staggs, M.; Carr, C. W.; Hahn, D.; Nov. 2001; In English

Report No.(s): DE2003-15004633; UCRL-JC-144367; No Copyright; Avail: National Technical Information Service (NTIS)

This work is an experimental investigation to evaluate the potential of fluorescence microscopy as a tool to detect surface contamination as well as reveal surface damage precursors on DKDP and SIO2 optics. To achieve these technical objectives, microscopic imaging systems were built that also incorporated in-situ damage testing capabilities. Fluorescence imaging experiments were performed using 351-nm laser excitation while damage testing was performed at relatively high laser fluences. The experimental results demonstrated the potential of this technique to address the aforementioned technical issues. NTIS

Fluorescence; Microscopes; Evaluation

20040068325 Swedish Defence Research Establishment, Stockholm, Sweden

Fibre Optic Hydrophone Array Evaluation of Technique and Possibilitites

Kullander, F.; Levonen, M.; Moren, P.; Olsson, A.; Sep. 2003; In Swedish

Report No.(s): PB2004-104545; FOI-R-0950-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A field experiment with fiber optic hydrophones was conducted at Oxdjupet September 9 - 11 2002. The purpose was to collect experimental data suitable for evaluation of the fiber-optic hydrophone performance characteristics, especially at lower frequencies. The question is, does a signature measured with a fiber-optic hydrophone have the potential to give better classification compared to a signature measured with a conventional mine sensor. In the report, the authors compare data from the fiber optic hydrophones measured at different ship passages with corresponding data from a dynamic pressure sensor and a reference hydrophone. Gained experiences from the use of fiber optic hydrophones in a full-scale experiment are summarized in the report. The high intensity caused by the passage of large ships gave unexpected disturbances in the signal. Basically, the fiber optic hydrophones were over-driven meaning that the used demodulating algorithm ceased to work correctly. Another disturbance, a low frequent oscillation around 2 Hz, observed in the fiber optic hydrophone recordings was not at all visible in the reference recordings. A possible explanation of these oscillations can be related to defects in the embedment of the hydrophone elements. The disturbances in the fiber optic signals have to a great extent complicated the analysis and by that the comparison with the reference sensors. Based upon these results the authors have not found any advantages of fiber-optic hydrophones for the use in mine sensor applications. However, fiber-optic techniques could make it possible to construct new types of hydrophones such as large, area covering sensors.
NTIS

Acousto-Optics; Dynamic Pressure; Pressure Sensors

20040070738 NASA Lewis Research Center, Cleveland, OH, USA

The Au Cathode in the System Li2CO3-CO2-CO at 800 to 900 C

Hagedorn, Norman H.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 3; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Gold is one of several metals being evaluated at NASA Lewis Research Center as positive electrode catalysts for an alkali metal/molten alkali metal carbonate/carbon dioxide electrochemical cell. Such a cell is proposed for CO2-rich planetary atmospheres such as those of Mars and Venus. Its application could be as a primary power supply, as a secondary power supply recharged either ‘chemically’ by replenishment of the alkali metal or electrochemically from a central station power source, or as a converter of carbon dioxide to oxygen via a complete electrochemical cycle. For the work being reported, lithium was

assumed to be the alkali metal of choice for the negative electrode of the cell, and therefore molten lithium carbonate was the electrolyte used in the Au electrode experiments. Cathodic linear sweep voltammetry (LSV) was the primary analytical technique for evaluating the performance of the Au cathode. interest comprised the cell temperature and the total pressure and composition of the reactant gas. In the absence of operational difficulties, the effect of bubbling the reactant gas through the melt was also determined. On the basis of the variation of electrode performance with changes in these parameters, inferences have been made concerning the electrochemical and chemical processes at and near the electrode. The results of post-test micrographic analyses of the Au cathode are also presented. An attempt is then made to project from the experimental results to some relevant conclusions pertaining to a gold cathode in a practical alkali metal - carbon dioxide cell.
Author
Gold; Cathodes; Electrochemical Cells; High Temperature Tests

20040070740 Aerospace Corp., El Segundo, CA, USA
The Effects of Platinum on Nickel Electrodes in Nickel Hydrogen Cells
Zimmerman, Albert H.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 9; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The hydrogen electrode in the NiH2 cells consists of a platinum catalyst that is in contact with the cell electrolyte. Typically this platinum catalyst electrode is at a reducing potential where the platinum is thermodynamically stable in the metallic state. However, conditions can arise in the nickel hydrogen cell where the voltage of the platinum catalyst electrode rises to the highly oxidizing potential of the nickel electrode, whereupon the Pt metal is unstable relative to platinum oxide. Since platinum oxide has some solubility in alkaline electrolyte, dissolved platinum species can conceivably migrate to, and interact with, the nickel electrode. This condition has been observed in several nickel hydrogen cells from the Hubble Space Telescope and from military programs. It must be pointed out that in these cases, cell performance was improved relative to cells that did not display this condition. with the nickel electrode during cell storage. Typically, in these cells there was an indication of a nickel precharge condition as well. This is not fully unexpected, since with a nickel precharge, cell storage at low cell voltages will drive the platinum catalyst electrode to the nickel electrode voltage. Chemical analysis of nickel electrodes from these cells indicated significant amounts of a platinum containing oxide that also seemed to be associated with large amounts of nickel and cobalt. Electrochemical Voltage Spectroscopic (EVS) analysis of these nickel electrodes revealed an anomalous material having a reduction potential of 0.16 volts (vs. Hg/HgO in 31% KOH).
Author (revised)
Platinum; Electrodes; Nickel Hydrogen Batteries; Nickel

20040070751 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Advances In Li-TiS2 Cell Techno1ogy
Surampudi, S.; Shen, D. H.; Huang, C.-K.; Deligiannis, F.; Attia, A. I.; Halpert, G.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 51; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

JPL is involved in a NASA sponsored program to develop ambient temperature secondary Lithium - Titanium Disulfide Cells for future space missions. After several years of research on various lithium systems, the Li-TiS2 system was selected for development in view of its practically realizable high specific energy. In the last two years, the efforts were focused on improving the cycle life of the system and optimizing the cell design. A number of approaches, such as the use of mixed solvent electrolytes, the use of alternate anode materials, the operation of cells at low temperature, and the cycling of cells under optimized voltage limits, are examined to improve cycle life performance of this system. Cycling studies in small 150 mAh cell have identified 1.5 M LiAsF6/2-MeTHF, 1.5 M LiAsF6/EC+2-eTHF, and 1.5 M LiAsF6/THF+2-MeTHF+2-MeF as promising electrolytes for Li-TiS2 cells. Li-Al and Li-C were selected for further assessment as candidate anode materials after a detailed theoretical and experimental evaluation. Cycling of the cells at low temperature did not result in improving the cycle life of the cells. Charge and discharge voltage limits were found to have significant influence on the cycle life of the cells activated with 1.5 M LiAsF6/THF+2-MeTHF+2-MeF electrolyte. The influence of design variables, such as ratio of electrode capacity, quantity of electrolyte, pack tightness, cell configuration, etc., on the cycle life performance are being examined as a part of the design optimization study. Spiral-wound 1 Ah cells fabricated for the design studies have completed more than 500 cycles at 50% DOD. This paper summarizes the advances made in the Li-TiS2 technology at JPL since 1989.
Author
Titanium; Disulfides; Technology Utilization; Lithium Batteries; Fabrication; Electrochemical Cells

20040070924 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ferroelectric Field Effect Transistor Model Using Partitioned Ferroelectric Layer and Partial Polarization
MacLeod, Todd C.; Ho, Fat D.; March 09, 2004; 1 pp.; In English; 16th International Symposium on Integrated Ferroelectrics, 8 Apr. 2004, Gyeonglu, Korea, Republic of
Contract(s)/Grant(s): 101-15-63; No Copyright; Avail: Other Sources; Abstract Only

A model of an n-channel ferroelectric field effect transistor has been developed based on both theoretical and empirical data. The model is based on an existing model that incorporates partitioning of the ferroelectric layer to calculate the polarization within the ferroelectric material. The model incorporates several new aspects that are useful to the user. It takes into account the effect of a non-saturating gate voltage only partially polarizing the ferroelectric material based on the existing remnant polarization. The model also incorporates the decay of the remnant polarization based on the time history of the FFET. A gate pulse of a specific voltage; will not put the ferroelectric material into a single amount of polarization for that voltage, but instead vary with previous state of the material and the time since the last change to the gate voltage. The model also utilizes data from FFETs made from different types of ferroelectric materials to allow the user just to input the material being used and not recreate the entire model. The model also allows the user to input the quality of the ferroelectric material being used. The ferroelectric material quality can go from a theoretical perfect material with little loss and no decay to a less than perfect material with remnant losses and decay. This model is designed to be used by people who need to predict the external characteristics of a FFET before the time and expense of design and fabrication. It also allows the parametric evaluation of quality of the ferroelectric film on the overall performance of the transistor.
Author
Ferroelectric Materials; Field Effect Transistors; Models; Fabrication

20040071065 Lockheed Martin Corp., Syracuse, NY, USA
Thermophotovoltaic Arrays for Electrical Power Generation
Nov. 2003; 14 pp.; In English
Report No.(s): DE2004-822278; LM-03K129; No Copyright; Avail: Department of Energy Information Bridge

Sarnoff has designed an integrated array of thermophotovoltaic (TPV) cells based on the In(Al)GaAsSb/GaSb materials system. These arrays will be used in a system to generate electrical power from a radioisotope heat source that radiates at temperatures from 700 to 1000 C. Two arrays sandwich the slab heat source and will be connected in series to build voltage. Between the arrays and the heat source is a spectral control filter that transmits above-bandgap radiation and reflects below-bandgap radiation. The goal is to generate 5 mW of electrical power at 3 V from a 700 C radiant source. Sarnoff is a leader in antimonide-based TPV cell development. InGaAsSb cells with a bandgap of 0.53 eV have operated at system conversion efficiencies greater than 17%. The system included a front-surface filter, and a 905 C radiation source. The cells were grown via organo-metallic vapor-phase epitaxy. Sarnoff will bring this experience to bear on the proposed project. The authors first describe array and cell architecture. They then present calculated results showing that about 80 mW of power can be obtained from a 700 C radiator. Using a conservative array design, a 5-V output is possible.
NTIS
Photovoltaic Cells; Electric Power; Arrays

20040071095 Helsinki Univ. of Technology, Espoo, Finland
Artificial Neural Network Based RF-Model Generator-Version 0.2
Roos, J.; Sengor, N. S.; Pohjala, A.; 2003; 32 pp.; In English
Report No.(s): PB2004-105756; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the development, implementation, and usage of an Artificial Neural Network (ANN) based RF-model generator. Once the user has provided appropriate measurement or simulation data describing the behavior of an RF component, the model generator trains the ANN, resulting in an S-parameter or equivalent-circuit model for the RF component. The ANN-based RF-model generator has been implemented using the flexible input language of APLAC circuit simulation and design tool. Therefore, the existing optimization methods of APLAC can be directly utilized in ANN training. The final RF model obtained can be immediately used in any APLAC simulation.
NTIS
Neural Nets; Radio Frequencies

20040071100 Helsinki Univ. of Technology, Espoo, Finland
Parallel Processing in APLAC. Part A: DC and Transient Analyses
Honkala, M.; 2003; 26 pp.; In English
Report No.(s): PB2004-105755; No Copyright; Avail: CASI; A03, Hardcopy

During the circuit design process, there is a need to perform computationally demanding numerical simulations to verify the functionality of the circuit under consideration. One of the most effective ways to reduce the computing time is to use parallel processing. The parallel DC and transient analyses based on hierarchical analysis are described. The analyses have been implemented in APLAC using message passing software. Simulation examples are presented to show the efficiency of the parallelization.
NTIS
Computerized Simulation; Computer Aided Design; Parallel Processing (Computers); Object-Oriented Programming

20040073471 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Chip and Pixel Qualification Methodology on Imaging Sensors
Chen, Yuan; Guertin, Steven M.; Petkov, Mihail; Nguyen, Duc N.; Novak, Frank; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NCC1-02043; 23-762-45-G6
Report No.(s): NASA/CR-2003-212167; No Copyright; Avail: CASI; A01, Hardcopy
This paper presents a qualification methodology on imaging sensors. In addition to overall chip reliability characterization based on sensor s overall figure of merit, such as Dark Rate, Linearity, Dark Current Non-Uniformity, Fixed Pattern Noise and Photon Response Non-Uniformity, a simulation technique is proposed and used to project pixel reliability. The projected pixel reliability is directly related to imaging quality and provides additional sensor reliability information and performance control.
Author
Pixels; Methodology; Imaging Techniques; Sensors; Chips (Electronics)

20040073538 Rensselaer Polytechnic Inst., Troy, NY
Free-Space Imaging Technology For THz Beams
Zhang, X. C.; Sep. 5, 2003; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0333
Report No.(s): AD-A422289; ARO-40154.21-PH; No Copyright; Avail: CASI; A02, Hardcopy
Under the support from ARO (DAAD19-99-1-0333), we have obtained three major achievements, including 1 dynamic aperture for THz wave microscopic imaging (see annual report 2001), 2 using THz wave for chemical & biological sensing activities (see annual report 2002), and 3 the development of the pulsed tomographic imaging technology. In this final report, I present the recent development of our free-space THz wave imaging and its application. This report gives an overview of our ARO supported THz tomographic imaging project and its related science and technology.
DTIC
Imaging Techniques; Laser Beams

20040073547 Naval Postgraduate School, Monterey, CA
Broadband Counter-Wound Helix Antenna for Land Mine Detection
Shivandas, Dilipkumar; Mar. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422326; No Copyright; Avail: CASI; A06, Hardcopy
Ground penetrating radars (GPRs), also known as subsurface radars, are used in many applications including detection of land mines and unexploded ordnance (UXO). Despite significant long-term investment in GPRs for mine and UXO detection, it remains true that no GPR system that meets operational requirements has yet been fielded; however, recent advances in several mine detection radars under development have produced significant improvements in detection performance and false-alarm mitigation over what was achievable only a few years ago. This research examines the suitability of modeling helical antennas to achieve a broadband characteristic for GPR implementation. Although the two-arm counter-wound helix provides the required spot illumination, it is expected that more arms may have to be added to reduce the radiation in the back direction and to match the input impedance to the feed line. Microwave Design Studio (MDS) has been used extensively to simulate the broadband characteristics of the helical antenna. An overall design strategy is outlined, together with a more detailed treatment of the ground penetrating radar subsystems and topics that are relevant to effective subsurface radar operation. These include soil characterization, the choice of the frequency of operation, as well as the design and construction of suitable helical antennas. Finally, a new antenna structure called the counter-wound quadrifilar helical antenna (CQHA), which is suitable for subsurface radar applications, is examined. The counter-wound quadrifilar helical antenna has a broad bandwidth and a linear polarization with a controllable plane of polarization from a planar geometry.
DTIC
Broadband; Ground Penetrating Radar; Helical Antennas; Mine Detectors

20040073555 State Univ. of New York, Stony Brook, NY

Study of Electron Relaxation Processes in Intersubband Laser Heterostructures

Belenky, G.; Kisin, M.; Suchalkin, S.; Luryi, S.; Mar. 15, 2004; 14 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0423

Report No.(s): AD-A422347; ARO-39792.14-EL; No Copyright; Avail: CASI; A03, Hardcopy

Comprehensive experimental and theoretical study of the electron relaxation processes responsible for the depopulation of the lower lasing slates in intersubband and interhand laser heterostructures has been accomplished. In theory, LO-phonon assisted relaxation has been given special attention due to the high impact on the laser gain and temperature performance. We showed that in type-II laser heterostructures LO phonon assisted depopulation of the lower lasing slates is more efficient than corresponding interband tunneling process. We suggested type-II intersubband laser design with phonon-assisted depopulation and lower lasing level located near the upper edge of the heterostructure leaky window, where direct interband tunneling depopulation is inefficient. This design is beneficial for the laser performance providing the highest value of the matrix element for intrawell optical lasing transition and simultaneously preventing thermal backfilling of the lower lasing states. We also proposed a piezo-acoustic DFB QCL tunable in a wide wavelength range, which is especially important for spectroscopic applications of the quantum cascade lasers. Experimental program was focused on the study of temperature dependence of the optical gain and loss which is the most important factors for laser high-temperature operation. Special measurement technique has been developed for MIR type- II lasers which allows gain and loss spectra analysis in wide temperature range. Heat removal and hole leakage processes were also studied using MQW InP-based laser and laser array heterostructures.

DTIC

Lasers; Semiconductor Lasers

20040073603 Naval Research Lab., Washington, DC

Temporally Resolved Langmuir Probe Measurements in LAPPS

Leonhardt, Darrin; Amatucci, WIlliam; Gatling, George; Apr. 12, 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422457; NRL/MR/6750--04-8761; No Copyright; Avail: CASI; A03, Hardcopy

Electron beams efficiently ionize and dissociate gas, to form low temperature (<1.5 eV) high-density (1O(to the 10)-lO(to the 12)cm(to the -3) plasmas with low internal fields. These plasma sources have culminated in LAPPS, NRL's Large Area Plasma Processing System for surface modification of materials. Single Langmuir probes were constructed and used to determine global plasma parameters (electron temperature, density, and plasma potential) in modulated plasmas generated by high-energy (2 keV) electron beams. This work describes in detail the construction of probes, applications of probes in modulated systems and magnetic fields, data acquisition, and data analysis used in the study of electron beam generated plasmas.

DTIC

Electrostatic Probes; Plasmas (Physics)

20040073687 Agile Materials and Technologies, Inc., Goleta, CA

Thin-Film Phase Shifters

Elsass, Chris; Sep. 9, 2003; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-C-0100

Report No.(s): AD-A422587; ARO-41271.1-MS; No Copyright; Avail: CASI; A02, Hardcopy

This work has concentrated on developing thin-film tunable dielectric technology towards commercial viability for phase-shifters. Agile's varactor and phase shifter modeling has demonstrated the potential for this technology to provide low loss phase shifters utilizing Barium Strontium Titanate (BST) as the tunable dielectric material. Initial work involved fabrication of parallel plate capacitors as test structures which demonstrated the high quality of the BST films. Prototype phase-shifters utilizing such films were successfully demonstrated and issues such as intermodulation distortion (IMD) were explored and quantified in terms of design parameters. This technology was also compared with alternatives such as MEMS and GaAs MMICs. Specifically, the tradeoff between control voltage and performance variables such as IMD, power handling, and phase noise was explored and tabulated for the various approaches. Agile's varactors technology enables low cost, low-loss phase shifters for DOD and commercial applications.

DTIC

Barium Titanates; Strontium Titanates; Thin Films

20040073702 Trex Enterprises Corp., San Diego, CA

Pupil Plane Array Based Millimeter-Wave Imaging Radiometer

Clark, Stuart; Lovberg, John; Kolinko, Vladimir; Martin, Chris; McCoy, John; Apr. 2004; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-C-0154; Proj-CWDP

Report No.(s): AD-A422603; AFRL-IF-RS-TR-2004-95; No Copyright; Avail: CASI; A03, Hardcopy

The work performed under this contract was related to the testing and procurement of the phase and, in particular, frequency processor boards that are needed in Trex Enterprises' second generation real-time passive millimeter- wave camera (PMC). In addition, an imaging demonstration performed under this contract demonstrated the feasibility of building such a PMC and that it is possible to obtain near diffraction limited imagery. The Trex Enterprises Corporation's PMC imager uses a patented flat panel antenna and millimeter-wave signal processors to enable a 30 by 20 degree instantaneous field of view true real time (30 Hz) sensor with a 2 Kelvin instantaneous thermal sensitivity, to be built in a highly compact package suitable for concealed weapons detection. The millimeter-wave (MMW) portion of the electromagnetic spectrum is chosen as it offers a good balance between clothing penetration as well as resolution and, therefore, allows compact, practical sized systems suitable for law enforcement to be built. By measuring only natural thermal emissions (from living beings and inanimate objects), and reflections of natural ambient sources (such as the cold sky), passive millimeter-wave imaging is intrinsically safe and suitable for imaging people.

DTIC

Focal Plane Devices; Microwave Imagery; Millimeter Waves; Pupils; Radiometers

20040073709 Arizona Univ., Tucson, AZ

Joint Services Optics Program Reasearch in the Optical Sciences

Wyant, James C.; Oct. 21, 2003; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-1-0359

Report No.(s): AD-A422613; ARO-41225.1-PH; No Copyright; Avail: CASI; A03, Hardcopy

This report describes research on eight different projects ranging from fundamental quantum optics to optical engineering. Topics discussed include me following: Collisional dark states and matter wave transparency, high power diffraction limited surface emitting flared lasers, qubits and quantum gates with laser trapped atoms, radiatively perfect quantum dot, 3D semiconductor nanocavities, excitonic and biexcitonic nonlinear optical processes in semiconductor quantum wells, blue lasers and near field techniques for ultra high capacity optical data storage, and an agile complete imaging polarimeter.

DTIC

Quantum Optics

20040073718 North Carolina State Univ., Raleigh, NC

AlGaN/InGaN Nitride Based Modulation Doped Field Effect Transistor

Blair, S. M.; Nov. 2003; 7 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0293

Report No.(s): AD-A422632; ARO-40003.1-EL; No Copyright; Avail: CASI; A02, Hardcopy

The goal of the proposed work is to investigate the potential advantages of the InGaN channel as a host of the 2DEG and to address the material related problems facing this ternary alloy in the AlGaN/InGaN MODFET structure. The impact on addressing these materials issues on the AlGaN/InGaN MODFET device performance will be systematically investigated and compared with the corresponding GaN 2DEG. There are several issues that were investigated, that are related to the properties of InGaN and AlGaInN material systems. These properties are concerned with the strain and its effects on the band structure, recombination process, band offset and piezoelectric fields and 2DEG.

DTIC

Aluminum Nitrides; Doped Crystals; Field Effect Transistors; Gallium Nitrides; Modulation; Nitrides; Quantum Dots

20040073719 State Univ. of New York, Stony Brook, NY

Superconducting Qubits for Quantum Computation

Lukens, James; Nov. 30, 2003; 8 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0341

Report No.(s): AD-A422633; ARO-40313.7-PH-QC; No Copyright; Avail: CASI; A02, Hardcopy

Superconducting Quantum Interference Devices (SQUIDs) have been studied to determine their suitability for use as

qubits in quantum computers. It has been demonstrated, using spectroscopic measurements, that it is possible to place such a SQUID in a coherent superposition of 0 and 1 quantum states as required for use as a qubit. A transformer for the controllable coupling of flux qubits (one of the key components needed for a quantum computer) has been developed. Theoretical techniques for the analysis of experimental, multilevel qubit systems have been developed. Analysis has been done for Aharonov-Casher qubits that allow access to all key variables and for quantum-limited JJ comparator readouts. The theory of linear detection has been extended to quadratic detectors. Our fabrication capability has been upgraded to yield high-quality Nb qubits (less than 1 pA subgap leakage current at 0.3 K) with a 1 week turn around.
DTIC
Quantum Computation; Quantum Electronics; Superconductivity

20040073734 Purdue Univ., West Lafayette, IN
Ultrafast Optical Encryption and Waveform Recognition Using Space-Time Optical Engineering
Weiner, Andrew M.; Jan. 27, 2004; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0497
Report No.(s): AD-A422651; ARO-41232.10-EL; No Copyright; Avail: CASI; A02, Hardcopy

Our overall objective is to demonstrate powerful new signal processing functionalities for ultrafast optical signals, with an emphasis on proof-of-concept experiments of new space-time (parallel-serial) optical processing methods. A key goal is to develop efficient methods for parallel-serial conversion of ultrafast optical signals, with potential application as an enabler for subsystems performing digital logic operations on ultrafast optical bit streams, especially encryption and temporal pattern matching operations. In particular, we have focused on research on subsystems for: (1) space-to-time conversion (or parallel-to-serial conversion) for generating ultrafast optical output pulse sequences corresponding to parallel (electronic) input data, and (2) time-to-space conversion (or serial-to-parallel conversion) for demultiplexing ultrafast time-domain optical data. In addition, we also obtained significant new results by applying our space-to-time converter for millimeter-wave arbitrary waveform generation. These results, not anticipated at the time of our proposal, open opportunities for generation of user defined, broadband electromagnetic signals at frequencies more than an order beyond the fastest commercial electronic arbitrary waveform generation instrumentation.
DTIC
Waveforms

20040073776 Naval Surface Warfare Center, Bethesda, MD
Bandwidth Limits and Other Considerations for Monostatic RCS Reduction by Virtual Shaping
Swandic, J. R.; Jan. 2004; 24 pp.; In English
Report No.(s): AD-A422729; NSWCCD-84-TR-2004/04; No Copyright; Avail: CASI; A03, Hardcopy

This work addresses some major issues in the adaptation and application of microstrip patch antenna and reflectarray technology to radar cross section reduction by virtual shaping. We define virtual shaping to be any technique used to cause the shape and orientation of an object as it affects a scattered radar signal to differ from the actual physical shape and orientation of the object. This is accomplished by introducing a linear phase gradient on the incident wave as it is scattered from various parts of the target surface. By this method a vertical surface can be made to appear to radar to be skewed from the vertical as is done in conventional shaping for radar cross section reduction. Virtual shaping has the potential to reduce the negative impacts imposed by conventional shaping on other ship design considerations such as hydrodynamics, stability, payload, and arrangements while maintaining or enhancing the signature control aspects. Microstrip patch antenna and reflectarray technologies offer a theoretical and practical basis for development of virtual shaping techniques; however, the goals of antenna design and the radiation characteristics of reflectarrays when applied to conventional uses of these technologies differ from those considerations when applied to signature control and radar cross section reduction. The major issues of these technologies that become more critical when applied to virtual shaping include (1) limited bandwidth, (2) high sidelobes, and (3) reflections from exposed dielectric surfaces. This paper summarizes efforts that have the potential to extend these technologies to virtual shaping.
DTIC
Bandwidth; Radar Cross Sections; Radar Echoes

20040073779 California Univ., Santa Barbara, CA
Uncooled RF Electronics for Airborne Radar
Mishra, Umesh K.; Aug. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0143
Report No.(s): AD-A422739; AFRL-SR-AR-TR-03-0372; No Copyright; Avail: CASI; A03, Hardcopy

Improvements to the AlGaN/GaN HEMT device technology was studied at the epitaxial level by MOCVD, aimed at enhancing efficiency and linearity. A number of projects were performed under the program, including reducing the contact resistance, introducing a type of contacts that permits very short access regions, introducing hot electron launching into the channel, and double channel structures. Basic research in support of these projects was also performed, including studies of non-planar selective area growth, polarization effects in AlGaN/CaN heterostructures, and doping of GaN with Fe and oxygen. DTIC

Airborne Radar; Aluminum Nitrides; Gallium Nitrides; High Electron Mobility Transistors; Radar Equipment; Radio Frequencies

20040074145 National Defense Univ., Washington, DC

Defense Horizons. Number 8, March 2002. Small Security: Nanotechnology and Future Defense

Petersen, John L.; Egan, Dennis M.; Mar. 2002; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422476; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Horizon; Military Technology; Nanotechnology

20040074156 National Defense Univ., Washington, DC

Defense Horizons. Number 30, July 2003. Moore's Law: A Department of Defense Perspective

Borsuk, Gerald M.; Coffey, Timothy; Jul. 2003; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422393; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Defense Program; Electronic Equipment; Horizon; Technology Assessment

34
FLUID MECHANICS AND THERMODYNAMICS

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

20040068125 NASA Marshall Space Flight Center, Huntsville, AL, USA

Thermostructural Analysis of Carbon Cloth Phenolics "Ply Lifting" and Correlation to LHMEL Test Results

Clayton, Louie; 2004; 1 pp.; In English; JANNAF 14th Nondestructuve Evaluation, 30 Mar. - 1 apr. 2004, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper provides a discussion of the history of Carbon Cloth Phenolic (CCP) ply lifting in the Redesigned Solid Rocket Motor (RSRM) Program, a brief presentation of theoretical methods used for analytical evaluation, and results of parametric analyses of CCP material subject to test conditions of the Laser Hardened Material Evaluation Laboratory. CCP ply lift can occur in regions of the RSRM nozzle where ply angle to flame surface is generally less than about 20 degrees. There is a heat rate dependence on likelihood and severity of the condition with the higher heating rates generally producing more ply lift. The event occurs in-depth, near the heated surface, where the load necessary to mechanically separate the CCP plies is produced by the initial stages of pyrolysis gas generation due to the thermal decomposition of the phenolic resin matrix. Due to the shallow lay-up angle of the composite, normal components of the indepth mechanical load, due to "pore pressure", are imparted primarily as a cross-ply tensile force on the interlaminar ply boundaries. Tensile capability in the cross-ply (out of plane) direction is solely determined by the matrix material capability. The elevated temperature matrix material capabilities are overcome by pressure induced mechanical normal stress and ply-lift occurs. A theoretical model used for CCP in-depth temperature, pressure, and normal stress prediction, based on first principles, is briefly discussed followed by a parametric evaluation of response variables subject to boundary conditions typical of on-going test programs at the LHMEL facility. Model response demonstrates general trends observed in test and provides insight into the interactivity of material properties and constitutive relationships.

Author

Temperature Effects; Phenolic Resins; Solid Propellant Rocket Engines; Structural Analysis; Carbon Fibers; Composite Materials; Thermal Decomposition

20040068170 NASA Ames Research Center, Moffett Field, CA, USA

CFD Support for STS-107 Ascent Investigation

Rogers, Stuart E.; Gomez, Reynaldo J.; Vicker, Darby; Aftosmis, Michael J.; Meakin, Robert; Chan, William M.; Murman, Scott; 2004; 24 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan. 2004, Reno, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

The research described in this viewgraph presentation investigates the ascent of STS-107 and foam-debris impact, and contributes to understanding of the STS-107 accident using CFD tools. The goals of the research are to: 1) Quantify loads on foam bipod ramp during ascent; 2) Provide steady-state flow-fields to debris-transport simulations; 3) Simulate flight of foam debris using unsteady six-degree-of-freedom calculations; 4) Provide estimates of foam mass, velocity, and impact angle which correlate with video and film evidence.

Derived from text

Computational Fluid Dynamics; Columbia (Orbiter); Accident Investigation

20040068181 NASA Ames Research Center, Moffett Field, CA, USA

Comparison of Artificial Compressibility Methods

Kiris, Cetin; Housman, Jeffrey; Kwak, Dochan; 2003; 2 pp.; In English; ICCFD3 Conference, 12-16 Jul. 2004, Toronto, Canada; No Copyright; Avail: CASI; A01, Hardcopy

Various artificial compressibility methods for calculating three-dimensional, steady and unsteady, laminar and turbulent, incompressible Navier-Stokes equations are compared in this work. Each method is described in detail along with appropriate physical and numerical boundary conditions. Analysis of well-posedness and numerical solutions to test problems for each method are provided. A comparison based on convergence behavior, accuracy, stability and robustness is used to establish the relative positive and negative characteristics of each method.

Author

Methodology; Numerical Analysis; Robustness (Mathematics); Incompressible Flow

20040068185 NASA Ames Research Center, Moffett Field, CA, USA

Automated Parameter Studies Using a Cartesian Method

Murman, Scott M.; Aftosimis, Michael J.; Nemec, Marian; 2004; 13 pp.; In English; 22nd AIAA Applied Aerodynamics Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A03, Hardcopy

Computational Fluid Dynamics (CFD) is now routinely used to analyze isolated points in a design space by performing steady-state computations at fixed flight conditions (Mach number, angle of attack, sideslip), for a fixed geometric configuration of interest. This "point analysis" provides detailed information about the flowfield, which aides an engineer in understanding, or correcting, a design. A point analysis is typically performed using high fidelity methods at a handful of critical design points, e.g. a cruise or landing configuration, or a sample of points along a flight trajectory.

Author

Computational Fluid Dynamics; Mach Number; Flow Distribution; Flight Conditions

20040068211 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Arrays of High Performance Thermal Detectors

Moseley, Harvey; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-15; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermal detectors have historically been the sensors of choice for applications where photoconductive or photovoltaic detectors are unavailable. While they have the advantage of broad wavelength coverage, a primary disadvantage has been sensitivity; at a given operating temperature, bolometers are typically much less sensitive than photodetectors. The development of cryogenic bolometers has resulted in thermal detectors which can reach fundamental sensitivity limits. When operated at temperatures below 0.3 K these devices can provide background-limited sensitivity for cryogenic imaging and spectroscopy in space. The past decade has seen a rapid growth in sensitivity and array format in cryogenic bolometers. Micromachining technology, combined with advances in superconducting electronics, provides a strong technological base for future developments. I will describe the present state of development of low-temperature thermal detectors, and the possible extension of this technology to higher temperature operation.

Author

Imaging Techniques; Photoconductivity; Superconductivity; Bolometers; Cryogenics

20040068248 Lawrence Livermore National Lab., Livermore, CA

Acoustically-Driven Microfluidic Systems

Wang, A. W.; Benett, E. J.; Tarte, L. R.; Jun. 23, 2000; 10 pp.; In English

Report No.(s): DE2004-15006374; UCRL-JC-138305; No Copyright; Avail: Department of Energy Information Bridge

We have demonstrated a non-contact method of concentrating and mixing particles in a plastic microfluidic chamber employing acoustic radiation pressure. A flaw cell package has also been designed that integrates liquid sample interconnects, electrical contacts and a removable sample chamber. Experiments were performed on 1, 3, 6, and 10(micro)m polystyrene beads. Increased antibody binding to a solid-phase substrate was observed in the presence of acoustic mixing due to improve mass transport.

NTIS

Acoustic Emission; Sound Waves; Mass Transfer

20040068252 Lockheed Martin Corp., Syracuse, NY, USA

Methods of Measuring Lock-In Strength and their Application to the Case of Flow over a Cavity Locking into a Single Side Branch Resonator

Mendelson, R. S.; Apr. 2003; In English

Report No.(s): DE2004-821511; LM-03K030; No Copyright; Avail: National Technical Information Service (NTIS)

Lock-in is a non-linear interaction between a flow induced noise source and a resonator when their respective frequencies are near each other. Lock-in has been reported under many different labels and for many different applications. There is a need however for a consistent community wide method to measure the strength of lock-in so that data from different tests and different source/resonator combinations can be compared. This paper discusses three methods for measuring lock-in strength. The first, Resonant Response Method, (RRM) subtracts (in the decibel scale) the linear modal response of the resonator to broadband (BB) flow noise from the resonant response when lock-in occurs. The second, Quality Factor Method (QFM) tracks the change in quality factor of the resonant response. The third defines the strength in terms of the difference between peak response and the local BB levels.

NTIS

Acoustics; Resonators

20040068370 Sverdrup Technology, Inc., Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Measuring Thermal Conductivity at LH2 Temperatures

Selvidge, Shawn; Watwood, Michael C.; [2004]; 1 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA

Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: Other Sources; Abstract Only

For many years, the National Institute of Standards and Technology (NIST) produced reference materials for materials testing. One such reference material was intended for use with a guarded hot plate apparatus designed to meet the requirements of ASTM C177-97, "Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus." This apparatus can be used to test materials in various gaseous environments from atmospheric pressure to a vacuum. It allows the thermal transmission properties of insulating materials to be measured from just above ambient temperature down to temperatures below liquid hydrogen. However, NIST did not generate data below 77 K temperature for the reference material in question. This paper describes a test method used at NASA's Marshall Space Flight Center (MSFC) to optimize thermal conductivity measurements during the development of thermal protection systems. The test method extends the usability range of this reference material by generating data at temperatures lower than 77 K. Information provided by this test is discussed, as are the capabilities of the MSFC Hydrogen Test Facility, where advanced methods for materials testing are routinely developed and optimized in support of aerospace applications.

Author

Liquid Hydrogen; Thermal Conductivity; Temperature Distribution; Aerospace Engineering

20040070710 NASA Ames Research Center, Moffett Field, CA, USA

Adaptive Low Dissipative High Order Filter Methods for Multiscale MHD Flows

Yee, H. C.; Sjoegreen, Bjoern; January 13, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Adaptive low-dissipative high order filter finite difference methods for long time wave propagation of shock/turbulence/combustion compressible viscous MHD flows has been constructed. Several variants of the filter approach that cater to

different flow types are proposed. These filters provide a natural and efficient way for the minimization of the divergence of the magnetic field [divergence of B] numerical error in the sense that no standard divergence cleaning is required. For certain 2-D MHD test problems, divergence free preservation of the magnetic fields of these filter schemes has been achieved.
Author
Magnetohydrodynamic Flow; Adaptive Control; Dissipation; Two Dimensional Flow; Multiscale Models

20040070725 NASA Glenn Research Center, Cleveland, OH, USA
Semi-Empirical Modeling of SLD Physics
Wright, William B.; Potapczuk, Mark G.; April 2004; 23 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-728-41-17
Report No.(s): NASA/TM-2004-212916; AIAA Paper 2004-0412; E-14352; No Copyright; Avail: CASI; A03, Hardcopy

The effects of supercooled large droplets (SLD) in icing have been an area of much interest in recent years. As part of this effort, the assumptions used for ice accretion software have been reviewed. A literature search was performed to determine advances from other areas of research that could be readily incorporated. Experimental data in the SLD regime was also analyzed. A semi-empirical computational model is presented which incorporates first order physical effects of large droplet phenomena into icing software. This model has been added to the LEWICE software. Comparisons are then made to SLD experimental data that has been collected to date. Results will be presented for the comparison of water collection efficiency, ice shape and ice mass.
Author
Drop Size; Supercooling; Mathematical Models; Semiempirical Equations; Computer Programs; Fluid Dynamics

20040070756 QSS Group, Inc., Cleveland, OH, USA
An Evaluation of Jet Impingement Heat Transfer Correlations for Piccolo Tube Application
Bond, Thomas, Technical Monitor; Wright, William B.; April 2004; 17 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): NAG3-00145; WBS 22-728-41-17
Report No.(s): NASA/CR-2004-212917; AIAA Paper 2004-0062; E-14355; No Copyright; Avail: CASI; A03, Hardcopy

Impinging jets have been used for a wide variety of applications where high rates of heat transfer are desired. This report will present a review of heat transfer correlations that have been published. The correlations were then added to the LEWICE software to evaluate the applicability of these correlations to a piccolo tube anti-icing system. The results of this analysis were then compared quantitatively to test results on a representative piccolo tube system.
Author
Jet Impingement; Conductive Heat Transfer; Thermodynamics; Mathematical Models

20040070765 NASA Glenn Research Center, Cleveland, OH, USA
Jet Noise Source Localization Using Linear Phased Array
Agboola, Ferni A.; Bridges, James; April 2004; 18 pp.; In English
Contract(s)/Grant(s): WBS 22-781-30-27
Report No.(s): NASA/TM-2004-213041; E-14478; No Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to further clarify the interpretation and application of linear phased array microphone results, for localizing aeroacoustics sources in aircraft exhaust jet. Two model engine nozzles were tested at varying power cycles with the array setup parallel to the jet axis. The array position was varied as well to determine best location for the array. The results showed that it is possible to resolve jet noise sources with bypass and other components separation. The results also showed that a focused near field image provides more realistic noise source localization at low to mid frequencies.
Author
Jet Aircraft Noise; Linear Arrays; Phased Arrays; Aeroacoustics; Position (Location)

20040070768 Lockheed Martin Corp., USA
Software for Refining or Coarsening Computational Grids
Daines, Russell; Woods, Jody; August 27, 2002; 1 pp.; In English
Report No.(s): NASA/NP-2002-10-00035-SSC; SSC-00167-SM; No Copyright; Avail: CASI; A01, Hardcopy

A computer program performs calculations for refinement or coarsening of computational grids of the type called

"structured" (signifying that they are geometrically regular and/or are specified by relatively simple algebraic expressions). This program is designed to facilitate analysis of the numerical effects of changing structured grids utilized in computational fluid dynamics (CFD) software. Unlike prior grid-refinement and -coarsening programs, this program is not limited to doubling or halving: the user can specify any refinement or coarsening ratio, which can have a noninteger value. In addition to this ratio, the program accepts, as input, a grid file and the associated restart file, which is basically a file containing the most recent iteration of flow-field variables computed on the grid. The program then refines or coarsens the grid as specified, while maintaining the geometry and the stretching characteristics of the original grid. The program can interpolate from the input restart file to create a restart file for the refined or coarsened grid. The program provides a graphical user interface that facilitates the entry of input data for the grid-generation and restart-interpolation routines.
Author
Computational Fluid Dynamics; Computational Grids; Computer Programs; Interpolation; Multigrid Methods

20040070770 NASA Glenn Research Center, Cleveland, OH, USA
Measurements of Infrared and Acoustic Source Distributions in Jet Plumes
Agboola, Femi A.; Bridges, James; Saiyed, Naseem; April 2004; 20 pp.; In English
Contract(s)/Grant(s): WBS 22-781-30-27
Report No.(s): NASA/TM-2004-213042; E-14479; No Copyright; Avail: CASI; A03, Hardcopy

The aim of this investigation was to use the linear phased array (LPA) microphones and infrared (IR) imaging to study the effects of advanced nozzle-mixing techniques on jet noise reduction. Several full-scale engine nozzles were tested at varying power cycles with the linear phased array setup parallel to the jet axis. The array consisted of 16 sparsely distributed microphones. The phased array microphone measurements were taken at a distance of 51.0 ft (15.5 m) from the jet axis, and the results were used to obtain relative overall sound pressure levels from one nozzle design to the other. The IR imaging system was used to acquire real-time dynamic thermal patterns of the exhaust jet from the nozzles tested. The IR camera measured the IR radiation from the nozzle exit to a distance of six fan diameters (X/D(sub FAN) = 6), along the jet plume axis. The images confirmed the expected jet plume mixing intensity, and the phased array results showed the differences in sound pressure level with respect to nozzle configurations. The results show the effects of changes in configurations to the exit nozzles on both the flows mixing patterns and radiant energy dissipation patterns. By comparing the results from these two measurements, a relationship between noise reduction and core/bypass flow mixing is demonstrated.
Author
Aeroacoustics; Jet Aircraft Noise; Infrared Imagery; Sound Generators; Nozzle Design; Rocket Exhaust; Noise Reduction

20040070776 NASA Glenn Research Center, Cleveland, OH, USA
Performance of Thermal Mass Flow Meters in a Variable Gravitational Environment
Brooker, John E.; Ruff, Gary A.; April 2004; 33 pp.; In English
Contract(s)/Grant(s): WBS 101-52-02
Report No.(s): NASA/TM-2004-213045; E-14482; No Copyright; Avail: CASI; A03, Hardcopy

The performance of five thermal mass flow meters, MKS Instruments 179A and 258C, Unit Instruments UFM-8100, Sierra Instruments 830L, and Hastings Instruments HFM-200, were tested on the KC-135 Reduced Gravity Aircraft in orthogonal, coparallel, and counterparallel orientations relative to gravity. Data was taken throughout the parabolic trajectory where the g-level varied from 0.01 to 1.8 times normal gravity. Each meter was calibrated in normal gravity in the orthogonal position prior to flight followed by ground testing at seven different flow conditions to establish a baseline operation. During the tests, the actual flow rate was measured independently using choked-flow orifices. Gravitational acceleration and attitude had a unique effect on the performance of each meter. All meters operated within acceptable limits at all gravity levels in the calibrated orthogonal position. However, when operated in other orientations, the deviations from the reference flow became substantial for several of the flow meters. Data analysis indicated that the greatest source of error was the effect of orientation, followed by the gravity level. This work emphasized that when operating thermal flow meters in a variable gravity environment, it is critical to orient the meter in the same direction relative to gravity in which it was calibrated. Unfortunately, there was no test in normal gravity that could predict the performance of a meter in reduced gravity. When operating in reduced gravity, all meters indicated within 5 percent of the full scale reading at all flow conditions and orientations.
Author
Flowmeters; Mass Flow; Flow Velocity; Buoyancy; Mathematical Models; Gravitational Effects

20040070802 QSS Group, Inc., Cleveland, OH, USA
EUPDF-II: An Eulerian Joint Scalar Monte Carlo PDF Module : User's Manual
Raju, M. S.; Liu, Nan-Suey, Technical Monitor; April 2004; 24 pp.; In English
Contract(s)/Grant(s): NAS3-00145; WBS 714-20-06
Report No.(s): NASA/CR-2004-213073; E-14549; No Copyright; Avail: CASI; A03, Hardcopy

EUPDF-II provides the solution for the species and temperature fields based on an evolution equation for PDF (Probability Density Function) and it is developed mainly for application with sprays, combustion, parallel computing, and unstructured grids. It is designed to be massively parallel and could easily be coupled with any existing gas-phase CFD and spray solvers. The solver accommodates the use of an unstructured mesh with mixed elements of either triangular, quadrilateral, and/or tetrahedral type. The manual provides the user with an understanding of the various models involved in the PDF formulation, its code structure and solution algorithm, and various other issues related to parallelization and its coupling with other solvers. The source code of EUPDF-II will be available with National Combustion Code (NCC) as a complete package.
Author
Monte Carlo Method; Probability Density Functions; Computational Fluid Dynamics; Euler Equations of Motion; Computer Programs; Modules; Sprayers; Combustion

20040070834 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Innovative, High-Pressure, Cryogenic Control Valve: Short Face-to-Face, Reduced Cost
Wilkes, Karlin; Larsen, Ed; McCourt, Jackson; [2004]; 1 pp.; In English
Report No.(s): NASA/NP-2002-05-00019; SSC-00159; No Copyright; Avail: CASI; A01, Hardcopy

A control valve that can throttle high pressure cryogenic fluid embodies several design features that distinguish it over conventional valves designed for similar applications. Field and design engineers worked together to create a valve that would simplify installation, trim changes, and maintenance, thus reducing overall cost. The seals and plug stem packing were designed to perform optimally in cryogenic temperature ranges. Unlike conventional high-pressure cryogenic valves, the trim size can be changed independent of the body. The design feature that provides flexibility for changing the trim is a split body. The body is divided into an upper and a lower section with the seat ring sandwiched in between. In order to maintain the plug stem packing at an acceptable sealing temperature during cryogenic service, heat-exchanging fins were added to the upper body section (see figure). The body is made of stainless steel.
Derived from text
Control Valves; Cost Reduction; Cryogenic Temperature; High Pressure

20040071073 NASA Marshall Space Flight Center, Huntsville, AL, USA
Comparison of SPHC Hydrocode Results with Penetration Equations and Results of Other Codes
Evans, Steven W.; Stallworth, Roderick; Stellingwerf, Robert F.; 2004; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, 19-24 Apr. 2004, Palm Springs, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

The SPHC hydrodynamic code was used to simulate impacts of spherical aluminum projectiles on a single-wall aluminum plate and on a generic Whipple shield. Simulations were carried out in two and three dimensions. Projectile speeds ranged from 2 kilometers per second to 10 kilometers per second for the single-wall runs, and from 3 kilometers per second to 40 kilometers per second for the Whipple shield runs. Spallation limit results of the single-wall simulations are compared with predictions from five standard penetration equations, and are shown to fall comfortably within the envelope of these analytical relations. Ballistic limit results of the Whipple shield simulations are compared with results from the AUTODYN-2D and PAM-SHOCK-3D codes presented in a paper at the Hypervelocity Impact Symposium 2000 and the Christiansen formulation of 2003.
Author
Hydrodynamics; Computerized Simulation; Mathematical Models; Penetration; Computer Programs; Hypervelocity Projectiles

20040071144 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
CFD Validation for Contaminant Transport in Aircraft Cabin Ventilation Flow Fields
Garner, Robert P.; Wong, Kwai L.; Ericson, Shawn C.; Baker, A. J.; Orzechowski, Joseph A.; April 2004; 9 pp.; In English
Report No.(s): DOT/FAA/AM-04/7; No Copyright; Avail: CASI; A02, Hardcopy

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

20040073179 NASA Dryden Flight Research Center, Edwards, CA, USA
Heat Shielding Characteristics and Thermostructural Performance of a Superalloy Honeycomb Sandwich Thermal Protection System (TPS)
Ko, William L.; May 2004; 45 pp.; In English
Contract(s)/Grant(s): WU 242-33-02-E8-23
Report No.(s): NASA/TP-2004-212024; H-2492; No Copyright; Avail: CASI; A03, Hardcopy

Heat-transfer, thermal bending, and mechanical buckling analyses have been performed on a superalloy "honeycomb" thermal protection system (TPS) for future hypersonic flight vehicles. The studies focus on the effect of honeycomb cell geometry on the TPS heat-shielding performance, honeycomb cell wall buckling characteristics, and the effect of boundary conditions on the TPS thermal bending behavior. The results of the study show that the heat-shielding performance of a TPS panel is very sensitive to change in honeycomb core depth, but insensitive to change in honeycomb cell cross-sectional shape. The thermal deformations and thermal stresses in the TPS panel are found to be very sensitive to the edge support conditions. Slight corrugation of the honeycomb cell walls can greatly increase their buckling strength.
Author
Heat Shielding; Thermal Protection; Thermal Stresses; Honeycomb Cores

20040073461 NASA Langley Research Center, Hampton, VA, USA
Characterization of Unsteady Flow Structures Near Leading-Edge Slat, Part 1, PIV Measurements
Jenkins, Luther N.; Khorrami, Mehdi R.; Choudhari, Meelan; [2004]; 15 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 23-781-10-10
Report No.(s): AIAA Paper 2004-2801; No Copyright; Avail: CASI; A03, Hardcopy

A comprehensive computational and experimental study has been performed at the NASA Langley Research Center as part of the Quiet Aircraft Technology (QAT) Program to investigate the unsteady flow near a leading-edge slat of a two-dimensional, high-lift system. This paper focuses on the experimental effort conducted in the NASA Langley Basic Aerodynamics Research Tunnel (BART) where Particle Image Velocimetry (PIV) data was acquired in the slat cove and at the slat trailing edge of a three-element, high-lift model at 4, 6, and 8 degrees angle of attack and a freestream Mach Number of 0.17. Instantaneous velocities obtained from PIV images are used to obtain mean and fluctuating components of velocity and vorticity. The data show the recirculation in the cove, reattachment of the shear layer on the slat lower surface, and discrete vortical structures within the shear layer emanating from the slat cusp and slat trailing edge. Detailed measurements are used to examine the shear layer formation at the slat cusp, vortex shedding at the slat trailing edge, and convection of vortical structures through the slat gap. Selected results are discussed and compared with unsteady, Reynolds-Averaged Navier-Stokes (URANS) computations for the same configuration in a companion paper by Khorrami, Choudhari, and Jenkins (2004). The

experimental dataset provides essential flow-field information for the validation of near-field inputs to noise prediction tools. Author

Unsteady Flow; Particle Image Velocimetry; Leading Edge Slats; Wind Tunnel Models; Aerodynamics; Characterization

20040073477 QSS Group, Inc., Cleveland, OH, USA

TopMaker: A Technique for Automatic Multi-Block Topology Generation Using the Medial Axis

Heidmann, James D., Technical Monitor; Rigby, David L.; April 2004; 16 pp.; In English; Fourth Joint Fluids Engineering Conference, 6-10 Jul. 2003, Honolulu, HI, USA

Contract(s)/Grant(s): NAS3-00145; WBS 22-714-09-11

Report No.(s): NASA/CR-2004-213044; FEDSM2003-45527; E-14481; No Copyright; Avail: CASI; A03, Hardcopy

A two-dimensional multi-block topology generation technique has been developed. Very general configurations are addressable by the technique. A configuration is defined by a collection of non-intersecting closed curves, which will be referred to as loops. More than a single loop implies that holes exist in the domain, which poses no problem. This technique requires only the medial vertices and the touch points that define each vertex. From the information about the medial vertices, the connectivity between medial vertices is generated. The physical shape of the medial edge is not required. By applying a few simple rules to each medial edge, the multiblock topology is generated with no user intervention required. The resulting topologies contain only the level of complexity dictated by the configurations. Grid lines remain attached to the boundary except at sharp concave turns where a change in index family is introduced as would be desired. Keeping grid lines attached to the boundary is especially important in the area of computational fluid dynamics where highly clustered grids are used near no-slip boundaries. This technique is simple and robust and can easily be incorporated into the overall grid generation process. Author

Grid Generation (Mathematics); Multiblock Grids; Topology; Computational Fluid Dynamics; Two Dimensional Models

20040073486 NASA Glenn Research Center, Cleveland, OH, USA

Predictions for the Effects of Free Stream Turbulence on Turbine Blade Heat Transfer

Boyle, Robert J.; Giel, Paul W.; Ames, Forrest E.; May 2004; 23 pp.; In English; Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria

Contract(s)/Grant(s): WBS 22-714-30-10

Report No.(s): NASA/TM-2004-213079; GT2004-54332; E-14555; No Copyright; Avail: CASI; A03, Hardcopy

An approach to predicting the effects of free stream turbulence on turbine vane and blade heat transfer is described. Four models for predicting the effects of free stream turbulence were in incorporated into a Navier-Stokes CFD analysis. Predictions were compared with experimental data in order to identify an appropriate model for use across a wide range of flow conditions. The analyses were compared with data from five vane geometries and from four rotor geometries. Each of these nine geometries had data for different Reynolds numbers. Comparisons were made for twenty four cases. Steady state calculations were done because all experimental data were obtained in steady state tests. High turbulence levels often result in suction surface transition upstream of the throat, while at low to moderate Reynolds numbers the pressure surface remains laminar. A two-dimensional analysis was used because the flow is predominately two-dimensional in the regions where free stream turbulence significantly augments surface heat transfer. Because the evaluation of models for predicting turbulence effects can be affected by other factors, the paper discusses modeling for transition, relaminarization, and near wall damping. Quantitative comparisons are given between the predictions and data.

Author

Computational Fluid Dynamics; Heat Transfer; Turbine Blades; Free Flow; Mathematical Models; Turbulence; Rotor Dynamics

20040073495 NASA Marshall Space Flight Center, Huntsville, AL, USA

An Overview of the Materials Science Research at the Marshall Space Flight Center Electrostatic Levitator Facility and Recent CDDF Efforts

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 17; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Containerless processing is an important tool for materials research. The freedom from a crucible allows processing of liquid materials in a metastable undercooled state, as well as allowing processing of high temperature and highly reactive melts. Electrostatic levitation (ESL) is a containerless method which provides a number of unique advantages, including the ability to process non-conducting materials, the ability to operate in ultra-high vacuum or at moderate gas pressure (approx.

= 5 atm), and the decoupling of positioning force from sample heating. ESL also has the potential to reduce internal flow velocities below those possible with electromagnetic, acoustic, or aero-acoustic techniques. In electrostatic levitation, the acceleration of gravity (or residual acceleration in reduced gravity) is opposed by the action of an applied electric field on a charged sample. Microgravity allows electrostatic levitation to work even more effectively. The ESL facility at NASA s Marshall Space Flight Center is in use for materials research and thermophysical property measurement by a number of different internal and external investigators. Results from the recent CDDF studies on the high energy X-ray beamline at the Advanced Photon Source of Argonne National Laboratory will be presented. The Microgravity Research Program supports the facility.
Author
Electrostatics; Research Facilities; Levitation; Thermophysical Properties; Space Processing; Potential Flow; Gravitation; Gas Pressure

20040073520 NASA Marshall Space Flight Center, Huntsville, AL, USA
Spaceflight Holography Investigation in a Virtual Apparatus
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 25; In English; See also 20040073490; No Copyright; A01, Hardcopy; Abstract only; Available from CASI only as part of the entire parent document.

The movement of a particle in a fluid is one of the most fundamental processes in physics and plays an important role in materials science. For example, the physics of crystal growth from a nucleation site in solution can be dominated by movement of the solution over the crystal surface. Gravity usually dominates the equations of motion, but in microgravity other terms can dominate, making the equation much more complex. Until recently, the equations were solved only by numerical methods and/or by neglecting terms. During this study, we discovered an exact solution to the equations, which shows that the usually neglected terms become extremely important in microgravity. We also developed diagnostic recording methods using holography to save all of the particle field data, allowing the experiment to essentially be transferred from space back to earth in what we call the virtual apparatus . We will record holograms of particle distributions in motion in microgravity and bring them back to earth for analysis, allowing the study of the full three-dimensional motion of sets of particles, allowing us to test the new analytical solutions. The experiment will also provide accurate measurements of the quasi-steady acceleration of the space platform and other interesting microgravity and g-jitter effects. This program will produce the flight definition for an experiment in the microgravity environment of space to validate the theoretical model. We will design an experiment with the help of the theoretical model that is optimized for testing the model, measuring g, g-jitter, and other microgravity phenomena.
Derived from text
Holography; Microgravity; Space Flight; Virtual Reality; Equipment; Mathematical Models

20040073611 Washington Univ., Seattle, WA
The Heat and Salt Balances of the Upper Ocean Beneath a Spatially Variable Melting Sea Ice Cover
Hayes, Daniel R.; Sep. 2003; 139 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-96-1-5033; N00014-98-1-0037
Report No.(s): AD-A422484; APL-UW-TR-0302; No Copyright; Avail: CASI; A07, Hardcopy

The aim of this study is to paint a picture of the evolution of the horizontally variable ice-ocean boundary layer throughout summer. Observations were made during the drifting Surface HEat Balance of the Arctic (SHEBA) experiment in the summer of 1998, The ice-ocean boundary layer near leads is studied with an Autonomous Underwater Vehicle (AUV) and a novel technique to use vehicle motion data to calculate turbulent vertical water velocity along the vehicle path. Vertical fluxes are obtained and extend from the energy- containing wave number range and continue into the inertial subrange. This study is the first to measure horizontal profiles of turbulent fluxes in the ice-ocean boundary layer. AUV data are used in conjunction with: fixed-mast turbulent fluxes at discrete levels in the boundary layer, Conductivity- Temperature-Depth data (vertical casts and lead surveys), and a suite of measurements made by other investigators. 1+ %A%+ +%%+ ,,%A +%% %.%%
DTIC
Arctic Ocean; Melting; Oceans; Sea Ice

20040073684 Wright State Univ., Dayton, OH
Scientific Research in Aircraft Mechanical/Thermal Technology
Thomas, Scott K.; Yerkes, Kirk L.; Castle, R. M.; Lykins, Richard C.; Lauer, Joel T.; Dec. 2003; 161 pp.; In English
Contract(s)/Grant(s): F33615-98-1-2844; Proj-3145
Report No.(s): AD-A422583; AFRL-PR-WP-TR-2004-2027; No Copyright; Avail: CASI; A08, Hardcopy

This final report describes the progress to date on six individual projects. "The Effect of Working Fluid Inventory on Performance of Revolving Helically-Grooved Heat Pipes" is related to an experimental analysis of working fluid inventory and its effects on the capillary lirnit of grooved heat pipes. "Fully-Developed Laminar Flow in Trapezoidal Grooves with Shear Stress at the Liquid-Vapor Interface" concerns the effects of geometry and interfacial shear stress on the pressure drop in trapezoidal grooves. "Fully-Developed Laminar Flow in Sinusoidal Grooves" is similar to the above, except that the sinusoidal grooves typically seen in micro- etching are examined. "Micro Capillary Pumped Loop Testing" deals with the design, manufacture and calibration of an experimental facility for testing capillary pumped loops embedded in silicon wafers. "Design and Testing of a Thermodynamic Filling Station for Miniature Heat Pipes" concerns a novel filling procedure for miniature heat pipes. "Acceleration Testing of Three Raytheon Heat Pipes using the AFRL/PRPS centrifuge Table" deals with the performance of heat pipes under various acceleration conditions, which were imposed by the centrifuge table located in Bldg. 71-B H-Bay in Area B of Wright-Patterson AFB.
DTIC
Laminar Flow; Mechanical Properties; Research Aircraft; Thermodynamic Properties

20040073801 Woods Hole Oceanographic Inst., MA
Development and Application of Dynamical Systems Techniques for Use With Ocean Data
Pratt, Lawrence J.; May 15, 2004; 6 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0258
Report No.(s): AD-A422811; WHOI-13025800; No Copyright; Avail: CASI; A02, Hardcopy

Various aspects of the Eulerian and Lagrangian predictability of oceanographically relevant flows are examined using models and data. For the problem of Lagrangian predictability, such as in search-and-rescue operations, dynamical systems techniques are used to determine the distributions of chaotic versus regular behavior in models of jets and recirculations. Eulerian predictability is addressed using phase space reconstruction of time series from models and hierarchy of oceanographic data sets. Uncertainty in flows in regions of complex, unresolvable topographic variations is examined using a porous medium approach.
DTIC
Dynamical Systems; Oceanographic Parameters; Oceans

20040073824 Army Cold Regions Research and Engineering Lab., Hanover, NH
Quasi-Wavelet Calculations of Sound Scattering Behind Barriers
Wilson, D. K.; Ostashev, Vladimir E.; Goedecke, George H.; Auvermann, Harry J.; Jan. 2004; 24 pp.; In English
Contract(s)/Grant(s): DAAG19-01-1-0640
Report No.(s): AD-A422877; ARO-42469-EV-H.15; No Copyright; Avail: CASI; A03, Hardcopy

Quasi-wavelets (QWs) are a representation of turbulence consisting of self-similar, eddy-like structures with random orientations and positions in space. They are used in this paper to calculate the scattering, due to turbulent velocity fluctuations, of sound behind noise barriers as a function of the size and spatial location of the eddies. The sound scattering cross-section for QWs of an individual size class (eddy size) is derived and shown to reproduce results for the von Karman spectrum when the scattered energies from a continuous distribution of QW sizes are combined. A Bragg resonance condition is derived for the eddy size that scatters most strongly for a given acoustic wavenumber and scattering angle. Results for scattering over barriers show that, for typical barrier conditions, most of the scattered energy originates from eddies in the size range of approximately one- half to twice the size of the eddies responsible for maximum scattering. The results also suggest that scattering over the barrier due to eddies with a line of sight to both the source and receiver is generally significant only for frequencies above several kilohertz, for sources and receivers no more than a few meters below the top of the barrier, and for very turbulent atmospheric conditions.
DTIC
Acoustic Scattering; Turbulence; Wavelet Analysis

20040073827 Stanford Univ., Stanford, CA
Stagnation Point Flow and Heat Transfer Under Free- Stream Turbulence
Xiong, Zhongmin; Lele, Sanjiva K.; Apr. 20, 2004; 232 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0138
Report No.(s): AD-A422883; AFRL-SR-AR-TR-04-0246; No Copyright; Avail: CASI; A11, Hardcopy

Stagnation point flow and heat transfer in the presence of free-stream turbulence is investigated through both numerical

simulation and theoretical analysis. Large eddy simulations (LES) results for different free-stream turbulent intensity, length scale, and Mach number are reported. The Reynolds stress statistics and budgets are obtained and presented. The numerical results show good agreement with experimental measurements on elevated heat transfer coefficient, and reveals the characteristic vortical flow structures responsible for the observed heat transfer enhancement. The theoretical analysis shows that the vorticity amplification, and hence the heat transfer enhancement, increases with decreasing length scale and reaches a maximum value at about five times the boundary layer thickness. A new correlation for heat transfer enhancement which incorporates turbulence intensity, integral length scale and mean flow Reynolds number is derived and shown to reasonably collapse the recent experimental data.
DTIC
Aerodynamic Heat Transfer; Flow Distribution; Free Flow; Heat Transfer; Stagnation Point; Turbulence

20040074207 NASA Langley Research Center, Hampton, VA, USA
Modelling Unsteady Wall Pressures Beneath Turbulent Boundary Layers
Ahn, B-K.; Graham, W. R.; Rizzi, S. A.; May 03, 2004; 12 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 781-20-11
Report No.(s): AIAA Paper 2004-2849; No Copyright; Avail: CASI; A03, Hardcopy

As a structural entity of turbulence, hairpin vortices are believed to play a major role in developing and sustaining the turbulence process in the near wall region of turbulent boundary layers and may be regarded as the simplest conceptual model that can account for the essential features of the wall pressure fluctuations. In this work we focus on fully developed typical hairpin vortices and estimate the associated surface pressure distributions and their corresponding spectra. On the basis of the attached eddy model, we develop a representation of the overall surface pressure spectra in terms of the eddy size distribution. Instantaneous wavenumber spectra and spatial correlations are readily derivable from this representation. The model is validated by comparison of predicted wavenumber spectra and cross-correlations with existing emperical models and experimental data.
Author
Turbulent Boundary Layer; Wall Pressure; Mathematical Models; Vortices; Unsteady Flow

20040074220 NASA Langley Research Center, Hampton, VA, USA
Characterization of Unsteady Flow Structures Near Landing-Edge Slat, Part 2, 2D Computations
Khorrami, Mehdi; Choudhari, Meelan M.; Jenkins, Luther N.; [2004]; 16 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 23-781-10-10
Report No.(s): AIAA Paper 2004-2802; No Copyright; Avail: CASI; A03, Hardcopy

In our previous computational studies of a generic high-lift configuration, quasi-laminar (as opposed to fully turbulent) treatment of the slat cove region proved to be an effective approach for capturing the unsteady dynamics of the cove flow field. Combined with acoustic propagation via Ffowes Williams and Hawkings formulation, the quasi-laminar simulations captured some important features of the slat cove noise measured with microphone array techniques. However. a direct assessment of the computed cove flow field was not feasible due to the unavailability of off-surface flow measurements. To remedy this shortcoming, we have undertaken a combined experiment and computational study aimed at characterizing the flow structures and fluid mechanical processes within the slat cove region. Part I of this paper outlines the experimental aspects of this investigation focused on the 30P30N high-lift configuration; the present paper describes the accompanying computational results including a comparison between computation and experiment at various angles of attack. Even through predictions of the time-averaged flow field agree well with the measured data, the study indicates the need for further refinement of the zonal turbulence approach in order to capture the full dynamics of the cove's fluctuating flow field.
Author
Unsteady Flow; Computation; Acoustic Propagation; Flow Distribution; Flow Measurement

20040074259 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Testing of a Miniature Loop Heat Pipe Using a Thermal Electrical Cooler for Temperature Control
Ku, Jentung; Jeong, Soeng-II; Butler, Dan; 2004; 17 pp.; In English; 34th ICES Conference, 19-22 Jul. 2003, Colorado Springs, CO, USA; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the design and testing of a miniature LHP having a 7 mm O.D. evaporator with an integral CC. The

vapor line and liquid line are made of 1.6mm stainless steel tubing. The evaporator and the CC are connected on the outer surface by a copper strap and a thermoelectric (TEC) is installed on the strap. The TEC is used to control the CC temperature by applying an electrical current for heating or cooling. Tests performed in ambient included start-up, power cycle, sink temperature cycle, and CC temperature control using TEC. The LHP demonstrated very robust operation in all tests where the heat load varied between 0.5W and 1OOW, and the sink temperature varied between 243K and 293K. The heat leak from the evaporator to the CC was extremely small. The TEC was able to control the CC temperature within +/-0.3K under all test conditions, and the required control heater power was less than 1W.
Author
Thermoelectricity; Heat Pipes; Loads (Forces); Miniaturization; Temperature Control; Cooling

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INSTRUMENTATION AND PHOTOGRAPHY

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

20040068186 NASA Goddard Space Flight Center, Greenbelt, MD, USA
International Thermal Detectors Workshop (TDW 2003)
Lakew, Brook, Editor; Brasunas, John, Editor; Aslam, Shahid, Editor; Fettig, Rainer, Editor; Boyle, Robert, Editor; February 2004; 159 pp.; In English; International Thermal Detectors Workshop, 19-20 Jun. 2003, Adelphi, MD, USA; See also 20040068187 - 20040068229; Original contains color and black and white illustrations
Report No.(s): NASA/CP-2004-212748; Rept-2004-00980-0; No Copyright; Avail: CASI; A08, Hardcopy

NASA's future planetary and Earth Science missions will require ever more sensitive thermal detectors operating between 2K and 300 K. It is in response to this need that the International Workshop on thermal detectors (TDW03) was held. It put together space borne IR/Sub-mm and heterodyne instrument scientists and astronomers, thermal detector developers, cryocooling technologists as well as bandpass and blocking filter experts. Their varied expertise and backgrounds allowed for a fertile discussion on outstanding issues and future detector developments. In this regard TDW03 was a great success.
Author
Measuring Instruments; Infrared Instruments

20040068187 Leicester Univ., UK
The IR Detector System for the GERB Instrument
Nelms, Nick; Butcher, Gillian; Blake, Oliver; Cole, Richard; Whitford, Chris; Holland, Andrew; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-21 - 2-24; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The Geostationary Earth Radiation Budget (GERB) instrument is an Earth observing scientific payload launched on-board the European Space Agency Meteosat Second Generation (MSG) satellite in September 2002. The instrument measures reflected and emitted radiation in two wavebands, 0.3 - 4 microns and 4 - 30 microns. The detector system comprises the focal plane and supporting front-end electronics. The focal plane consists of a 256-element thermoelectric linear array operating at approx. 300 K and four application specific integrated circuits (ASIC) providing parallel amplification, filtering and digitisation. The front-end electronics are built around a digital signal processor, which performs integration and additional filtering of the ASIC product. This paper describes in detail the design, operation and performance of the GERB detector system.
Author
Infrared Detectors; Signal Processing; Signal Analyzers; Reflected Waves; Radiation Measurement

20040068188 Raytheon Co., Santa Barbara, CA, USA
Thermal Emission Imaging System (THEMIS)
Schueler, Carl F.; Silverman, Steven H.; Christensen, Philip R.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-29 - 2-32; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The Thermal Emission Imaging System (THEMIS) is based on bolt-together pushbroom optics and uncooled silicon microbolometer focal plane array (FPA) technology. Sometimes dubbed "Mars Landsat," THEMIS was launched in 2001 on Mars Odyssey, and provides guidance for future lander missions now in preparation for launch. Advanced materials

and optical machining allow THEMIS low-scatter, reflective, wide field-of-view (WFOV) pushbroom optics for relatively long dwell-time compared to narrow FOV optics requiring cross-track scanning for equivalent spatial resolution. This allows uncooled silicon microbolometer FPAs, with less signal sensitivity than cryogenically cooled photo-diode FPAs, to meet the THEMIS sensitivity requirements.
Author
Imaging Techniques; Thermal Emission; Bolometers; Satellite Instruments

20040068193 Canadian Space Agency, Saint Hubert, Quebec, Canada
Canadian Microbolometer Technology for Future Space Missions
Phong, Linh Ngo; Zheng, Wan-Ping; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-10 - 2-13; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

This paper provides an overview of the microbolometer technology developed in Canada, including pixel engineering, readout electronics, and detector packaging. Design considerations are also presented for a two band LWIR radiometer intended for microsatellite-based demonstration of microbolometer technology.
Author
Bolometers; Readout; Microsatellites; Technology Assessment

20040068198 Rochester Univ., NY, USA
Ultimate Sensitivity of Superconducting Single-Photon Detectors in the Visible to Infrared Range
Verevkin, A.; Zhang, J.; Pearlman, A.; Slysz, W.; Sobolewski, Roman; Korneev, A.; Kouminov, P.; Okunev, O.; Chulkova, G.; Goltsman, G.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-6 - 2-9; In English; See also 20040068186
Contract(s)/Grant(s): F49620-01-1-0463; RFBR-02-02-16774; No Copyright; Avail: CASI; A01, Hardcopy

We present our quantum efficiency (QE) and noise equivalent power (NEP) measurements of the meander-type ultrathin NbN superconducting single-photon detector in the visible to infrared radiation range. The nanostructured devices with 3.5-nm film thickness demonstrate QE up to approx. 10% at 1.3 - 1.55 microns wavelength, and up to 20% in the entire visible range. The detectors are sensitive to infrared radiation with the wavelengths down to approx. 10 microns. NEP of about 2 x 10(exp -18) W/Hz(sup 1/2) was obtained at 1.3 microns wavelength. Such high sensitivity together with GHz-range counting speed, make NbN photon counters very promising for efficient, ultrafast quantum communications and another applications. We discuss the origin of dark counts in our devices and their ultimate sensitivity in terms of the resistive fluctuations in our superconducting nanostructured devices.
Author
Sensitivity; Superconductivity; Photons; Detectors; Infrared Radiation; Quantum Efficiency

20040068199 Towson State Univ., MD, USA
Perovskite Manganites: A New Family of Materials for Uncooled/Moderately Cooled IR Detector Applications
Rajeswari, M.; Smolyaninova, V.; Overby, M.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 3-11 - 3-16; In English; See also 20040068186
Contract(s)/Grant(s): NSF DMR-01-16619; NSF DMR-96-32521; No Copyright; Avail: CASI; A02, Hardcopy

Alkaline earth doped perovskite manganites have been a focus of research during the past several years on account of the phenomenon of colossal magneto-resistance (CMR) and its application in magnetic information storage technology. Somewhat less known is the potential of these materials for use as bolometric infrared detectors. The bolometric sensor functionality is based on the steep temperature dependence of resistance in the vicinity of the insulator-metal transition. The insulator-metal transition temperature can be tuned by manipulating the chemistry, which makes it feasible to tailor these materials for sensor operation over a wide temperature range anywhere from well over room temperature down to liquid nitrogen and lower temperatures. Figure of merit calculations based on the best currently demonstrated values of the temperature-coefficient of resistance and 1/f noise indicate good potential for development of state-of-the-art IR detectors based on manganites.
Author
Infrared Detectors; Manganese Compounds; Perovskites; Cooling; Mineralogy

20040068200 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Bolometer Simulation Using SPICE
Jones, Hollis H.; Aslam, Shahid; Lakew, Brook; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 3-17 - 3-21; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A general model is presented that assimilates the thermal and electrical properties of the bolometer - this block model demonstrates the Electro-Thermal Feedback (ETF) effect on the bolometers performance. This methodology is used to construct a SPICE model that by way of analogy combines the thermal and electrical phenomena into one simulation session. The resulting circuit diagram is presented and discussed.
Author
Bolometers; Thermodynamic Properties; Simulation; Analogies

20040068204 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Programmable 2-D Addressable Cryogenic Aperture Masks
Kutyrev, A. S.; Moseley, S. H.; Jhabvala, M.; Li, M.; Schwinger, D. S.; Silverberg, R. F.; Wesenberg, R. P.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P4; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are developing a two-dimensional array of square microshutters (programmable aperture mask) for a multi-object spectrometer for the James Webb Space Telescope (JWST). This device will provide random access selection of the areas in the field to be studied. The device is in essence a close packed array of square slits, each of which can be opened independently to select areas of the sky for detailed study.The device is produced using a 100-micron thick silicon wafer as a substrate with 0.5-micron thick silicon nitride shutters on top of it. Silicon nitride has been selected as the blade and flexure material because its stiffness allows thinner and lighter structures than single crystal Si, the chief alternative, and because of its ease of manufacture. The 100 micron silicon wafer is backetched in a high aspect ratio Deep Reactive Ion Etching (Deep RIE) to leave only a support grid for the shutters and the address electronics. The shutter actuation is done magnetically whereas addressing is electrostatic. 128x128 format microshutter arrays have been produced. Their operation has been demostarted on 32x32 subarrays. Good reliability of the fabrication process and good quality of the microshutters has been achieved. The mechanical behavior and optical performance of the fabricated arrays at cryogenic temperature are being studied.
Author
James Webb Space Telescope; Spectrometers; Shutters; Microelectromechanical Systems

20040068208 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Economical Microbolometer-Based Environmental Radiometer Satellite (EMBERSat) Designed for Forest Fire Detection and Monitoring
Lancaster, Redgie S.; Skillman, David R.; Welch, Wayne C.; Spinhirne, James D.; Manizade, Katherine F.; Beecken, Brian P.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-25 - 2-28; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

Thermal infrared imagery from several satellite instruments, such as the NOAA AVHRR and the NASA MODIS, is presently used to detect and map forest fires. But while these radiometers can identify fires they are designed and optimized for cloud detection, providing relatively low spatial resolution and quickly saturating even for small fires. Efforts to detect and monitor forest fires from space would benefit from the development of single-sensor satellites designed specifically for this purpose. With the advent of uncooled thermal detectors, and thus the absence of aggressive cooling, the possibility of developing small satellites for the purpose of fire detection and monitoring becomes practical and cost-effective. Thus is the case with the Economical Microbolometer Based Environmental Radiometer Satellite (EMBERSat) program. The objective of this program is to develop a single, prototype satellite that will provide multiband thermal imagery with a spatial resolution of 250m and a dynamic range of 300-1000K. The thermal imaging payload has flight heritage in the Infrared Spectral Imaging Radiometer that flew aboard mission STS-85 and the spacecraft is a variant of the SimpleSat bus launched from the shuttle Columbia as part of STS-105. The EMBERSat program is a technology demonstration initiative with the eventual goal of providing high-resolution thermal imagery to both the scientific community and the public.
Author
Bolometers; Forest Fire Detection; MODIS (Radiometry); Infrared Imagery; Satellite Instruments; Thermal Mapping; Economy

20040068209 Commissariat a l'Energie Atomique, Gif-sur-Yvette, France
Far IR and Submillimeter Filled Bolometer Arrays Performances at 300 mK and 2 K
Reveret, Vincent; Rodriguez, Louis; Vigroux, Laurent; Agnese, Patrick; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-33 - 2-36; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

CEA developed large (2048 pixels) filled bolometer arrays for the HERSCHEL PACS photometer in the 60-200 micron

spectral band. We present the detector design and its performances at 300 mK. The PACS spectral band can easily be extended to longer wavelengths for future applications. Some details of the possible adaptation are given here. We also evaluate the expected performances when adapted and operated at higher temperature (2K). Calculations show that, in this condition, the expected NEP is close to 1.10(exp -15) Watts per Hertz (sup 1/2) for a 100 pWatts per pixel flux.
Author
Bolometers; Submillimeter Waves; Arrays; Far Infrared Radiation; Photometers

20040068210 California Univ., Berkeley, CA, USA
Superconducting TES Bolometers Above 1K
Richards, P. L.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-1 - 2-5; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

The discovery of High Tc superconductivity led to the exploration of current-biased superconducting bolometers cooled with liquid nitrogen and optimized to view 300K backgrounds at wavelengths beyond 10 m. If such detectors reach the thermal fluctuation noise limit they would be a great improvement over room temperature pyroelectric detectors and thermopiles for many applications. The superconducting detectors fabricated in the 1990 s had a number of operational problems, and were typically slow because of the large heat capacity of the materials used .However, voltage-biased (TES) superconducting bolometers operated at low temperatures now show superior operating characteristics and enhanced response speed due to electrothermal feedback. This approach may help higher temperature thermal detectors reach their theoretical potential. We have built and tested a Nb-based TES bolometer cooled with liquid helium at 4.2k. This device is optimized for the background power appropriate for far-infrared spectroscopy at frequencies below 100/cm with a commercial rapid-scan Fourier transform spectrometer. The sensitivity of our TES detector is a factor approx. 10 better than that of a semiconducting bolometer optimized for the same operating temperature, linearity and speed of response.
Author
Superconductivity; Imaging Techniques; Infrared Detectors; Operational Problems; Photoconductors

20040068212 Chalmers Univ. of Technology, Goeteborg, Sweden
Cold-Electron Bolometer with Strong Electrothermal Feedback
Kuzmin, Leonid; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-37 - 2-41; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A novel concept of the Cold-Electron Bolometer (CEB) based on strong direct electron cooling of the absorber has been proposed. This concept is purposed to overcome the unavoidable contradiction of supersensitive detectors between supersensitivity and supersaturation due to background power load. The effective electron cooling can be treated as strong electrothermal feedback (ETF) similar to TES (transition-edge sensor) in voltage-biased mode. However, in contrast to TES, an additional artificial dc heating for electrothermal feedback is replaced by deep electron cooling removing all incoming power from the absorber to the next stage and keeping minimum temperature (less than phonon temperature for small level of power). The CEB can be treated as "0-detector" in comparison with TES treated as "Tc-detector". Noise properties (NEP) are considerably improved by decreasing the electron temperature. It could mean principle breakthrough in realization of supersensitive detectors. All incoming power is removed from supersensitive absorber to the next stage of readout system a SQUID with considerably higher dynamic range. As in TES, the strong ETF (up to 1000) decreases the response time of CEB from eph time (congruent to 10 microseconds) to cooling (tunneling) time (congruent to 10 nanoseconds). The estimations show that it is realistic to achieve NEP of the order of 10(exp -19) Watts per Hertz (sup 1/2) with SQUID readout system at 100 mK and 10(exp -18) Watts per Hertz (sup 1/2) at 300 mK. At 2 Kelvin the theoretical evaluations show that the expected NEP is of the order of 2 x 10(exp -16) Watts per Hertz (sup 1/2) and increases to the level of 8 x 10(exp -16) Watts per Hertz (sup 1/2) for background load of 100 pW.
Author
Bolometers; Electron Energy; Feedback; Cooling

20040068213 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Case for Moderately-Cooled, Far-Infrared Thermal Detectors
Brasunas, John C.; Lakew, Brook; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 3-1 - 3-5; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

There are moderately-cooled (around 77K) infrared detectors, for instance InSb (around 5 microns wavelength) and HgCdTe (around 15 to 20 microns wavelength). However for longer wavelengths there are either uncooled thermal-type

detectors or highly cooled (about 4K and lower) quantum and thermal detectors, with the notable exception of high Tc superconductor detectors. We will describe certain long-wavelength applications in space where only moderate cooling is feasible, and where better sensitivity is required than possible with uncooled detectors. These requirements could be met with high Tc bolometers, but it may also be prudent to develop other technologies. Additionally, over the past 16 years a marketplace has not developed for the commercial production of high Tc bolometers, indicating their production may be a natural endeavor for government laboratories.
Author
Cooling; High Temperature Superconductors; Infrared Detectors; Bolometers; Space Missions

20040068214 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fabrication of Monolithic Sapphire Membranes for High T(sub c) Bolometer Array Development
Pugel, D. E.; Lakew, B.; Aslam, S.; Wang, L.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 3-6 - 3-10; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

This paper examines the effectiveness of Pt/Cr thin film masks for the architecture of monolithic membrane structures in r-plane single crystal sapphire. The development of a pinhole-free Pt/Cr composite mask that is resistant to boiling H2SO4:H3PO4 etchant will lead to the fabrication of smooth sapphire membranes whose surfaces are well-suited for the growth of low-noise high Tc films. In particular, the relationship of thermal annealing conditions on the Pt/Cr composite mask system to: (1) changes in the surface morphology (2) elemental concentration of the Pt/Cr thin film layers and (3) etch pit formation on the sapphire surface will be presented.
Author
Fabrication; Sapphire; Membrane Structures; High Temperature Superconductors; Bolometers

20040068215 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SQUID Multiplexers for Cryogenic Detector Arrays
Irwin, Kent; Beall, James; Deiker, Steve; Doriese, Randy; Duncan, William; Hilton, Gene; Moseley, S. Harvey; Reintsema, Carl; Stahle, Caroline; Ullom, Joel; Vale, Leila; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 4-5; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

SQUID multiplexers make it possible to build arrays of thousands of cryogenic detectors with a manageable number of readout channels. We are developing time-division SQUID multiplexers based on Nb trilayer SQUIDs to read arrays of superconducting transition-edge sensors. Our first-generation, 8-channel SQUID multiplexer was used in FIBRE, a one-dimensional TES array for submillimeter astronomy. Our second-generation 32-pixel multiplexer, based on an improved architecture, has been developed for instruments including Constellation-X, SCUBA-2, and solar x-ray astronomy missions. SCUBA-2, which is being developed for the James Clerk Maxwell Telescope, will have more than 10,000 pixels. We are now developing a third-generation architecture based on superconducting hot-electron switches. The use of SQUID multiplexers in instruments operating at above 2 K will also be discussed.
Author
Cryogenics; Multiplexing; Squid (Detectors); Arrays

20040068217 NASA Goddard Space Flight Center, Greenbelt, MD, USA
High- and Mid-temperature Superconducting Sensors for Far IR/Sub-mm Applications in Space
Lakew, Brook; Brasunas, J. C.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 4-1 - 4-4; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

In this review paper an overview of the potential applications of high Tc (approx. 90 K) superconductors (HTS) and mid-Tc (approx. 39 K) superconductors (MTS) thin films in far IR/Sub-mm thermal detectors is presented. HTSs (YBCO, GdBCO etc.) were discovered in the late 80s while superconductivity in MgB2, an MTS, was discovered in 2001. The sharp transition in transport properties of HTS has allowed the fabrication of composite infrared thermal detectors (bolometers) with better figures of merit than thermopile detectors - thermopiles are currently on board the CIRS instrument on the Cassini mission to Saturn. The potential for developing even more sensitive sensors for IR/Sub-mm applications using MgB2 thin films is assessed. Current MgB2 thin film deposition techniques and film quality are reviewed.
Author
Superconductors (Materials); Thin Films; Far Infrared Radiation; Ybco Superconductors

20040068224 NASA Goddard Space Flight Center, Greenbelt, MD, USA

THIS: A Next Generation Tuneable Heterodyne Infrared Spectrometer for SOFIA

Sonnabend, Guido; Wirtz, Daniel; Schieder, Rudolf; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 7-8 - 7-11; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A new infrared heterodyne instrument has been developed which allows the use of both tuneable diode lasers (TDL) and quantum cascade lasers (QCL) as local oscillators (LO). The current frequency tuning range of our system extends from 900 to 1100/cm depending on the availability of lasers but is planned to be extended to 600/cm soon. The IF-bandwidth is 1.4 GHz using an acousto-optical spectrometer (AOS). The frequency resolution and stability of the system is approximately 10(exp 7). Currently, mercury-cadmium-telluride (MCT) detectors are used as mixers while new devices like quantum-well-infrared-photodetectors (QWIP) and hot-electron-bolometers (HEB) are investigated. The IF-bandwidth can be extended to about 3 GHz by using a new broadband acousto-optical spectrometer presently under development. The instrument is fully transportable and can be attached to any infrared or optical telescope. The semiconductor laser is stabilized to a Fabry-Perot ring-resonator, which is also used as an efficient diplexer to superimpose the local-oscillator and the signal radiation. As a first step measurements of trace gases in Earth's atmosphere and non-LTE emission from Venus' atmosphere were carried out as well as observations of molecular features in sunspots. Further astronomical observations from ground-based telescopes and the airborne observatory SOFIA are planned for the future. Of particular interest are molecules without a permanent dipole moment like H2, CH4, C2H2 etc.

Author

Tunable Lasers; Heterodyning; Infrared Spectrometers; Sofia (Airborne Observatory)

20040068228 NASA Langley Research Center, Hampton, VA, USA

Development of a Submillimeter/Far-Infrared Radiometer for Cirrus Measurements

Hayton, Darren; Ade, Peter; Evans, Frank; Lee, Clare; Nolt, Ira; Vanek, Mike; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P1; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We introduce a low-cost, lightweight and compact polarisation-sensitive radiometer for the measurement of Cirrus clouds in the submillimeter and far-infrared region (10 150 cm-1). It is widely recognised that enhanced global measurements of cirrus properties are essential to the development of General Circulation and Climate Prediction Models since cirrus clouds have a strong effect on the Earth's Global Radiation Budget. The purpose of this project is to design and build a novel instrument suitable for aircraft deployment in order to measure Ice Water Path (IWP) along with cirrus particle size and shape. This airborne instrument, which is currently under development in Cardiff, will serve as a prototype for a future satellite-based radiometer. The radiometer will capitalize on the ongoing measurements of the NASA-led, Fourier Transform interferometer-based, FIRSC (Far-Infrared Sensor for Cirrus) instrument for which Cardiff has been closely associated. Data from FIRSC campaigns is being used to select optimum radiometer channels that exhibit good sensitivity to specific cirrus. This new multichannel radiometer will, however, have some key advantages over similar spectroscopic instruments, for example, portability, increased optical efficiency, a multi-angle field of view and a reduced integration period leading to an improved spatial resolution. The radiometer will benefit from the application of state-of-the-art submm/FIR polarizer and solid filter technology currently being developed in Cardiff. The instrument will require a detector array that is robust enough to withstand aircraft/space deployment.

Author

Infrared Detectors; Microwave Radiometers; Meteorological Instruments; Cirrus Clouds

20040070895 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA

LDCM Preliminary Thermal Trades

Ryan, Robert; Pagnutti, Mary; Blonski, Slawomir; Spruce, Joe; May 10, 2001; 47 pp.; In English; Atmospheric Trades Meeting for Landsat Continuity, 15-16 May 2001, Beltsville, MD, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS13-650

Report No.(s): SE-2001-05-00019-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The expected cost of adding thermal bands to the next generation Landsat Data Continuity Mission (LDCM) could be significant. This viewgraph presentation investigates both traditional cooled cross-track scanners and new architectures (cooled and uncooled) which could enable a low cost thermal capability. The presentation includes surveys of applications of Landsat thermal data and the architecture of thermal instruments. It also covers new thermal architecture sensor trades, ALI

Architecture with Uncooled TIR Detectors, and simulated thermal imagery.
CASI
Satellite Imagery; Infrared Instruments; Landsat Satellites

20040070934 North Dakota Univ., Grand Forks, ND, USA
Plans for a 1-Meter-Class Professional Astronomical Observatory for the State of North Dakota
Hardersen, P. S.; deSilva, S.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students and the General Public in Space Science Exploration; 2004; 2 pp.; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The Department of Space Studies at the University of North Dakota (UND) is proposing to build and operate a 1-meter-class professional astronomical observatory in the State of North Dakota. Currently, no professional observatories exist within the state. The proposed facility, which will be operated and maintained by the Department of Space Studies, will serve state-wide research, education, and public outreach goals through collaborative outreach efforts with North Dakota s colleges, universities, and public and private schools. Educators, students, and researchers will have access to the observatory either on-site or via the Internet. Research efforts will primarily focus on different types of photometry due to the low-altitude location of the observatory.
Author
Astronomical Observatories; Low Altitude; Photometry

20040070968 Lawrence Livermore National Lab., Livermore, CA
Germanium Based Coded Aperture Gamma-Ray Imager
Ziock, K. P.; Pohl, B.; Schmid, G.; Cork, C.; Hull, E.; Jul. 06, 2000; 14 pp.; In English
Report No.(s): DE2004-15006370; UCRL-JC-137316; No Copyright; Avail: Department of Energy Information Bridge

The advantages of spectrally resolved gamma-ray imaging have previously been demonstrated for the detection of fissile materials. However, previous results have been obtained with the relatively poor spectral resolution provided by scintillator-based detectors. In this paper we present a new class of coded aperture imager based on a position-sensitive germanium detector. The use of this detector type provides a factor of 40 improvement in energy resolution which improves the quality of the images obtained while reducing the integration time required. Tight spectral cuts on known emission lines allow deeper penetration into highly attenuating objects. In addition, advanced analysis techniques can provide information on overlying material though the application of spatially resolved gamma-gauging. We describe the imager, present simulations of its capabilities and the first characterizations of a prototype detector.
NTIS
Radiation Detectors; Germanium; Imaging Techniques; Gamma Ray Spectra

20040071001 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Portable Instrument to Measure CDOM Light Absorption in Aquatic Systems: WPI Success Story
September 20, 2001; 8 pp.; In English; Original contains black and white illustrations
Report No.(s): SE-2001-09-00053-SSC; No Copyright; Avail: CASI; A02, Hardcopy

World Precision Instruments, Inc. (WPI), of Sarasota, FL, in collaboration with NASA's John C. Stennis Space Center, has developed an innovative instrument to accurately measure Colored Dissolved Organic Matter (CDOM) absorption in the field. This successful collaboration has culminated in an exciting new device, called the UltraPath, now commercially available through WPI. Traditional methods of measuring absorption of dissolved materials require special handling and storage prior to measurement. Use of laboratory spectrophotometers as the measuring devices have proven time consuming, cumbersome, and delicate to handle. The UltraPath provides a low-cost, highly sensitive, rugged, portable system that is capable of high sensitivity measurements in widely divergent waters.
Author
Dissolved Organic Matter; Absorptivity; Optical Measurement; Spectrometers

20040071006 Spectra Research Systems, Inc., Huntsville, AL, USA
Innovative Structural Design Features for a 10 m Solar Sail Demonstrator
Laue, G.; Moore, J.; Clayton, W.; April 07, 2004; 3 pp.; In English; AIAA Gossamer Spacecraft Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy

The successful development of sail architectures will require careful attention to a number of key issues including but not

limited to material strength issues, stress conditions for the membrane, load interactions between membrane and structure, and membrane material planarity. Along with the inherent challenges of fabricating and handling very large membrane structures these issues will pose real challenges for the near-term development of practical sail technologies. SRS has developed innovative technologies that deal directly with the challenges of developing very large sail membranes. Some of these technologies include edge reinforcements and innovative reinforcement attachment techniques, production of flight durable sail materials of less than 2.5 micron thicknesses and large scale fabrication techniques. SRS has employed these technologies in several large 10 m demonstrators that have been delivered to LaRC for solar vacuum testing. Details of the design of this system will be discussed.
Author
Structural Design; Solar Sails; Membrane Structures; Durability

20040071076 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Corp., Bay Saint Louis, MS, USA
Floating Probe Assembly for Measuring Temperature of Water
Selinsky, T.; Stewart, Randy; Ruffin, Clyde; [2002]; 1 pp.; In English
Report No.(s): NASA/NP-2002-06-00026; SSC-00136; No Copyright; Avail: CASI; A01, Hardcopy

A floating apparatus denoted a temperature probe aquatic suspension system (TPASS) has been developed for measuring the temperature of an ocean, lake, or other natural body of water at predetermined depths. Prior instruments built for the same purpose were found to give inaccurate readings because the apparatuses themselves significantly affected the temperatures of the water in their vicinities. The design of the TPASS is intended to satisfy a requirement to minimize the perturbation of the temperatures to be measured. The TPASS includes a square-cross-section aluminum rod 28 in. (approx. = 71 cm) long with floats attached at both ends. Each float includes five polystyrene foam disks about 3/4 in. (approx. = 1.9 cm) thick and 2.5 in. (approx. = 6.4 cm) in diameter. The disks are stacked to form cylinders, bolted to the rod, and covered with hollow plastic sleeves. A metal sleeve is clamped to the middle of the aluminum rod, from whence it hangs down into the water. Temperature probes (which can be thermocouples, thermistors, or resistance temperature devices) are placed within the sleeve at the desired measurement depths. Wires from the temperature probes are routed to the input terminals of a data logger. This work was done by Randy
Derived from text
Temperature Probes; Body Fluids; Floating; Temperature Measurement; Thermocouples; Water Temperature

20040071077 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Corp., Bay Saint Louis, MS, USA
Nulling Infrared Radiometer for Measuring Temperature
Ryan, Robert; [2004]; 2 pp.; In English
Report No.(s): NASA/NP-2002-06-00025; SSC-00124; No Copyright; Avail: CASI; A01, Hardcopy

A nulling, self-calibrating infrared radiometer is being developed for use in noncontact measurement of temperature in any of a variety of industrial and scientific applications. This instrument is expected to be especially well-suited to measurement of ambient or near-ambient temperature and, even more specifically, for measuring the surface temperature of a natural body of water. Although this radiometer would utilize the long-wavelength infrared (LWIR) portion of the spectrum (wavelengths of 8 to 12 m), its basic principle of operation could also be applied to other spectral bands (corresponding to other temperature ranges) in which the atmosphere is transparent and in which design requirements for sensitivity and temperature-measurement accuracy could be satisfied.
Derived from text
Accuracy; Calibrating; Infrared Radiation; Infrared Radiometers; Sensitivity; Temperature Measurement

20040071078 NASA Stennis Space Center, Bay Saint Louis, MS, USA, BAFCO, Inc., Warminster, PA, USA
Improved Electrohydraulic Linear Actuators
Hamtil, James; Selinsky, T.; July 5, 2002; 2 pp.; In English
Report No.(s): NASA/NP-2002-09-00034-SSC; SSC-00165; No Copyright; Avail: CASI; A01, Hardcopy

A product line of improved electrohydraulic linear actuators has been developed. These actuators are designed especially for use in actuating valves in rocket-engine test facilities. They are also adaptable to similar industrial uses. The advantageous features of the improved electrohydraulic linear actuators are best described with respect to shortcomings of prior electrohydraulic linear actuators that the improved ones are intended to supplant. The shortcomings are the following: They perform unreliably and inconsistently as positioning devices. Their capabilities for end-of-stroke buffering (that is, deceleration to gentle stops at designated stopping positions) range from unsatisfactory to nonexistent, with consequent

potential for inducing catastrophic failures. It takes long times to modify standard actuators to meet specifications, and the costs of such modifications are high. In the cases of actuators equipped with fail-safe shutdown systems, the stroking times of these systems cannot be adjusted in the field.
Derived from text
Actuators; Fail-Safe Systems; Stopping; Valves; Hydraulic Control

20040071092 Pacific Island Technology, Inc., Honolulu, HI, USA, Advanced Testing Technologies, Inc., USA
Coastal Research Imaging Spectrometer
Lucey, Paul G.; Williams, Timothy; Horton, Keith A.; July 30, 2002; 1 pp.; In English
Report No.(s): NASA/NP-2003-01-0003-SSC; SSC-00158; No Copyright; Avail: CASI; A01, Hardcopy

The Coastal Research Imaging Spectrometer (CRIS) is an airborne remote-sensing system designed specifically for research on the physical, chemical, and biological characteristics of coastal waters. The CRIS includes a visible-light hyperspectral imaging subsystem for measuring the color of water, which contains information on the biota, sediment, and nutrient contents of the water. The CRIS also includes an infrared imaging subsystem, which provides information on the temperature of the water. The combination of measurements enables investigation of biological effects of both natural and artificial flows of water from land into the ocean, including diffuse and point-source flows that may contain biological and/or chemical pollutants. Temperature is an important element of such measurements because temperature contrasts can often be used to distinguish among flows from different sources: for example, a sewage outflow could manifest itself in spectral images as a local high-temperature anomaly.
Derived from text
Biological Effects; Coastal Water; Imaging Spectrometers; Infrared Imagery; Remote Sensing; Chemical Analysis; Physical Properties; Bioassay

20040071102 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Thermocouple Extension-Wire-Connections and Low Temperatures
Figueroa, Fernando; Mitchell, Mark; Richardson, Gregory; October 2000; 5 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2000-10-00013-SSC; No Copyright; Avail: CASI; A01, Hardcopy

Experiments were carried out to determine the casue of erroneous readings from thermocouples of type K when measuring temperatures of liquid hydrogen. It was believed to be linked to te temperature of the connector used to extend the thermocouple wires to the voltage meter.
Author
Thermocouples; Electric Potential

20040071161 NASA Langley Research Center, Hampton, VA, USA
Validar: A Testbed for Advanced 2-Micron Doppler Lidar
Koch, Grady J.; Petros, Mulugeta; Barnes, Bruce W.; Beyon, Jeffrey Y.; Amzajerdian, Farzin; Yu, Jirong; Kavaya, Michael J.; Singh, Upendra N.; [2004]; 12 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA
Contract(s)/Grant(s): 23-319-02-02; No Copyright; Avail: CASI; A03, Hardcopy

High-energy 2-microns lasers have been incorporated in a breadboard coherent Doppler lidar to test component technologies and explore applications for remote sensing of the atmosphere. Design of the lidar is presented including aspects in the laser transmitter, receiver, photodetector, and signal processing. Sample data is presented on wind profiling and CO2 concentration measurements.
Author
Breadboard Models; Doppler Radar; Lasers; Remote Sensing; Wind Measurement; Design Analysis; Carbon Dioxide Concentration

20040073180 NASA Langley Research Center, Hampton, VA, USA
Design Considerations for an Integrated Solar Sail Diagnostics System
Jenkins, Christopher H. M.; Gough, Aaron R.; Pappa, Richard S.; Carroll, Joe; Blandino, Joseph R.; Miles, Jonathan J.; Rakoczy, John; [2004]; 12 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-800-53-05
Report No.(s): AIAA Paper 2004-1510; No Copyright; Avail: CASI; A03, Hardcopy

Efforts are continuing under NASA support to improve the readiness level of solar sail technology. Solar sails have one of the best chances to be the next gossamer spacecraft flown in space. In the gossamer spacecraft community thus far, solar sails have always been considered a "low precision" application compared with, say, radar or optical devices. However, as this paper shows, even low precision gossamer applications put extraordinary demands on structural measurement systems if they are to be traceable to use in space.
Author
Design Analysis; Systems Integration; Solar Sails; Diagnosis

20040073506 NASA Marshall Space Flight Center, Huntsville, AL, USA
Silicon Detector System for Cross Section Measurements
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 12; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In order to estimate the radiation shielding effectiveness of materials it is necessary to know cosmic ray particles are broken up as they pass though these materials. The breakup of cosmic ray particles is characterized by the nuclear fragmentation cross sections, i.e. an effective geometrical cross section assigned to each target nucleus that represents its apparent size for fragmenting the incident particle. The values of these cross sections depend on the details of nuclear physics and cannot be calculated from first principles owing to the many-body nature of the interactions. The only way to determine them is to measure them. Once a sufficient number of cross sections have been measured, the systematic nature of the interactions allows other cross-sections to be estimated. The number of cross sections that contribute to the estimation of shielding effectiveness is very large 10,000. Fortunately most make minor contributions. These can be estimated from nuclear systematics. Only those who's uncertainties make significant contributions to the error in the shielding effectiveness estimations need to be measured. In the past it has proven difficult to measure light fragment production cross sections from the interactions of heavy cosmic rays owing to the size of the detectors used. We have developed a highly pixilated silicon (Si) detector system that can individually identify these light fragments while making efficient use of costly accelerator time. This system is an outgrowth of detector technology developed under a CDDF and a Code S sponsored cosmic ray experiment.
Author
Radiation Shielding; Silicon Radiation Detectors

20040073560 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Wachtberg-Werthhoven
Space-Time Adaptive FIR Filtering With Staggered PRI
Klemm, Richard; Mar. 14, 2001; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422358; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Adaptive Filters; Far Infrared Radiation; Moving Target Indicators

20040073563 Space and Naval Warfare Systems Center, San Diego, CA
Man-Portable Networked Sensor System
Bryan, W. D.; Nguyen, H. G.; Gage, D. W.; Apr. 1998; 11 pp.; In English
Report No.(s): AD-A422372; No Copyright; Avail: CASI; A03, Hardcopy

The Man-Portable Networked Sensor System (MPNSS) with its baseline sensor suite of a pan/tilt with video and FLIR cameras and laser rangefinder, functions in a distributed network of remote sensing packages and control stations designed to provide a rapidly deployable extended-range surveillance capability for a wide variety of Security operations and other tactical missions. While first developed as a man-portable prototype these sensor packages can also be deployed on UGVs and UAVs and a copy of this package been demonstrated flying on the Sikorsky Cypher VTOL UAV in counterdrug and MOUT scenarios. The system takes maximum use of COTS components for sensing processing and communications and of both established and emerging standard communications networking protocols and system integration techniques. This paper will

discuss the technical issues involved in: (1) system integration using COTS components and emerging bus standards (2) flexible networking for a scalable system and (3) the human interface designed to maximize information presentation to the warfighter in battle situations.
DTIC
Intrusion; Security

20040073564 Space and Naval Warfare Systems Center, San Diego, CA
Radar-Based Intruder Detection for a Robotic Security System
Cory, Phil; Everett, H. R.; Pastore, Tracy H.; Nov. 1998; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422373; No Copyright; Avail: CASI; A03, Hardcopy

The Mobile Detection Assessment and Response System, Exterior (MDARS-E) provides an automated robotic security capability for storage yards, petroleum tank farms, rail yards, and arsenals. The system includes multiple supervised-autonomous platforms equipped with intrusion detection, barrier assessment, and inventory assessment subsystems commanded from an integrated control station. The MDARS-E Intrusion Detection System consists of a motion sensor suite which is selectively enabled while the vehicle is momentarily halted in execution of pre-defined buy randomly executed patrols. The system can detect a crawling, walking, or running intruder at a distance of 100 meters, even in darkness or the presence of smoke, fog, dust, and precipitation. The demanding nature of the required detection criteria necessitates the integration of complementary technologies which can sense motion, pattern characteristics, thermal signatures, and temporal behavior.
DTIC
Detection; Radar Detection; Robotics; Robots; Security; Warning Systems

20040073606 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Overview of the Mobile Detection Assessment and Response System
Inderieden, R. S.; Everett, H. R.; Heath-Pastore, T. A.; Smurlo, R. P.; Oct. 1995; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422465; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
Detection

20040073617 Center for Night Vision and Electro-Optics, Fort Belvoir, VA
The Targeting Task Performance (TTP) Metric A New Model for Predicting Target Acquisition Performance
Vollmerhausen, Richard H.; Jacobs, Eddie; Apr. 20, 2004; 126 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422493; AMSEL-NV-TR-230; No Copyright; Avail: CASI; A07, Hardcopy

In Figure 1.1, the soldier is using an imaging sensor, hoping to quickly identify whether the tank is a threat, This report describes a model which predicts the probability that he connectly identifies the target. The problem is tackled in two parts. First, the soldier's quality of vision when using the sensor and display is quantified. Most of the report is devoted to this topic. Second, the relationship between quality of vision and peforming a visual task, such as identifying the tank, is discussed.
DTIC
Human Performance; Mathematical Models; Performance Prediction; Target Acquisition; Tasks

20040073645 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Supervisory Control of Untethered Undersea Systems: A New Paradigm Verified
Uhrich, Richard; Walton, James; Sep. 1995; 6 pp.; In English
Report No.(s): AD-A422529; No Copyright; Avail: CASI; A02, Hardcopy

The primary advantage of untethered underwater systems is freedom from cables. Tethered systems benefit from realtime human control based upon immediate information received from the remote vehicle. This paper describes a well- proven system which has the advantages of both, and proposes that the concepts utilized therein offer exciting new possibilities for exploring and exploiting the deep ocean. The Advanced Unmanned Search System (AUSS) features an underwater vehicle which is both unmanned and untethered, yet not strictly autonomous. Communication with a surface ship is accomplished by means of underwater sound, as employed by a sophisticated digital acoustic link. Operation is analogous to radio-controlled robotic space probes: the vehicle generally proceeds on its own intelligence while transmitting status information and mission data, but it can receive new instructions at any time. AUSS is, in fact, far more versatile than a probe, with such abilities as

going to a newly commanded location, hovering at a specified altitude and location, executing a complete search pattern, or returning home on command.
DTIC
Underwater Vehicles

20040073658 Naval Ocean Systems Center, San Diego, CA
A Surveillance and Targeting System for an Unmanned Ground Vehicle
Solorzano, Manuel R.; Gage, Douglas W.; Aug. 1990; 20 pp.; In English
Report No.(s): AD-A422542; No Copyright; Avail: CASI; A03, Hardcopy
Presentation on a surveillance and targeting system for an unmanned ground vehicle.
DTIC
Surveillance; Unmanned Ground Vehicles

20040073689 Coventor, Inc., Cambridge, MA
Optoflow: Design Tools for Integrating Optical Detection in Micro-Total Analysis Systems
Korsmeyer, Tom; Apr. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-2-0547; Proj-E117
Report No.(s): AD-A422589; AFRL-IF-RS-TR-2004-93; No Copyright; Avail: CASI; A03, Hardcopy
The finest systems for chemical and microchemical analysis today use optical systems for detection and identification of chemical samples. This is because these systems offer both the highest sensitivity and can make use of the most powerful array of labeling and tagging technologies to give specificity to any measurement. The major drawback of such optical subsystems for DoD applications in chemical and biological warfare detection (CBD) is their large size, high cost, and relative fragility. Given the recent progress in integrated microfluidics, in optical MEMS, and in passive micro-optics, the time is right to drive high quality optical detection systems for microchemistry to compact micro- fabricated implementations.
DTIC
Biological Effects; Detection; Microanalysis; Optical Equipment; Optical Measurement

20040073713 Brigham Young Univ., Provo, UT
Parametric Filters For Non-Stationary Interference Mitigation in Airborne Radars
Parker, Peter; Swindlehurst, A. L.; Mar. 14, 2001; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422623; No Copyright; Avail: CASI; A03, Hardcopy
Workshop presentation on parametric filters for non-stationary interference mitigation in airborne radars.
DTIC
Airborne Radar; Multistatic Radar

20040073748 Army Cold Regions Research and Engineering Lab., Hanover, NH
Point-Surface Energetics Detection: Initial Sensor Evaluation
Van Wyck, Neal E.; Thorne, Phillip G.; Apr. 2004; 28 pp.; In English
Report No.(s): AD-A422671; ERDC/CRREL-TR-04-10; No Copyright; Avail: CASI; A03, Hardcopy
The development of real-time detection capability for explosives and propellants in high- concentration point sources is an important objective for comprehensive test and training range management. This report documents efforts to identify and characterize sensors that are both sensitive and selective to high-concentration point sources and can operate in a standoff mode by detecting the vapors released by energetics. Other factors under study included portability, speed of analysis, and overall system ruggedness. Initial evaluations identified 28 potential detection systems. Based primarily on sensitivity requirements, the initial list was reduced to five candidate detectors. The subset of detectors was then subjected to further evaluation, including extensive laboratory testing. Based on the results of laboratory testing and evaluations, we identified a single detector that warrants further investigation: GE Ion Track's Vapor Tracer2. The Vapor Tracer2 is the most sensitive of the detectors tested and has the greatest freedom from interferences. We recommend follow- on laboratory and field investigations to determine the potential of this detector for high-concentration point-source detection.
DTIC
Explosives; Propellants

20040073759 Michigan Technological Univ., Houghton, MI
Improving NQR Detection of Materials
Suits, B. H.; Jan. 2001; 6 pp.; In English
Contract(s)/Grant(s): N000173-01-1-G000
Report No.(s): AD-A422685; No Copyright; Avail: CASI; A02, Hardcopy

Recent Collaborative work with the Naval Research Laboratory (NRL) to improve explosive detection using nuclear quadrupole resonance (NQR) is summarized. The work included aspects of radio-frequency (RF) mitigation particularly concerning RF coil design for NQR applications in the field, such as land mine detection. Additional studies involving three-frequency NQR were also pursued.
DTIC
Explosives Detection; Nuclear Quadrupole Resonance

20040074175 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Feasibility Study of Utilizing Existing Infrared Array Cameras for Daylight Star Tracking on NASA's Ultra Long Duration Balloon (ULDB) Missions
Tueller, Jack, Technical Monitor; Fazio, Giovanni G.; Tolls, Volker; May 2004; 13 pp.; In English
Contract(s)/Grant(s): NAG5-8662; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study was to investigate the feasibility of developing a daytime star tracker for ULDB flights using a commercially available off-the-shelf infrared array camera. This report describes the system used for ground-based tests, the observations, the test results, and gives recommendations for continued development.
Derived from text
Feasibility; Infrared Radiation; Balloon Flight; Daytime; CCD Star Tracker; Long Duration Space Flight

20040074179 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Estimation of Aperture Errors with Direct Interferometer-Output Feedback for Spacecraft Formation Control
Lu, Hui-Ling; Cheng, Victor H. L.; Leitner, Jesse A.; Carpenter, Kenneth G.; [2004]; 6 pp.; In English; American Control Conference 2004, 30 Jun. - 2 Jul. 2004, Boston, MA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Long-baseline space interferometers involving formation flying of multiple spacecraft hold great promise as future space missions for high-resolution imagery. The major challenge of obtaining high-quality interferometric synthesized images from long-baseline space interferometers is to control these spacecraft and their optics payloads in the specified configuration accurately. In this paper, we describe our effort toward fine control of long-baseline space interferometers without resorting to additional sensing equipment. We present an estimation procedure that effectively extracts relative x/y translational exit pupil aperture deviations from the raw interferometric image with small estimation errors.
Author
Apertures; Error Analysis; Interferometers; Feedback Control

20040074204 Arizona Univ., Tucson, AZ, USA
Acquisition of a High-resolution Inductively Coupled Plasma Mass Spectrometer for Cosmochemical and Geochemical Research
Lauretta, D. S.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-11355; No Copyright; Avail: CASI; A01, Hardcopy

The primary goal of our research in this program is to develop new techniques for the analysis of volatile trace elements in very small samples using inductively coupled plasma mass spectrometry (ICP-MS) in preparation for samples returned by the Stardust mission. The instrument that will serve as the basis of our experiments is the ELEMENT2 high-resolution ICP-MS. We have spent the past year designing the laboratory to house this instrument as well as space to store and prepare samples returned by the Stardust mission. Unfortunately, the location that we had initially selected for the instrument turned out to be insufficient for our needs. This was determined almost eight months into the first year of our funding cycle, after extensive work including the production of engineering drawings. However, during this time the Lunar and Planetary Laboratory was selected to lead Phoenix, the first Mars Scout mission. As a result of this award LPL purchased a new, 50,000 square foot building. We have acquired 1400 square feet of laboratory space in this new facility. Four-hundred square feet will be used for a class-100 clean room. This area is designated for storage and preparation of extraterrestrial materials. The additional 1000 square feet will house the ELEMENT2 ICP-MS and peripheral devices. This is an enormous amount of space for this instrument, but it provides plenty of room for expansion in the future. The ICP-MS and the clean room facilities have

been purchased. The instrument has been delivered. The startup time for this instrument is relatively short and we expect to be collecting our first data by mid-summer.
Author
Mass Spectrometers; Inductively Coupled Plasma Mass Spectrometry; Cosmochemistry; Geochemistry

20040074209 NASA Stennis Space Center, Bay Saint Louis, MS, USA
PITCON 2002: New Product Forum
Bailey, John; March 17, 2002; 29 pp.; In English; PITTCON 2002, 17-22 Mar. 2002, New Orleans, LA, USA
Report No.(s): SE-2002-03-00016-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The Radiant Temperature Nulling Radiometer and the Polarization Enhanced Thermal Radiometer, which can measure water body temperatures, are potentially useful for the calibration of remote sensing instruments. The design and operation of both instruments are described in this viewgraph presentation.
CASI
Radiometers; Product Development

20040074241 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atmospheric and Surface Reflectance Measurements by the Geoscience Laser Altimeter System
Spinhirne, James D.; Palm, Steven P.; Hlavka, Dennis L.; Hart, William D.; Mehesh, Ashwin; Welton, Ellsworth J.; [2004]; 2 pp.; In English; AGU Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Geoscience Laser Altimeter System launched in early 2003 is the first satellite instrument IC space to globally observe the distribution of clouds and aerosol through laser remote sensing. The instrument is a basic backscatter lidar that operates at two wavelengths, 532 and 1064 nm. The mission data products for atmospheric observations include the calibrated, observed, attenuated backscatter cross section for cloud and aerosol; height detection for multiple cloud layers; planetary boundary layer height; cirrus and aerosol optical depth and the height distribution of aerosol and cloud scattering cross section profiles. The data will enhance knowledge in several areas of atmospheric science: the distribution, transport and influence of atmospheric aerosol, significantly more accurate measurements of the coverage and height of cirrus and other clouds, polar cloud climatology and radiation influence, the dynamics planetary boundary layer and others. An overview and summary of initial results are presented. Initial results from the first months of operation show the detailed height structure of clouds and aerosol on a global basis as expected. The 532 nm channel was expected to be the more sensitive and primary channel for aerosol measurements, but extensive aerosol loading in many regions are observed by the 1064 nm channel. Sensitivities are down to a few times l0(exp 6) l/(m-sr), much better than originally expected. The 532 channel adds an order of magnitude addition sensitivity. Initial comparisons to aerosol models have been done. Similarly for global cloud cover, good results are obtained just from the 1064 nm channel and from both channels, a measurement of multiple layers and cloud overlap has been made. Antarctica observations show high levels of total cloud cover including unique low-level cirrus and blowing snow. Data products have been generated for cloud, aerosol and PBL presence and heights in addition to the basic scattering cross section profiles.
Derived from text
Laser Altimeters; Cloud Physics; Aerosols; Surface Properties; Scattering Cross Sections; Remote Sensing

20040074254 Missouri Univ., Rolla, MO, USA
Manipulation of Microenvironment with a Built-in Electrochemical Actuator in Proximity of a Dissolved Oxygen Microsensor
Kim, Chang-Soo; Lee, Cae-Hyang; Fiering, Jason O.; Ufer, Stefan; Scarantino, Charles W.; Nagle, H. Troy; Fiering, Jason O.; Ufer, Stefan; Nagle, H. Troy; Scarantino, Charles W.; June 09, 2004; 24 pp.; In English
Contract(s)/Grant(s): NAG9-1423; 01-OBPR-01; Copyright; Avail: CASI; A03, Hardcopy

Abstract - Biochemical sensors for continuous monitoring require dependable periodic self- diagnosis with acceptable simplicity to check its functionality during operation. An in situ self- diagnostic technique for a dissolved oxygen microsensor is proposed in an effort to devise an intelligent microsensor system with an integrated electrochemical actuation electrode. With a built- in platinum microelectrode that surrounds the microsensor, two kinds of microenvironments, called the oxygen-saturated or oxygen-depleted phases, can be created by water electrolysis depending on the polarity. The functionality of the microsensor can be checked during these microenvironment phases. The polarographic oxygen microsensor is fabricated on a flexible polyimide substrate (Kapton) and the feasibility of the proposed concept is demonstrated in a physiological

solution. The sensor responds properly during the oxygen-generating and oxygen- depleting phases. The use of these microenvironments for in situ self-calibration is discussed to achieve functional integration as well as structural integration of the microsensor system.
Author
Actuators; Biochemistry; Diagnosis; Dissolved Gases; Microinstrumentation; Oxygen

20040074258 Missouri Univ., Rolla, MO, USA
Flexible Microsensor Array for the Root Zone Monitoring of Porous Tube Plant Growth System
Sathyan, Sandeep; Kim, Chang-Soo; Porterfield, D. Marshall; Nagle, H. Troy; Brown, Christopher S.; 2004; 20 pp.; In English
Contract(s)/Grant(s): NAG9-1423; 01-OBPR-01; No Copyright; Avail: CASI; A03, Hardcopy

Control of oxygen and water in the root zone is vital to support plant growth in the microgravity environment. The ability to control these sometimes opposing parameters in the root zone is dependent upon the availability of sensors to detect these elements and provide feedback for control systems. In the present study we demonstrate the feasibility of using microsensor arrays on a flexible substrate for dissolved oxygen detection, and a 4-point impedance microprobe for surface wetness detection on the surface of a porous tube (PT) nutrient delivery system. The oxygen microsensor reported surface oxygen concentrations that correlated with the oxygen concentrations of the solution inside the PT when operated at positive pressures. At negative pressures the microsensor shows convergence to zero saturation (2.2 micro mol/L) values due to inadequate water film formation on porous tube surface. The 4-point microprobe is useful as a wetness detector as it provides a clear differentiation between dry and wet surfaces. The unique features of the dissolved oxygen microsensor array and 4-point microprobe include small and simple design, flexibility and multipoint sensing. The demonstrated technology is anticipated to provide low cost, and highly reliable sensor feedback monitoring plant growth nutrient delivery system in both terrestrial and microgravity environments.
Author
Oxygen; Measuring Instruments; Water; Drying; Feedback Control; Microinstrumentation; Moisture Content

20040074273 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Wavefront Sensing and Control Technology for Submillimeter and Far-Infrared Space Telescopes
Redding, Dave; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 393-407; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

The NGST wavefront sensing and control system will be developed to TRL6 over the next few years, including testing in a cryogenic vacuum environment with traceable hardware. Doing this in the far-infrared and submillimeter is probably easier, as some aspects of the problem scale with wavelength, and the telescope is likely to have a more stable environment; however, detectors may present small complications. Since this is a new system approach, it warrants a new look. For instance, a large space telescope based on the DART membrane mirror design requires a new actuation approach. Other mirror and actuation technologies may prove useful as well.
Author
Membranes; Mirrors; Submillimeter Waves

20040074275 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Wide-Field Imaging Interferometry Testbed: Progress and Plans
Rinehart, S. A.; Leisawitz, D.; Leviton, D.; Martino, A.; Maynard, W.; Mundy, L. G.; Zhang, X.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 421-427; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

We describe the technique of wide field mosaic imaging for optical/IR interferometers and present early experimental results from a laboratory instrument designed to validate, experiment with, and refine the technique. A conventional single-detector stellar interferometer operating with narrow bandwidth at center wavelength lambda is limited in its field of view to the primary beam of the individual telescope apertures, or approx. lambda/D(sub tel) radians, where is the telescope diameter. Such a field is too small for many applications; often one wishes to image extended sources. We are developing and testing a technique analogous to the mosaic method employed in millimeter and radio astronomy, but applicable to optical/IR Michelson interferometers, in which beam combination is done in the pupil plane. An N(sub pix) x N(sub pix) detector array placed in the image plane of the interferometer is used to record simultaneously the fringe patterns from many contiguous telescope fields, effectively multiplying the field size by N(sub pix)/2, where the factor 2 allows for Nyquist sampling. This

mosaic imaging technique will be especially valuable for far IR and submillimeter interferometric space observatories such as the Space Infrared Interferometric Telescope (SPIRIT) and the Submillimeter Probe of the Evolution of Cosmic Structure (SPECS). SPIRIT and SPECS will be designed to provide sensitive, high angular resolution observations of fields several arcminutes in diameter, and views of the universe complementary to those provided by HST, NGST, and ALMA.
Author
Interferometers; Image Analysis; Mosaics; Optical Equipment; Imaging Techniques

20040074279 NASA Goddard Space Flight Center, Greenbelt, MD, USA
First Astronomical Use of Multiplexed Transition Edge Sensor Bolometers
Staguhn, J. G.; Ames, T. A.; Benford, D. J.; Chervenak, J. A.; Grossman, E. N.; Irwin, K. D.; Khan, S. A.; Maffei, B.; Moseley, S. H.; Pajot, F., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 374-377; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

We present performance results based on the first astronomical use of multiplexed superconducting bolometers. The Fabry-Perot Interferometer Bolometer Research Experiment (FIBRE) is a broadband submillimeter spectrometer that achieved first light in June 2001 at the Caltech Submillimeter Observatory (CSO). FIBRE's detectors are superconducting transition edge sensor (TES) bolometers read out by a SQUID multiplexer. The Fabry-Perot uses a low resolution grating to order sort the incoming light. A linear bolometer array consisting of 16 elements detects this dispersed light, capturing 5 orders simultaneously from one position on the sky. With tuning of the Fabry-Perot over one free spectral range, a spectrum covering Delta lambda/lambda = 1/7 at a resolution of delta lambda/lambda approx. 1/1200 can be acquired. This spectral resolution is sufficient to resolve Doppler-broadened line emission from external galaxies. FIBRE operates in the 350 m and 450 m bands. These bands cover line emission from the important star formation tracers neutral carbon (CI) and carbon monoxide (CO). We have verified that the multiplexed bolometers are photon noise limited even with the low power present in moderate resolution spectrometry.
Author
Bolometers; Multiplexing; Fabry-Perot Interferometers; Spectrometers

20040074282 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dual Transition Edge Sensor Bolometer for Enhanced Dynamic Range
Chervenak, J. A.; Benford, D. J.; Moseley, S. H.; Irwin, K. D.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 378-381; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

Broadband surveys at the millimeter and submillimeter wavelengths will require bolometers that can reach new limits of sensitivity and also operate under high background conditions. To address this need, we present results on a dual transition edge sensor (TES) device with two operating modes: one for low background, ultrasensitive detection and one for high background, enhanced dynamic range detection. The device consists of a detector element with two transition temperatures (T(sub c)) of 0.25 and 0.51 K located on the same micromachined, thermally isolated membrane structure. It can be biased on either transition, and features phonon-limited noise performance at the lower T(sub c). We measure noise performance on the lower transition 7 x 10(exp -18) W/rt(Hz) and the bias power on the upper transition of 12.5 pW, giving a factor of 10 enhancement of the dynamic range for the device. We discuss the biasable range of this type of device and present a design concept to optimize utility of the device.
Author
Bolometers; Dynamic Range; Bias; Superconducting Devices

20040074283 NASA Goddard Space Flight Center, Greenbelt, MD, USA
TES Detector Noise Limited Readout Using SQUID Multiplexers
Staguhn, J. G.; Benford, D. J.; Chervenak, J. A.; Khan, S. A.; Moseley, S. H.; Shafer, R. A.; Deiker, S.; Grossman, E. N.; Hilton, G. C.; Irwin, K. D., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 370-373; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The availability of superconducting Transition Edge Sensors (TES) with large numbers of individual detector pixels requires multiplexers for efficient readout. The use of multiplexers reduces the number of wires needed between the cryogenic electronics and the room temperature electronics and cuts the number of required cryogenic amplifiers. We are using an 8 channel SQUID multiplexer to read out one-dimensional TES arrays which are used for submillimeter astronomical observations. We present results from test measurements which show that the low noise level of the SQUID multiplexers allows accurate measurements of the TES Johnson noise, and that in operation, the readout noise is dominated by the detector

noise. Multiplexers for large number of channels require a large bandwidth for the multiplexed readout signal. We discuss the resulting implications for the noise performance of these multiplexers which will be used for the readout of two dimensional TES arrays in next generation instruments.
Author
Sensors; Superconductivity; Submillimeter Waves; Readout; Noise Intensity

20040074285 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Least-Squares Self-Calibration of Imaging Array Data
Arendt, R. G.; Moseley, S. H.; Fixsen, D. J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 382-390; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

When arrays are used to collect multiple appropriately-dithered images of the same region of sky, the resulting data set can be calibrated using a least-squares minimization procedure that determines the optimal fit between the data and a model of that data. The model parameters include the desired sky intensities as well as instrument parameters such as pixel-to-pixel gains and offsets. The least-squares solution simultaneously provides the formal error estimates for the model parameters. With a suitable observing strategy, the need for separate calibration observations is reduced or eliminated. We show examples of this calibration technique applied to HST NICMOS observations of the Hubble Deep Fields and simulated SIRTF IRAC observations.
Author
Calibrating; Imaging Techniques; Least Squares Method

20040074290 Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany
Integral Field Spectroscopy in the Far Infrared
Poglitsch, Albrecht; Geis, Norbert; Looney, Leslie; Raab, Walfried; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 301-308; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

We are presently building far-infrared integral field spectrometers for Herschel (PACS) and SOFIA (FIFI LS). These have become possible by: (1) the development of relatively large, low noise photoconductor arrays and their associated cryogenic readout electronics and (2) a novel design for a reflective image slicer which - compared to equivalent designs in the visible or near-infrared - leads to a very compact unit capable of handling the large etendue (A(Omega)) required in a diffraction limited FIR system. In conjunction with a moderate size (30 cm x 8 cm) grating this concept allows for moderate resolution (R approx. 2000), imaging spectroscopy perfectly suited for extragalactic astronomy. If we project the recent progress in detector development (photoconductors and bolometers) in terms of number of pixels and sensitivity into the near future then this instrument concept could be readily extended in two ways which could contribute significantly to the scientific success of SAFIR: A line spectrometer with an instantaneous spectral coverage of a modest number of resolutions elements but a large field of view would ideally complement the photometric imaging capabilities of the mission for objects that can be spatially resolved. Applications could be spectral line maps of galaxies which would allow detailed diagnostics of phenomena like sequential star formation, galaxy interaction, and nuclear activity. Complementary to this, a small field of view in combination with very broad spectral coverage would be ideally suited for pointing-uncertainty tolerant spectroscopy, including spectroscopic redshift determination, of galaxies in the early universe, with the goal to study their formation and evolution (star formation and AGN formation).
Author
Spectroscopy; Far Infrared Radiation; Imaging Techniques

20040074291 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Progress Towards High-Sensitivity Arrays of Detectors of Sub-mm Radiation Using Superconducting Tunnel Junctions with Integrated Radio Frequency Single-Electron Transistors
Stevenson, T. R.; Hsieh, W.-T.; Li, M. J.; Prober, D. E.; Rhee, K. W.; Schoelkopf, R. J.; Stahle, C. M.; Teufel, J.; Wollack, E. J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 349-358; In English; See also 20040074260
Contract(s)/Grant(s): NSG5-8589; No Copyright; Avail: CASI; A02, Hardcopy

For high resolution imaging and spectroscopy in the FIR and submillimeter, space observatories will demand sensitive, fast, compact, low-power detector arrays with 104 pixels and sensitivity less than 10(exp -20) W/Hz(sup 0.5). Antenna-coupled superconducting tunnel junctions with integrated rf single-electron transistor readout amplifiers have the potential for achieving this high level of sensitivity, and can take advantage of an rf multiplexing technique. The device consists of an

antenna to couple radiation into a small superconducting volume and cause quasiparticle excitations, and a single-electron transistor to measure current through junctions contacting the absorber. We describe optimization of device parameters, and results on fabrication techniques for producing devices with high yield for detector arrays. We also present modeling of expected saturation power levels, antenna coupling, and rf multiplexing schemes.
Author
Antenna Couplers; High Resolution; Imaging Techniques; Submillimeter Waves

20040074296 California Inst. of Tech., Pasadena, CA, USA
The Role of Coherent Detection
Zmuidzinas, J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 329-341; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

Many interesting astronomical objects, such as galaxies, molecular clouds, PDRs, star - forming regions, protostars, evolved stars, planets, and comets, have rich submillimeter spectra. In order to avoid line blending, and to be able to resolve the line shape, it is often necessary to measure these spectra at high resolution. This paper discusses the relative advantages and limitations of coherent and direct detection for high resolution spectroscopy in the submillimeter and far - infrared. In principle, direct detection has a fundamental sensitivity advantage. In practice, it is di.cult to realize this advantage given the sensitivities of existing detectors and reasonable constraints on the instrument volume. Thus, coherent detection can be expected to play an important role in submillimeter and far - infrared astrophysics well into the future.
Author
Comets; Detection; Far Infrared Radiation; High Resolution; Line Shape; Spectroscopy; Submillimeter Waves

20040074297 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ideal Integrating Bolometer
Kogut, A.; DiPirro, M.; Moseley, S. H.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 342-348; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

We describe a new "ideal integrator" bolometer as a prototype for a new generation of sensitive, flexible far-IR detectors suitable for use in large arrays. The combination of a non-dissipative sensor coupled with a fast heat switch provides breakthrough capabilities in both sensitivity and operation. The bolometer temperature varies linearly with the integrated infrared power incident on the detector, and may be sampled intermittently without loss of information between samples. The sample speed and consequent dynamic range depend only on the heat switch reset cycle and can be selected in software. Between samples, the device acts as an ideal integrator with noise significantly lower than resistive bolometers. Since there is no loss of information between samples, the device is well-suited for large arrays. A single SQUID readout could process an entire column of detectors, greatly reducing the complexity, power requirements, and cost of readout electronics for large pixel arrays.
Author
Bolometers; Far Infrared Radiation; Sensitivity; Prototypes

20040074298 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Millimeter-Wave Bolometric Interferometer
Ali, S.; Ade, P. A. R.; Bock, J. J.; Novak, G.; Piccirillo, L.; Timbie, P.; Tucker, G. S.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 309-316; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The Millimeter-wave Bolometric Interferometer (MBI) is a proposed ground-based instrument designed for a wide range of cosmological and astrophysical observations including studies of the polarization of the cosmic microwave background (CMB). MBI combines the advantages of two well-developed technologies - interferometers and bolometric detectors. Interferometers have many advantages over .filled-aperture telescopes and are particularly suitable for high resolution imaging. Cooled bolometers are the highest sensitivity detectors at millimeter and sub-millimeter wavelengths. The combination of these two technologies results in an instrument with both high sensitivity and high angular resolution.
Author
Millimeter Waves; Bolometers; Interferometers

20040074303 Cologne Univ., Germany

Heterodyne Array Receiver Development at KOSMA

Heyminck, S.; Graf, U. U.; Michael, E. A.; Stanko, S.; Rabanus, D.; Honingh, C. E.; Jacobs, K.; Schieder, R.; Stutzki, J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 359-369; In English; See also 20040074260

Contract(s)/Grant(s): DFG-SFB-494; BMBF-05-AH9PK1; No Copyright; Avail: CASI; A03, Hardcopy

We present an overview of the array receiver development in the KOSMA receiver group. The central topic of the presentation is the 16 element 40/810 GHz array SMART (SubMillimeter Array Receiver for Two frequencies), which has been installed at the KOSMA telescope on Gornergrat near Zermatt/Switzerland in September of 2001. The opto-mechanical design of this receiver makes intensive use of our CNC machining capabilities, both to produce special optical components like imaging phase gratings for LO multiplexing, and also to manufacture relatively large receiver sub-assemblies as monolithic integrated optics blocks. We use our standard waveguide SIS mixers as detectors and the KOSMA Array-AOS as backends. We give a short presentation of the receiver design and show results obtained with the instrument during its first astronomical observing season. Based on the good experience with SMART, we are using a similar approach for the design of STAR (SOFIA Terahertz Array Receiver), a 16 element 1.9 THz hot electron bolometer array, which we are currently developing.

Author

Heterodyning; Arrays; Receivers

20040074309 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

BLAST: The Balloon-Borne Large Aperture Submillimeter Telescope

Devlin, Mark; Ade, Peter; Bock, Jamie; Dicker, Simon; Griffin, Matt; Gunderson, Josh; Halpern, Mark; Hargrave, Peter; Hughes, David; Klein, Jeff, et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 317-322; In English; See also 20040074260

Contract(s)/Grant(s): NRA-99-01-SPA-015; No Copyright; Avail: CASI; A02, Hardcopy

BLAST is the Balloon-borne Large-Aperture Sub-millimeter Telescope. It will fly from a Long Duration Balloon (LDB) platform from Antarctica. The telescope design incorporates a 2 m primary mirror with large-format bolometer arrays operating at 250, 350 and 500 microns. By providing the first sensitive large-area (10 sq. deg.) sub-mm surveys at these wavelengths, BLAST will address some of the most important galactic and cosmological questions regarding the formation and evolution of stars, galaxies and clusters. Galactic and extragalactic BLAST surveys will: (1) identify large numbers of high-redshift galaxies; (2) measure photometric redshifts, rest-frame FIR luminosities and star formation rates thereby constraining the evolutionary history of the galaxies that produce the FIR and sub-mm background; (3) measure cold pre-stellar sources associated with the earliest stages of star and planet formation; (4) make high-resolution maps of diffuse galactic emission over a wide range of galactic latitudes. In addition to achieving the above scientific goals, the exciting legacy of the BLAST LDB experiment will be a catalogue of 3000-5000 extragalactic sub-mm sources and a 100 sq. deg. sub-mm galactic plane survey. Multi-frequency follow-up observations from SIRTF, ASTRO-F, and Herschel, together with spectroscopic observations and sub-arcsecond imaging from ALMA are essential to understand the physical nature of the BLAST sources.

Author

Balloon-Borne Instruments; Bolometers; Galactic Evolution; Imaging Techniques; Telescopes

20040074317 UK Astronomy Technology Centre, UK

Detector Technology for SCUBA-2: The New Generation Submillimeter Imager for the JCMT

Duncan, W. D.; Holland, W. S.; Audley, M. D.; Kelly, B. D.; Gostick, D.; Peacocke, P. T.; MacIntosh, M. J.; Hodson, T.; Irwin, K. D.; Hilton, G., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 295-300; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The contents include the following: 1. New Detector Technologies. Transition Edge sensors. Pixel modelling. Monolithic arrays. 2. Thermal conductance of the pixel. Multiplexed SQUID Readout. 3. Dark SQUID experiment. 4. SCUBA 2 instrument - 4K and 1K optics and array modules.

CASI

Detectors; Technology Assessment; Submillimeter Waves

20040074318 California Univ., Berkeley, CA, USA

Future Far Infrared/Submillimeter Direct Detectors

Richards, P. L.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 325-328; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The new mission concepts developed at this workshop will require large format arrays (1024 or more) of direct detectors at far infrared and millimeter wavelengths. The present status of such detectors will be reviewed and new technologies will be described which promise to meet anticipated mission requirements.
Author
Far Infrared Radiation; Submillimeter Waves; Infrared Detectors

20040074319 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Cryogenic Delay Line for Long-Baseline Interferometry in the Far-Infrared
Lawson, P. R.; Swain, M. R.; Dumont, P. J.; Moore, J. D.; Smythe, R. F.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 408-414; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy
We discuss the design, current status, and ongoing development of a cryogenic delay line for long-baseline direct-detection interferometry in the far-infrared.
Author
Cryogenics; Delay Lines

36
LASERS AND MASERS

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

20040073534 Weapon Systems Technology Information Analysis Center, Alexandria, VA
WSTIAC: Weapon Systems Technology Information Analysis Center. Volume 4, Number 3
Scannell, Edward P.; Jan. 2004; 16 pp.; In English
Report No.(s): AD-A422221; No Copyright; Avail: CASI; A03, Hardcopy
This is the third of a triad of articles on Directed Energy Weapons (DEWs). The first article by Mark Scoff covered High Energy Laser (HEL) Weapons (Vol. 4, No.1, Spring 2003), and in the second article, by the present author, we reviewed Radio Frequency DEWs, most often referred to as High Power Microwave (HPM) Weapons, which constitute the second largest R&D effort in the DEW field.
DTIC
Information; Information Systems; Weapon Systems

20040073536 Colorado State Univ., Fort Collins, CO
Development of a Discharge Pumped 13 nm Laser for Metrology of Projection Lithography Optics at the Manufacture-Site
Rocca, Jorge J.; Sep. 14, 2003; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0279
Report No.(s): AD-A422274; ARO-40300.1-EL; No Copyright; Avail: CASI; A03, Hardcopy
A high power capillary discharge cadmium plasma source was developed to investigate the generation of 13.2 nm coherent radiation for metrology tasks in Extreme Ultraviolet Lithography. Excitation of a capillary channel filled with Cd vapor with a fast current pulse (190 kA, 15 ns risetime) resulted in the successful excitation of 13.2 nm radiation from the 4d ISO-4p 1P1 laser line of Nickel-like Cd (Cd XXI). Spectra of this capillary discharge plasma showed the emission from the 13.2nm laser line is the most intense in that spectral region. Detailed spectroscopic studies confirmed that the observed 13.2 nm line radiation corresponds to the Cd XXI laser line, and identified fifty-five Cd XXI lines in the 12.7- 18.4 nm region which constitute a valuable diagnostics to optimize the gain in the 13.2 nm laser line using line intensity ratio techniques. The dynamics and symmetry of the capillary discharge Cd plasma column were also studied using an EUV pinhole camera . The pinhole images show that the plasma column presents a good degree of symmetry up to the time of maximum compression.
DTIC
Lasers; Lithography; Metrology

20040073556 Florida State Univ., Tallahassee, FL

Laser Induced Desorption Time of Flight Mass Spectrometer Analysis of Adsorbed Contaminants on Vacuum Ultraviolet Lithography Optic Materials

Allen, Susan D.; Feb. 2004; 104 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-00-1-1727; Proj-ARPS

Report No.(s): AD-A422349; AFRL-SN-WP-TR-2004-1054; No Copyright; Avail: CASI; A06, Hardcopy

Adsorbed surface contaminants on optical elements absorb light energy in an optical lithography system and, if left unclean, will result in reduced wafer yield. In order to nondestructively analyze the surface adsorbate of different CaF2 samples, a laser induced desorption-Time of Flight Mass Spectrometer (LID-TOFMS) technique was developed. The main object of this technique is to investigate the surface composition of adsorbed contaminants as a function of position on the sample. An Er:YAG laser at 2.94 micrometers was used as the light source to induce desorption. Electron impact ionization was used to obtain ionization of desorbed molecules. The detection of ionized species was accomplished by TOFMS operated in Angular Reflectron (AREF) mode to obtain better resolution. The data reported here can be used in semiconductor industries either to modify conventional processing or to design a new efficient laser cleaning process for optical elements.

DTIC

Adsorption; Contaminants; Desorption; Detection; Far Ultraviolet Radiation; Lasers; Lithography; Mass Spectrometers; Optical Measurement; Time of Flight Spectrometers

20040073559 Naval Postgraduate School, Monterey, CA

Multiple Beam Directors for Naval Free Electron Laser Weapons

Mitchell, Ethan D.; Mar. 2004; 82 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422357; No Copyright; Avail: CASI; A05, Hardcopy

The Free Electron Laser has the potential to become a revolutionary weapon system. Deep magazines, low cost- per-shot, pinpoint accuracy, and speed of light delivery give this developing weapon system significant advantages over conventional systems. One limiting factor in high energy laser implementation is then%al blooming, a lensing effect which is caused by the quick heating of the atmosphere, so that the laser beam does not focus on the desired spot, thereby degrading the effectiveness of the laser on target. The use of multiple beam directors focusing on a target from a single platform% may mitigate then%al blooming by allowing half of the laser's energy to travel through a given volume of air, so that they only overlap very near the target. Less energy traveling through a given volume of space means less heating, and therefore lessens the effects of then%al blooming. Also, simulations of FEL's were conducted modifying parameters such as the number of undulator periods, electron beam focus, the normalized Rayleigh length, and mirror output coupling, in order to determine optimum design parameters. New parameters for the next proposed FEL were simulated to examine the effect of mirror tilt on laser power and extraction as well.

DTIC

Free Electron Lasers; Laser Weapons

20040074138 National Defense Univ., Washington, DC

Defense Horizons. Number 18, October 2002. High- Energy Lasers: Technical, Operational, and Policy Issues

Zimet, Elihu; Oct. 2002; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422467; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

High Power Lasers; Horizon; Policies

20040074140 National Defense Univ., Washington, DC

Defense Horizons. Number 12, April 2002. The Airborne Laser From Theory to Reality: An Insider's Account

Mark, Hans; Apr. 2002; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422471; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available

Airborne Lasers; Horizon; Laser Weapons

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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*.

20040068130 NASA Langley Research Center, Hampton, VA, USA
Recent Developments and Status of the Langley Single Vector Balance Calibration System (SVS)
Jones, Shirley M.; Rhew, Ray D.; 2004; 6 pp.; In English; Fourth International Symposium on Strain Gauge Balances, 10-13 May 2004, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

The Langley Research Center (LaRC) Single Vector Balance Calibration System (SVS) was first introduced in 2000 by Peter Parker. The SVS combines the Design of Experiments (DOE) methodology with a novel load application system. Since that time three systems have been designed and developed with different load range capabilities (ranging from 2 pounds to 3,000 pounds). Approximately fifteen balances have been calibrated and their data compared to conventional techniques. This paper will present results of these comparisons, based on the mathematical models and accuracies, and discuss differences that were observed. In addition, changes in the implementation of the initial load schedules developed using DOE will be highlighted. One of the principles behind DOE is randomization. The initial loading schedules used to date have been randomized in the traditional DOE sense but not for repeat calibrations or experiments. Implementation of this randomization within blocks and its impact on data quality will be reviewed. Areas of potential future development will be presented which include changes in the centers to include loads with the force position system in the pure error estimates.
Author
Calibrating; Error Analysis; Mathematical Models

20040070764 Louisiana Tech Univ., Ruston, LA, USA
Elastic-Plastic Thermal Stress Analysis of a High-Pressure Cryogenic Storage Tank
Barker, J. Mark; Field, Robert E., Technical Monitor; August 15, 2003; 5 pp.; In English
Report No.(s): EB-2003-08-00005-SSC; No Copyright; Avail: Other Sources

The thermal stresses on a cryogenic storage tank contribute strongly to the state of stress of the tank material and its ability to withstand operational stresses. These thermal stresses also affect the growth of any surface damage that might occur in the tank walls. These stresses are particularly of concern during the initial cooldown period for a new tank placed into service, and during any subsequent thermal cycles. A previous preliminary elastic analysis showed that the thermal stress on the inner wall would reach approximately 1,000MPa (145,000 psi). This stress far exceeds the ASTM specified room temperature values for both yield (170MPa) and ultimate (485 MPa) strength for 304L stainless steel. The present analysis determines the thermal stresses using an elastic-plastic model. The commercial software application ANSYS was used to determine the transient spatial temperature profile and the associated spatial thermal stress profiles in a segment of a thick-walled vessel during a typical cooldown process. A strictly elastic analysis using standard material properties for 304L stainless steel showed that the maximum thermal stress on the inner and outer walls was approximately 960 MPa (tensile) and - 270 MPa (compressive) respectively. These values occurred early in the cooldown process, but at different times, An elastic-plastic analysis showed significantly reducing stress, as expected due to the plastic deformation of the material. The maximum stress for the inner wall was approximately 225 MPa (tensile), while the maximum stress for the outer wall was approximately - 130 MPa (compressive).
Author
Elastic Properties; Stress Distribution; Thermal Stresses; High Pressure; Storage Tanks; Plastic Properties; Cryogenic Equipment

20040070814 Texas-Pan American Univ., Edinburg, TX, USA
Improved Temperature Dynamic Model of Turbine Subcomponents for Facilitation of Generalized Tip Clearance Control
Kypuros, Javier A.; Colson, Rodrigo; Munoz, Afredo; January 2004; 13 pp.; In English
Contract(s)/Grant(s): NAG3-2857; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes efforts conducted to improve dynamic temperature estimations of a turbine tip clearance system to facilitate design of a generalized tip clearance controller. This work builds upon research previously conducted and presented in and focuses primarily on improving dynamic temperature estimations of the primary components affecting tip clearance (i.e. the rotor, blades, and casing/shroud). The temperature profiles estimated by the previous model iteration, specifically for the

rotor and blades, were found to be inaccurate and, more importantly, insufficient to facilitate controller design. Some assumptions made to facilitate the previous results were not valid, and thus improvements are presented here to better match the physical reality. As will be shown, the improved temperature sub- models, match a commercially validated model and are sufficiently simplified to aid in controller design.
Author
Temperature Profiles; Dynamic Models; Turbines; Engine Parts

20040071041 NASA Marshall Space Flight Center, Huntsville, AL, USA
Friction Stir Welding of GR-Cop 84 for Combustion Chamber Liners
Russell, Carolyn K.; Carter, Robert; Ellis, David L.; Goudy, Richard; 2004; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

GRCop-84 is a copper-chromium-niobium alloy developed by the Glenn Research Center for liquid rocket engine combustion chamber liners. GRCop-84 exhibits superior properties over conventional copper-base alloys in a liquid hydrogen-oxygen operating environment. The Next Generation Launch Technology program has funded a program to demonstrate scale-up production capabilities of GR-Cop 84 to levels suitable for main combustion chamber production for the prototype rocket engine. This paper describes a novel method of manufacturing the main combustion chamber liner. The process consists of several steps: extrude the GR-Cop 84 powder into billets, roll the billets into plates, bump form the plates into cylinder halves and friction stir weld the halves into a cylinder. The cylinder is then metal spun formed to near net liner dimensions followed by finish machining to the final configuration. This paper describes the friction stir weld process development including tooling and non-destructive inspection techniques, culminating in the successful production of a liner preform completed through spin forming.
Author
Chromium Alloys; Preforms; Powder (Particles); Niobium Alloys; Manufacturing; Friction Stir Welding

20040073438 General Electric Co., Niskayuna, NY, USA
Disk Crack Detection for Seeded Fault Engine Test
Luo, Huageng; Rodriguez, Hector; Hallman, Darren; Corbly, Dennis; Lewicki, David G., Technical Monitor; June 2004; 54 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-01135; WBS-22-728-30-03
Report No.(s): NASA/CR-2004-213069; E-14545; No Copyright; Avail: CASI; A04, Hardcopy

Work was performed to develop and demonstrate vibration diagnostic techniques for the on-line detection of engine rotor disk cracks and other anomalies through a real engine test. An existing single-degree-of-freedom non-resonance-based vibration algorithm was extended to a multi-degree-of-freedom model. In addition, a resonance-based algorithm was also proposed for the case of one or more resonances. The algorithms were integrated into a diagnostic system using state-of-the-art commercial analysis equipment. The system required only non-rotating vibration signals, such as accelerometers and proximity probes, and the rotor shaft 1/rev signal to conduct the health monitoring. Before the engine test, the integrated system was tested in the laboratory by using a small rotor with controlled mass unbalances. The laboratory tests verified the system integration and both the non-resonance and the resonance-based algorithm implementations. In the engine test, the system concluded that after two weeks of cycling, the seeded fan disk flaw did not propagate to a large enough size to be detected by changes in the synchronous vibration. The unbalance induced by mass shifting during the start up and coast down was still the dominant response in the synchronous vibration.
Author
Cracks; Detection; Vibration; Diagnosis; Engine Tests; Rotons

20040073465 National Inst. of Aerospace Research, Hampton, VA, USA, NASA Langley Research Center, Hampton, VA, USA
Stress Distribution During Deformation of Polycrystalline Aluminum by Molecular-Dynamics and Finite-Element Modeling
Yamakov, V.; Saether, E.; Phillips, D.; Glaessgen, E. H.; March 25, 2004; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NAS1-00135; NCC1-02043; 706-63-51
Report No.(s): AIAA Paper 2004-1700; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, a multiscale modelling strategy is used to study the effect of grain-boundary sliding on stress localization in a polycrystalline microstructure with an uneven distribution of grain size. The development of the molecular dynamics (MD) analysis used to interrogate idealized grain microstructures with various types of grain boundaries and the multiscale modelling strategies for modelling large systems of grains is discussed. Both molecular-dynamics and finite-element (FE) simulations for idealized polycrystalline models of identical geometry are presented with the purpose of demonstrating the effectiveness of the adapted finite-element method using cohesive zone models to reproduce grain-boundary sliding and its effect on the stress distribution in a polycrystalline metal. The yield properties of the grain-boundary interface, used in the FE simulations, are extracted from a MD simulation on a bicrystal. The models allow for the study of the load transfer between adjacent grains of very different size through grain-boundary sliding during deformation. A large-scale FE simulation of 100 grains of a typical microstructure is then presented to reveal that the stress distribution due to grain-boundary sliding during uniform tensile strain can lead to stress localization of two to three times the background stress, thus suggesting a significant effect on the failure properties of the metal.
Author
Molecular Dynamics; Polycrystals; Stress Distribution; Aluminum; Deformation; Microstructure

20040073474 NASA Glenn Research Center, Cleveland, OH, USA
Strain-Life Assessment of Grainex Mar-M 247 for NASA's Turbine Seal Test Facility
Delgado, Irebert R.; Halford, Gary R.; Steinetz, Bruce M.; Rimnac, Clare M.; April 2004; 14 pp.; In English; Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria
Contract(s)/Grant(s): WBS 22-714-09-18; DA Proj. 1L1-61102-AF-20
Report No.(s): NASA/TM-2004-212985; ARL-TR-3178; GT2004-53939; E-14460; No Copyright; Avail: CASI; A03, Hardcopy

NASA s Turbine Seal Test Facility is used to test air-to-air seals for use primarily in advanced jet engine applications. Combinations of high temperature, high speed, and high pressure limit the disk life, due to the concern of crack initiation in the bolt holes of the Grainex Mar-M 247 disk. The primary purpose of this current work is to determine an inspection interval to ensure safe operation. The current work presents high temperature fatigue strain-life data for test specimens cut from an actual Grainex Mar-M 247 disk. Several different strain-life models were compared to the experimental data including the Manson-Hirschberg Method of Universal Slopes, the Halford-Nachtigall Mean Stress Method, and the Modified Morrow Method. The Halford-Nachtigall Method resulted in only an 18 percent difference between predicted and experimental results. Using the experimental data at a 99.95 percent prediction level and the presence of 6 bolt holes it was found that the disk should be inspected after 665 cycles based on a total strain of 0.5 percent at 649 C.
Author
Fatigue Life; Nickel Compounds; Crack Initiation; Life (Durability); Turbines; Sealing

20040073522 Maryland Univ., College Park, MD, USA
Planetary Transmission Diagnostics
Lewicki, David G., Technical Monitor; Samuel, Paul D.; Conroy, Joseph K.; Pines, Darryll J.; May 2004; 90 pp.; In English
Contract(s)/Grant(s): NAS3-2223; WBS 22-714-09-16
Report No.(s): NASA/CR-2004-213068; E-14544; No Copyright; Avail: CASI; A05, Hardcopy

This report presents a methodology for detecting and diagnosing gear faults in the planetary stage of a helicopter transmission. This diagnostic technique is based on the constrained adaptive lifting algorithm. The lifting scheme, developed by Wim Sweldens of Bell Labs, is a time domain, prediction-error realization of the wavelet transform that allows for greater flexibility in the construction of wavelet bases. Classic lifting analyzes a given signal using wavelets derived from a single fundamental basis function. A number of researchers have proposed techniques for adding adaptivity to the lifting scheme, allowing the transform to choose from a set of fundamental bases the basis that best fits the signal. This characteristic is desirable for gear diagnostics as it allows the technique to tailor itself to a specific transmission by selecting a set of wavelets that best represent vibration signals obtained while the gearbox is operating under healthy-state conditions. However, constraints on certain basis characteristics are necessary to enhance the detection of local wave-form changes caused by certain types of gear damage. The proposed methodology analyzes individual tooth-mesh waveforms from a healthy-state gearbox vibration signal that was generated using the vibration separation (synchronous signal-averaging) algorithm. Each waveform is separated into analysis domains using zeros of its slope and curvature. The bases selected in each analysis domain are chosen to minimize the prediction error, and constrained to have the same-sign local slope and curvature as the original signal. The resulting set of bases is used to analyze future-state vibration signals and the lifting prediction error is inspected. The constraints allow the transform to effectively adapt to global amplitude changes, yielding small prediction errors. However,

local wave-form changes associated with certain types of gear damage are poorly adapted, causing a significant change in the prediction error. The constrained adaptive lifting diagnostic algorithm is validated using data collected from the University of Maryland Transmission Test Rig and the results are discussed.
Author
Transmissions (Machine Elements); Fault Detection; Algorithms; Helicopter Propeller Drive; Methodology

20040074323 NASA Langley Research Center, Hampton, VA, USA
Predicting the Influence of Nano-Scale Material Structure on the In-Plane Buckling of Orthotropic Plates
Gates, Thomas S.; Odegard, Gregory M.; Nemeth, Michael P.; Frankland, Sarah-Jane V.; April 12, 2004; 15 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamic, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 762-55-LC
Report No.(s): AIAA Paper 2004-1607; No Copyright; Avail: CASI; A03, Hardcopy

A multi-scale analysis of the structural stability of a carbon nanotube-polymer composite material is developed. The influence of intrinsic molecular structure, such as nanotube length, volume fraction, orientation and chemical functionalization, is investigated by assessing the relative change in critical, in-plane buckling loads. The analysis method relies on elastic properties predicted using the hierarchical, constitutive equations developed from the equivalent-continuum modeling technique applied to the buckling analysis of an orthotropic plate. The results indicate that for the specific composite materials considered in this study, a composite with randomly orientated carbon nanotubes consistently provides the highest values of critical buckling load and that for low volume fraction composites, the non-functionalized nanotube material provides an increase in critical buckling stability with respect to the functionalized system.
Author
Carbon Nanotubes; Composite Materials; Continuum Modeling; Elastic Properties; Orthotropic Plates; Structural Stability

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*.

20040068231 Lockheed Martin Corp., Syracuse, NY, USA
Effects of Equipment Loading on the Vibrations of Edge-Stiffened Plates and Associated Modeling Issues
Campbell, R. L.; Hambric, S. A.; Jun. 2002; 14 pp.; In English
Report No.(s): DE2004-822283; LM-02K044; No Copyright; Avail: Department of Energy Information Bridge

Predicting structural radiated noise is a process that involves several steps, often including the development of a finite element (FE) model to provide structural response predictions. Limitations of these FE models often govern the success of overall noise predictions. The purpose of the present investigation is to identify the effects of real world attachments on edge-stiffened plates and identify advanced modeling methods to facilitate vibroacoustic analyses of such complex structures. A combination of experimental and numerical methods is used in the evaluation. The results show the effects of adding attachments to the edge-stiffened plate in terms of mode shape mass loading, creation of new mode shapes, modifications to original mode shapes, and variations in damping levels. A finite element model of the edge-stiffened plate with simplified attachments has been developed and is used in conjunction with experimental data to aid in the developments. The investigation presented here represents a necessary first step toward implementing an advanced modeling technique.
NTIS
Finite Element Method; Plates (Structural Members); Mathematical Models; Noise Prediction

20040068305 Texas A&M Univ., College Station, TX
Crash Testing and Evaluation of the Modified T77 Bridge Rail
Bullard, D. L.; Buth, C. E.; Williams, W. F.; Menges, W. L.; Haug, R. R.; Sep. 2003; 94 pp.; In English
Report No.(s): PB2004-105020; TTI-0-4852; No Copyright; Avail: CASI; A05, Hardcopy

Under a previous study, Texas Transportation Institute (TTI) and TX DOT worked cooperatively to conceptualize and develop two aesthetically pleasing and crashworthy rail designs. The rails were designated the T77 and the F411. Researchers performed and evaluated full-scale crash tests on the new rails in accordance with National Cooperative Highway Research

Program (NCHRP) Report 350 test 3-11. The TX DOT F411 bridge rail performed acceptably according to the evaluation criteria of NCHRP Report 350. However, the T77 design failed to perform acceptably with the pickup truck. The objective of this project was to modify the TX DOT T77 bridge rail to perform as an aesthetically pleasing and crashworthy bridge rail. TT1 and TX DOT worked cooperatively to modify the design to make the rail perform satisfactorily. Researchers performed full-scale crash tests in accordance with NCHRP Report 350. The T77 bridge rail was modified so it would perform in accordance with the evaluation criteria for NCHRP Report 350 test 3-11.
NTIS
Rails; Transportation

20040070719 NASA Langley Research Center, Hampton, VA, USA
Global-Local Finite Element Analysis of Bonded Single-Lap Joints
Kilic, Bahattin; Madenci, Erdogan; Ambur, Damodar R.; April 15, 2004; 13 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 762-55-LE
Report No.(s): AIAA Paper 2004-1559; Copyright; Avail: CASI; A03, Hardcopy

Adhesively bonded lap joints involve dissimilar material junctions and sharp changes in geometry, possibly leading to premature failure. Although the finite element method is well suited to model the bonded lap joints, traditional finite elements are incapable of correctly resolving the stress state at junctions of dissimilar materials because of the unbounded nature of the stresses. In order to facilitate the use of bonded lap joints in future structures, this study presents a finite element technique utilizing a global (special) element coupled with traditional elements. The global element includes the singular behavior at the junction of dissimilar materials with or without traction-free surfaces.
Author
Adhesive Bonding; Bonded Joints; Lap Joints; Finite Element Method; Stress Analysis

20040070761 NASA Langley Research Center, Hampton, VA, USA
Application of Non-Deterministic Methods to Assess Modeling Uncertainties for Reinforced Carbon-Carbon Debris Impacts
Lyle, Karen H.; Fasanella, Edwin L.; Melis, Matthew; Carney, Kelly; Gabrys, Jonathan; March 05, 2004; 11 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The Space Shuttle Columbia Accident Investigation Board (CAIB) made several recommendations for improving the NASA Space Shuttle Program. An extensive experimental and analytical program has been developed to address two recommendations related to structural impact analysis. The objective of the present work is to demonstrate the application of probabilistic analysis to assess the effect of uncertainties on debris impacts on Space Shuttle Reinforced Carbon-Carbon (RCC) panels. The probabilistic analysis is used to identify the material modeling parameters controlling the uncertainty. A comparison of the finite element results with limited experimental data provided confidence that the simulations were adequately representing the global response of the material. Five input parameters were identified as significantly controlling the response.
Author
Carbon-Carbon Composites; Finite Element Method; Structural Analysis; Space Shuttle Orbiters; Impact Damage; Panels; Monte Carlo Method

20040070811 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of a Fatigue Crack Growth Coupon for Highly Plastic Stress Conditions
Allen, Phillip A.; Aggarwal, Pravin K.; Swanson, Gregory R.; July 24, 2003; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents an analytical approach used to develop a novel fatigue crack growth coupon for a highly plastic 3-D stress field condition. The flight hardware investigated in this paper is a large separation bolt that fractures using pyrotechnics at the appointed time during the flight sequence. The separation bolt has a deep notch that produces a severe stress concentration and a large plastic zone when highly loaded. For this geometry, linear-elastic fracture mechanics (LEFM) techniques are not valid due to the large nonlinear stress field. Unfortunately, industry codes that are generally available for fracture mechanics analysis and fatigue crack growth (e.g. NASGRO (11) are limited to LEFM and are available for only a

limited number of geometries. The results of LEFM based codes are questionable when used on geometries with significant plasticity. Therefore elastic-plastic fracture mechanics (EPFM) techniques using the finite element method (FEM) were used to analyze the bolt and test coupons. scale flight hardware is very costly in t e r n of assets, laboratory resources, and schedule. Therefore to alleviate some of these problems, a series of novel test coupons were developed to simulate the elastic-plastic stress field present in the bolt.
Author
Crack Propagation; Fatigue (Materials); Stress Concentration; Fracture Mechanics; Fractures (Materials); Pyrotechnics; Finite Element Method

20040070826 NASA Langley Research Center, Hampton, VA, USA
Thermo-Elastic Triangular Sandwich Element for the Complete Stress Field Based on a Single-Layer Theory
Das, M.; Barut, A.; Madenci, E.; Ambur, D. R.; [2004]; 31 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): 23-762-55-LE
Report No.(s): AIAA Paper 2004-1770; Copyright; Avail: CASI; A03, Hardcopy

This study presents a new triangular finite element for modeling thick sandwich panels, subjected to thermo-mechanical loading, based on a {3,2}-order single-layer plate theory. A hybrid energy functional is employed in the derivation of the element because of a C interelement continuity requirement. The single-layer theory is based on five weighted-average field variables arising from the cubic and quadratic representations of the in-plane and transverse displacement fields, respectively. The variations of temperature and distributed loading acting on the top and bottom surfaces are non-uniform. The temperature varies linearly through the thickness.
Author
Sandwich Structures; Mathematical Models; Finite Element Method; Thermoelasticity; Shear Stress; Stress Distribution

20040070894 NASA Langley Research Center, Hampton, VA, USA
Material Modeling of Space Shuttle Leading Edge and External Tank Materials For Use in the Columbia Accident Investigation
Carney, Kelly; Melis, Matthew; Fasanella, Edwin L.; Lyle, Karen H.; Gabrys, Jonathan; [2004]; 10 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): RTOP 23-728-01-06; No Copyright; Avail: CASI; A02, Hardcopy

Upon the commencement of the analytical effort to characterize the impact dynamics and damage of the Space Shuttle Columbia leading edge due to External Tank insulating foam, the necessity of creating analytical descriptions of these materials became evident. To that end, material models were developed of the leading edge thermal protection system, Reinforced Carbon Carbon (RCC), and a low density polyurethane foam, BX-250. Challenges in modeling the RCC include its extreme brittleness, the differing behavior in compression and tension, and the anisotropic fabric layup. These effects were successfully included in LS-DYNA Material Model 58, *MAT_LAMINATED_ COMPOSITE_ FABRIC. The differing compression and tension behavior was modeled using the available damage parameters. Each fabric layer was given an integration point in the shell element, and was allowed to fail independently. Comparisons were made to static test data and coupon ballistic impact tests before being utilized in the full scale analysis. The foam's properties were typical of elastic automotive foams; and LS-DYNA Material Model 83, *MAT_FU_CHANG_FOAM, was successfully used to model its behavior. Material parameters defined included strain rate dependent stress-strain curves for both loading and un-loading, and for both compression and tension. This model was formulated with static test data and strain rate dependent test data, and was compared to ballistic impact tests on load-cell instrumented aluminum plates. These models were subsequently utilized in analysis of the Shuttle leading edge full scale ballistic impact tests, and are currently being used in the Return to Flight Space Shuttle re-certification effort.
Author
Accident Investigation; Full Scale Tests; Impact Damage; Impact Tests; Leading Edges; Stress-Strain Relationships; Space Shuttle Orbiters

20040070896 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA

Dynamic Analysis of a Building Under Rocket Engine Plume Acoustic Load

Qian, Z.; VanDyke, D.; Wright, S.; Redmond, M.; July 09, 2001; 11 pp.; In English; 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-10 Jul. 2001, Salt Lake City, UT, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS13-650; SWR H308A22200

Report No.(s): AIAA Paper 2001-3526; SE 2001-06-00029-SSC; Copyright; Avail: CASI; A03, Hardcopy

Studies have been performed to develop finite-element modeling and simulation techniques to predict the dynamic structural response of Building 4010 to the acoustic load from the plume of high-thrust rocket motors. The building is the Test Control Center and general office space for the E-complex at Stennis Space Center. It is a large single span; light-structured building located approximately 1,000 feet from the E-1 test stand. A three-dimensional shell/beam combined model of the building was built using Pro/Engineer platform and imported into Pro/Mechanica for analysis. An Equivalent Shell technique was developed to simplify the highly complex building structure so that the calculation is more efficient and accurate. A deterministic approach was used for the dynamic analysis. A pre-stressed modal analysis was performed to simulate the weight stiffening of the structure, through which about 200 modes ranging from 0 to 35 Hz were identified. In an initial dynamic frequency analysis, the maximum response over the model was found. Then the complete 3-D distributions of the displacement, as well as the stresses, were calculated through a final frequency analysis. The results were compared to a strain gage and accelerometer recordings from rocket engine tests and showed reasonable agreement.

Author

Buildings; Test Facilities; Dynamic Response; Engine Tests; Acoustics; Loads (Forces); Rocket Engines; Dynamic Structural Analysis

20040070935 NASA Langley Research Center, Hampton, VA, USA

Test and Analysis Correlation of Form Impact onto Space Shuttle Wing Leading Edge RCC Panel 8

Fasanella, Edwin L.; Lyle, Karen H.; Gabrys, Jonathan; Melis, Matthew; Carney, Kelly; March 05, 2004; 12 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Soon after the Columbia Accident Investigation Board (CAIB) began their study of the space shuttle Columbia accident, "physics-based" analyses using LS-DYNA were applied to characterize the expected damage to the Reinforced Carbon-Carbon (RCC) leading edge from high-speed foam impacts. Forensic evidence quickly led CAIB investigators to concentrate on the left wing leading edge RCC panels. This paper will concentrate on the test of the left-wing RCC panel 8 conducted at Southwest Research Institute (SwRI) and the correlation with an LS-DYNA analysis. The successful correlation of the LS-DYNA model has resulted in the use of LS-DYNA as a predictive tool for characterizing the threshold of damage for impacts of various debris such as foam, ice, and ablators onto the RCC leading edge for shuttle return-to-flight.

Author

Accident Investigation; Carbon-Carbon Composites; Leading Edges; Impact Damage; Space Shuttle Orbiters; Finite Element Method

20040070940 NASA Langley Research Center, Hampton, VA, USA

The Use of LS-DYNA in the Columbia Accident Investigation and Return to Flight Activities

Gabrys, Jonathan; Schatz, Josh; Carney, Kelly; Melis, Matthew; Fasanella, Edwin L.; Lyle, Karen H.; [2004]; 10 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

During the launch of the Space Shuttle Columbia on January 16, 2003, foam originating from the external tank impacted the shuttle's left wing 81 seconds after lift-off. Then on February 1st, Space Shuttle Columbia broke-up during re-entry. In the weeks that followed, the Columbia Accident Investigation Board had formed various teams to investigate every aspect of the tragedy. One of these teams was the Impact Analysis Team, which was asked to investigate the foam impact on the wing leading edge. This paper will describe the approach and methodology used by the team to support the accident investigation, and more specifically the use of LS-DYNA for analyzing the foam impact event. Due to the success of the analytical predictions, the impact analysis team has also been asked to support Return to Flight activities. These activities will analyze a far broader range of impact events, but not with just foam and not only on the wing leading edge. The debris list has expanded and so have the possible impact locations. This paper will discuss the Return to Flight activities and the use of LS-DYNA to support them.

Author

Accident Investigation; Spacecraft Reentry; Impact Damage; Leading Edges; Finite Element Method; Computerized Simulation

20040071005 NASA Marshall Space Flight Center, Huntsville, AL, USA

Statistical Comparison and Improvement of Methods for Combining Random and Harmonic Loads

Brown, Andrew M.; McGhee, David S.; March 1, 2004; 6 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Structures in many environments experience both random and harmonic excitation. A variety of closed-form techniques has been used in the aerospace industry to combine the loads resulting from the two sources. The resulting combined loads are then used to design for both yield ultimate strength and high cycle fatigue capability. This paper examines the cumulative distribution function (CDF) percentiles obtained using each method by integrating the joint probability density function of the sine and random components. A new Microsoft Excel spreadsheet macro that links with the software program Mathematics is then used to calculate the combined value corresponding to any desired percentile along with a curve fit to this value. Another Excel macro is used to calculate the combination using a Monte Carlo simulation. Unlike the traditional techniques, these methods quantify the calculated load value with a Consistent percentile. Using either of the presented methods can be extremely valuable in probabilistic design, which requires a statistical characterization of the loading. Also, since the CDF at high probability levels is very flat, the design value is extremely sensitive to the predetermined percentile; therefore, applying the new techniques can lower the design loading substantially without losing any of the identified structural reliability.

Author

Aerospace Industry; Harmonic Excitation; Random Loads; Statistical Analysis; Dynamic Structural Analysis

20040071071 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of a Fatigue Crack Growth Coupon for Highly Plastic Stress Conditions

Allen, Phillip A.; Aggarwal, Pravin K.; Swanson, Gregory R.; November 10, 2003; 7 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

The analytical approach used to develop a novel fatigue crack growth coupon for highly plastic stress field condition is presented in this paper. The flight hardware investigated is a large separation bolt that has a deep notch, which produces a large plastic zone at the notch root when highly loaded. Four test specimen configurations are analyzed in an attempt to match the elastic-plastic stress field and crack constraint conditions present in the separation bolt. Elastic-plastic finite element analysis is used to compare the stress fields and critical fracture parameters. Of the four test specimens analyzed, the modified double-edge notch tension - 3 (MDENT-3) most closely approximates the stress field, J values, and crack constraint conditions found in the flight hardware. The MDENT-3 is also most insensitive to load misalignment and/or load redistribution during crack growth.

Author

Crack Propagation; Fatigue (Materials); Stress Distribution; Mechanical Properties; Plastic Properties

20040073435 NASA Glenn Research Center, Cleveland, OH, USA

Telescoping Mechanics: A New Paradigm for Composite Behavior Simulation

Chamis, C. C.; Murthy, P. L. N.; Gotsis, P. K.; Mital. S. K.; April 2004; 24 pp.; In English

Contract(s)/Grant(s): WBS-22-708-48-11

Report No.(s): NASA/TM-2004-209317; E-11804; No Copyright; Avail: CASI; A03, Hardcopy

This report reviews the application of telescoping mechanics to composites using recursive laminate theory. The elemental scale is the fiber-matrix slice, the behavior of which propagates to laminate. The results from using applications for typical, hybrid, and smart composites and composite-enhanced reinforced concrete structures illustrate the versatility and generality of telescoping scale mechanics. Comparisons with approximate, single-cell, and two- and three-dimensional finite-element methods demonstrate the accuracy and computational effectiveness of telescoping scale mechanics for predicting complex composite behavior.

Author

Composite Materials; Hybrid Composites; Laminates; Fiber Composites

20040073705 Imperium, Inc., Silver Spring, MD

Large Area, Real Time Inspection of Rocket Motors Using a Novel Handheld Ultrasound Camera

Gurney, J. W.; Lasser, M. E.; , R. S; Kula, J. P.; Rich, D. C.; Aug. 3, 2004; 10 pp.; In English

Contract(s)/Grant(s): F04611-03-C-0022; Proj-3005

Report No.(s): AD-A422607; AFRL-PR-ED-TP-2004-064; No Copyright; Avail: CASI; A02, Hardcopy

Ultrasound is arguably the most effective nondestructive testing method for the inspection of subsurface faults. However, hand scanning of parts is subject to inspector error and fatigue, and automated point-by-point is extremely time consuming. We are reporting on the results of the use of a novel ultrasound camera for the rapid inspection of composite rocket motor cases in both production and in- service settings. This camera technology can be used for a variety of materials of different sizes and geometries. Using this system, subsurface delaminations, voids, cracks and other faults can be seen with high resolution and quantified immediately. This technique results in scans that can be done several times faster than conventional point-by-point or hand scanning.
DTIC
Cameras; Composite Structures; Inspection; Real Time Operation; Rocket Engines; Ultrasonics

20040073807 Naval War Coll., Newport, RI
Operational Infrastructure Development: A Critical Factor in the Global War on Terrorism
Bowers, William J.; Feb. 9, 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422825; No Copyright; Avail: CASI; A03, Hardcopy

Operational infrastructure development is the construction and establishment of roads, airfields, ports, installations, communications systems, hospitals, schools, irrigation systems, and water treatment systems by operational- level military commands. For several reasons, it has become a decisive operational concept in the global war on terrorism (GWOT). As the USA confronts failed states, quasi- failed states, and rogue dictatorships that threaten its national security, there is a requirement for operational commanders to focus on operational infrastructure development. In the first two years of the GWOT, three models of operational infrastructure development have blossomed: the facilitative, creative, and reconstructive models. The first is the facilitative model employed by Joint Task Force (JTF) 510 on Basilan Island in the Republic of the Philippines. The second is the creative model led by Combined Joint Task Force (CJTF) 180 in Afghanistan. The third is the reconstructive model now ongoing in Iraq, commanded by CJTF-7 and the Coalition Provisional Authority (CPA). This paper argues that these campaigns show that operational infrastructure development is a critical factor in the GWOT, and should be planned for by operational commanders and integrated into joint doctrine. (37 refs.)
DTIC
Armed Forces (United States); Structural Engineering; Terrorism; Warfare

20040074202 Ohio State Univ., Columbus, OH, USA
High Strain-Rate and Temperature Effects on the Response of Composites
Gilat, Amos; May 2004; 19 pp.; In English
Contract(s)/Grant(s): NCC3-1027; OSURF Proj. 744258; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the research is to expand the experimental study of the effect of strain rate on mechanical response (deformation and failure) of epoxy resins and carbon fibers/epoxy matrix composites, to include elevated temperature tests. The experimental data provide the information needed for NASA scientists for the development of a nonlinear, strain rate and temperature dependent deformation and strength models for composites that can subsequently be used in design. This year effort was directed into the development and testing of the epoxy resin at elevated temperatures. Two types of epoxy resins were tested in shear at high strain rates of about 700 per second and elevated temperatures of 50 and 80 C. The results show that the temperature significantly affects the response of epoxy.
Derived from text
Strain Rate; Temperature Effects; Mechanical Properties; Composite Materials; High Temperature Tests

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EARTH RESOURCES AND REMOTE SENSING

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

20040070799 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Commercial Systems Validation Overview
Ryan, Robert; April 30, 2001; 52 pp.; In English
Report No.(s): SE-2001-04-00020-SSC; No Copyright; Avail: CASI; A04, Hardcopy

The Commercial Systems Validation Laboratory (CSVL) is composed of the 1) Virtual Product Laboratory (VPL), 2)

Commercial Instrument Validation Laboratory (CIVL), and 3) In-Flight Verification & Validation Network (IVVN). All three laboratories are described in this viewgraph presentation, which covers the characterization of CCD cameras, hyperspectral sensors, ground reference equipment, and the Multispectral Thermal Imager (MTI). The presentation also includes sections on thermal modeling, measurements taken from a float, and the Scientific Data Purchase (SDP) Program. The section of the SDP profiles four data providers: 1) EarthSat; 2) Intermap; 3) Positive Systems; 4) Space Imaging.
CASI
Remote Sensors; Characterization; CCD Cameras; Multispectral Band Scanners; Infrared Imagery

20040070825 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Monitoring Air Quality from Space using AURA Data
Gleason, James F.; Chance, Kelly V.; Fishman, Jack; Torres, Omar; Veefkind, Pepijn; [2003]; 2 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Measurements from the Earth Observing System (EOS) AURA mission will provide a unique perspective on air quality monitoring. Ozone, nitrogen dioxide, formaldehyde and aerosols from the Ozone Monitoring Instrument (OMI) and carbon monoxide from the Troposheric Emission Spectrometer (TES) will be simultaneously measured with the spatial resolution and coverage needed for improving our understanding of air quality. AURA data products useful for air quality monitoring will be given.
Author
Air Quality; Earth Observing System (Eos); Remote Sensing; Atmospheric Composition

20040070830 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Expanded UV Irradiance Database from TOMS Including the Effects of Ozone, Clouds, and Aerosol Attenuation
Herman, J.; Krotkov, N.; [2003]; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The TOMS UV irradiance database (1978 to 2003) has been expanded to include five new products (noon irradiance at 305,310,324, and 380 nm, and noon erythemal-weighted irradiance), in addition to the existing erythemal daily exposure, that permit direct comparisons with ground-based measurements from spectrometers and broadband instruments. The new data are available on http://toms.gsfc.nasa.gov/>http://toms.gsfc.nasa.gov. Comparisons of the TOMS estimated irradiances with ground-based instruments are given along with a review of the sources of known errors, especially the recent improvements in accounting for aerosol attenuation. Trend estimations from the new TOMS irradiances permit the clear separation of changes caused by ozone and those caused by aerosols and clouds. Systematic differences in cloud cover are shown to be the most important factor in determining regional differences in UV radiation reaching the ground for locations at the same latitude (e.g., the summertime differences between Australia and the US southwest).
Author
Total Ozone Mapping Spectrometer; Irradiance; Ultraviolet Radiation; Data Bases

20040070838 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Low Altitude AVIRIS Data for Mapping Land Cover in Yellowstone National Park: Use of Isodata Clustering Techniques
Spruce, Joe; January 05, 2001; 1 pp.; In English; 2001 AVIRIS Earth Science and Applications Workshop, 27 Feb. - 2 Mar. 2001, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-01-00004-SSC; No Copyright; Avail: Other Sources; Abstract Only

Yellowstone National Park (YNP) contains a diversity of land cover. YNP managers need site-specific land cover maps, which may be produced more effectively using high-resolution hyperspectral imagery. ISODATA clustering techniques have aided operational multispectral image classification and may benefit certain hyperspectral data applications if optimally applied. In response, a study was performed for an area in northeast YNP using 11 select bands of low-altitude AVIRIS data calibrated to ground reflectance. These data were subjected to ISODATA clustering and Maximum Likelihood Classification techniques to produce a moderately detailed land cover map. The latter has good apparent overall agreement with field surveys and aerial photo interpretation.
Author
Low Altitude; Yellowstone National Park (ID-MT-WY); Data Acquisition; Aerial Photography; Infrared Spectrometers; Airborne Equipment; Land; Cluster Analysis

20040070941 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Ocean Color and Evidence of Chlorophyll Signature in the TOMS Minimum Reflectivity Data

Ahmad, Z.; Herman, J. R.; Bhartia, P. K.; 2003; 1 pp.; In English; Fall AGU 2003, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Analysis of the TOMS minimum reflectivity data for 380 nm channel (R380) show regions of high reflectivity values (approx. 7 to 8%) over Sargasso Sea in the Northern Atlantic, anti-cyclonic region in the Southern Atlantic, and a large part of the ocean in the Southern Pacific, and low values (5 approx. 6 %) over the rest of the open ocean. Through radiative transfer simulations we show that these features are highly correlated with the distribution of chlorophyll in the ocean. Theoretical minimum reflectivity values derived with the help of CZCS chlorophyll concentration data as input into a vector ocean-atmosphere radiative transfer code developed by Ahmad and Fraser show very good agreement with TOMS minimum reflectivity data for the winter season of year 1980. For the summer season of year 1980, good qualitative agreement is observed in the equatorial and northern hemisphere but not as good in the southern hemisphere. Also, for cloud-free conditions, we find a very strong correlation between R340 minus R380 values and the chlorophyll concentration in the ocean. Results on the possible effects of absorbing and non-absorbing aerosols on the TOMS minimum reflectivity will also be presented. The results also imply that ocean color will affect the aerosol retrieval over oceans unless corrected.

Author

Total Ozone Mapping Spectrometer; Aerosols; Air Water Interactions; Chlorophylls; Radiative Transfer; Water Color

20040070942 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Implementation of Coupled Skin Temperature Analysis and Bias Correction in a Global Atmospheric Data Assimilation System

Radakovich, Jon; Bosilovich, M.; Chern, Jiun-dar; daSilva, Arlindo; 2004; 1 pp.; In English; AGU Spring Meeting, 17-21 May 2004, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The NASA/NCAR Finite Volume GCM (fvGCM) with the NCAR CLM (Community Land Model) version 2.0 was integrated into the NASA/GMAO Finite Volume Data Assimilation System (fvDAS). A new method was developed for coupled skin temperature assimilation and bias correction where the analysis increment and bias correction term is passed into the CLM2 and considered a forcing term in the solution to the energy balance. For our purposes, the fvDAS CLM2 was run at 1 deg. x 1.25 deg. horizontal resolution with 55 vertical levels. We assimilate the ISCCP-DX (30 km resolution) surface temperature product. The atmospheric analysis was performed 6-hourly, while the skin temperature analysis was performed 3-hourly. The bias correction term, which was updated at the analysis times, was added to the skin temperature tendency equation at every timestep. In this presentation, we focus on the validation of the surface energy budget at the in situ reference sites for the Coordinated Enhanced Observation Period (CEOP). We will concentrate on sites that include independent skin temperature measurements and complete energy budget observations for the month of July 2001. In addition, MODIS skin temperature will be used for validation. Several assimilations were conducted and preliminary results will be presented.

Author

Finite Volume Method; Temperature Measurement; MODIS (Radiometry); Imaging Spectrometers; Data Systems; Bias; Satellite Observation

20040071002 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA

The 10-Year Remote Sensing Industry Forecast and Analysis

Rabin, Ron; January 08, 2002; 31 pp.; In English; Presentation at Management Association for Private Photogrammetric Surveyors (MAPPAS) Winter Meeting 2002, 19-23 Jan. 2002, Cabo San Lucas, Mexico; Original contains black and white illustrations

Contract(s)/Grant(s): NAS13-650

Report No.(s): SE-2002-01-00002-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides the results of a survey of 1450 professionals employed by organizations in the remote sensing industry. The survey asked participants about the status of the industry.

CASI

Remote Sensing; Industries; Technology Assessment; Economic Factors

20040071082 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Derivative Analysis of AVIRIS Hyperspectral Data for the Detection of Plant Stress
Estep, Lee; Berglund, Judith; June 25, 2001; 3 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-06-00032-SSC; No Copyright; Avail: CASI; A01, Hardcopy

A remote sensing campaign was conducted over a U.S. Department of Agriculture test site at Shelton, Nebraska. The test field was set off in blocks that were differentially treated with nitrogen. Four replicates of 0-kg/ha to 200-kg/ha, in 50-kg/ha increments, were present. Low-altitude AVIRIS hyperspectral data were collected over the site in 224 spectral bands. Simultaneously, ground data were collected to support the airborne imagery. In an effort to evaluate published, derivative-based algorithms for the detection of plant stress, different derivative-based approaches were applied to the collected AVIRIS image cube. The results indicate that, given good quality hyperspectral imagery, derivative techniques compare favorably with simple, well known band ratio algorithms for detection of plant stress.
Author
Airborne Equipment; Multispectral Band Scanners; Imaging Spectrometers; Plant Stress

20040071135 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Monitoring Geothermal Features in Yellowstone National Park with ATLAS Multispectral Imagery
Spruce, Joseph; Berglund, Judith; October 06, 2000; 2 pp.; In English; Fourteenth International Conference and Workshops: Applied Geologic Remote Sensing Integrated Solutions for Real World Problems, 6-8 Nov. 2000, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2000-10-00014-SSC; No Copyright; Avail: Other Sources; Abstract Only

The National Park Service (NPS) must produce an Environmental Impact Statement for each proposed development in the vicinity of known geothermal resource areas (KGRAs) in Yellowstone National Park. In addition, the NPS monitors indicator KGRAs for environmental quality and is still in the process of mapping many geothermal areas. The NPS currently maps geothermal features with field survey techniques. High resolution aerial multispectral remote sensing in the visible, NIR, SWIR, and thermal spectral regions could enable YNP geothermal features to be mapped more quickly and in greater detail In response, Yellowstone Ecosystems Studies, in partnership with NASA's Commercial Remote Sensing Program, is conducting a study on the use of Airborne Terrestrial Applications Sensor (ATLAS) multispectral data for monitoring geothermal features in the Upper Geyser Basin. ATLAS data were acquired at 2.5 meter resolution on August 17, 2000. These data were processed into land cover classifications and relative temperature maps. For sufficiently large features, the ATLAS data can map geothermal areas in terms of geyser pools and hot springs, plus multiple categories of geothermal runoff that are apparently indicative of temperature gradients and microbial matting communities. In addition, the ATLAS maps clearly identify geyserite areas. The thermal bands contributed to classification success and to the computation of relative temperature. With masking techniques, one can assess the influence of geothermal features on the Firehole River. Preliminary results appear to confirm ATLAS data utility for mapping and monitoring geothermal features. Future work will include classification refinement and additional validation.
Author
Airborne Equipment; Yellowstone National Park (ID-MT-WY); Remote Sensing; Geothermal Resources; Multispectral Photography

20040073706 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Decision Analysis Using Value Focused Thinking to Select Renewable Energy Sources
Duke, James S.; Mar. 2004; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422609; AFIT/GEM/ENV/04M-09; No Copyright; Avail: CASI; A06, Hardcopy

The USA is heavily dependent on fossil fuels to produce electricity. Renewable energy can provide an alternative source of energy for electricity production as well as reduce fossil fuel consumption. The executive agencies in the U.S. must also reduce greenhouse gas emissions by 2010 based on 1990 emission levels as directed by Executive Order. However, there is currently no analysis model to provide guidance toward which renewable energy to select as a course of action. This research effort used value-focused thinking decision analysis to create a model based on inputs from the Air Force Civil Engineer Support Agency. This model allows a decision-maker to easily alter weights and value functions related to renewable energy sources as needed to correspond to the personal values of that person. These values combined with the objective scores obtained from the generated alternatives results in a suggested course of action. The sensitivity analysis shows the changes of the output based on the alterations of the weighting of each measure. All measures were varied to study their influence on

the final outcome. Application of the model at three bases showed this model appears to work based on the influencing weights and values of the decision-maker.
DTIC
Decision Theory; Fossil Fuels; Renewable Energy

20040073782 Naval War Coll., Newport, RI
Commercial Imagery Satellite Threat: How Can U.S. Forces Protect Themselves?
Sleeth, Denette L.; Feb. 9, 2004; 32 pp.; In English
Report No.(s): AD-A422750; No Copyright; Avail: CASI; A03, Hardcopy

Commercially available satellite imagery represents a growing threat to U. S. military operations. To mitigate this threat, the operational commander has a variety of techniques or methods to consider during planning. Some mitigation methods, such as shutter control, diplomacy, or buy- to-deny, require approval and coordination with outside agencies. Other methods, such as jamming, laser blinding, or synchronized operations, require a thoroughly integrated plan to ensure U.S. forces are protected and able to conduct planned movements without enemy interference. Camouflage, concealment, and deception efforts also need to consider the capabilities of commercial imagery platforms and be integrated into operational planning.
DTIC
Aerial Photography; Imagery; Satellite Imagery

20040074172 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Low Altitude AVIRIS Data for Mapping Landform Types on West Ship Island, Mississippi
Spruce, Joseph; Otvos, Ervin; Giardino, Marco; February 08, 2003; 2 pp.; In English; Presenation at AVIRIS Earth Science and Applications Workshop, 5-8 Mar. 2002, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-02-00006-SSC; No Copyright; Avail: CASI; A01, Hardcopy

A chain of barrier islands provides protection against hurricanes and severe storms along the southern and southeastern shores of the Unites States. Barrier island landform types can be spectrally similar and as small as a few meters across, making highly detailed maps difficult to produce. To determine whether high-resolution airborne hyperspectral imagery could provide detailed maps of barrier island landform types, we used low-altitude hyperspectral and multispectral imagery to map surface environments of West Ship Island, Mississippi. We employed 3.4 meter AVIRIS hyperspectral imagery acquired in July 1999 and 0.5 meter ADAR multispectral data acquired in November 1997. The data were co-registered to digital ortho aerial imagery, and the AVIRIS data was scaled to ground reflectance using ATREM software. Unsupervised classification of AVIRIS and ADAR data proceeded using ISODATA clustering techniques. The resulting landform maps were field-checked and compared to aerial photography and digital elevation maps. Preliminary analyses indicated that the AVIRIS classification mapped more landform types, while the ADAR-based map enabled smaller patches to be identified. Used together, these maps provided a means to assess landform distributions of West Ship Island before and after Hurricane Georges. Classification accuracy is being assessed through photo-interpretation and field surveys of sample areas selected with stratified random sampling.
Author
Imaging Spectrometers; Mapping; Barriers (Landforms); Multispectral Photography

20040074208 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Systems Co., Huntsville, AL, USA
An Approach to Application Validation of Multispectral Sensors Using AVIRIS
Warner, Amanda; Blonski, Slawomir; Gasser, Gerald; Ryan, Robert; Zanoni, Vicki; August 30, 2001; 9 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-01-00005-SSC; No Copyright; Avail: CASI; A02, Hardcopy

High-resolution multispectral data are becoming widely available for commercial and scientific use. For specific applications, such as agriculture studies, there is a need to quantify the performance of such systems. In many cases, parameters such as GSD and SNR can be optimized. Data sets with varying GSD's for the Landsat ETM+ bands were produced to evaluate the effects of GSD on various algorithms and transformations, such as NDVI, principal component analysis, unsupervised classification, and mixture analysis. By showing that AVIRIS data can be used to simulate spaceborne and airborne multispectral platforms over a wide range of GSD, this research can be used to assist in band selection and spatial

resolution specifications for new sensors and in optimization of acquisition strategies for existing multispectral systems.
Author
Sensors; Earth Sciences; Multispectral Radar; Airborne Equipment; Infrared Spectrometers; Imaging Spectrometers

20040074210 NASA Stennis Space Center, Bay Saint Louis, MS, USA
NASA Remote Sensing Research as Applied to Archaeology
Giardino, Marco J.; Thomas, Michael R.; March 27, 2002; 9 pp.; In English
Report No.(s): SE-2002-03-00031-SSC; Copyright; Avail: CASI; A02, Hardcopy

The use of remotely sensed images is not new to archaeology. Ever since balloons and airplanes first flew cameras over archaeological sites, researchers have taken advantage of the elevated observation platforms to understand sites better. When viewed from above, crop marks, soil anomalies and buried features revealed new information that was not readily visible from ground level. Since 1974 and initially under the leadership of Dr. Tom Sever, NASA's Stennis Space Center, located on the Mississippi Gulf Coast, pioneered and expanded the application of remote sensing to archaeological topics, including cultural resource management. Building on remote sensing activities initiated by the National Park Service, archaeologists increasingly used this technology to study the past in greater depth. By the early 1980s, there were sufficient accomplishments in the application of remote sensing to anthropology and archaeology that a chapter on the subject was included in fundamental remote sensing references. Remote sensing technology and image analysis are currently undergoing a profound shift in emphasis from broad classification to detection, identification and condition of specific materials, both organic and inorganic. In the last few years, remote sensing platforms have grown increasingly capable and sophisticated. Sensors currently in use, or nearing deployment, offer significantly finer spatial and spectral resolutions than were previously available. Paired with new techniques of image analysis, this technology may make the direct detection of archaeological sites a realistic goal.
Author (revised)
Remote Sensing; Archaeology; Technology Utilization

20040074211 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Spatial Resolution Determination with the Stennis Edge Target and NIIRS
Ryan, Robert; Pagnutti, Mary; Cao, Changyong; Blonski, Slawomir; Zanoni, Vicki; Jenner, Jeff; April 1, 1999; 2 pp.; In English; 1999 International Symposium on Spectral Sensing Research, 1999
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-05-00037-SSC; No Copyright; Avail: CASI; A01, Hardcopy

Methodologies for determining the modulation transfer function (MTF) and National Imagery Interpretability Rating Scale (NIIRS) of airborne panchromatic and multispectral digital imaging cameras using the NASA Stennis Space Center (SSC) edge target have been developed. The application of NIIRS for determining the relative utility of data sets against various applications is discussed. Sampling requirements and optimal flightlines for focal plane imagers have been investigated. It is shown that with sufficient flight tilt angle, an adequate number of samples can be obtained to define the edge response accurately. The relationships between the tilt angle, Ground Sample Distance (GSD), and the number of samples are discussed. Sample results using commercially available data and the NASA SSC edge target are presented and compared to theoretical results.
Author
Spatial Resolution; Imagery; Imaging Techniques; Earth Sciences; Methodology; Targets

20040074212 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
New Method for Calibration for Hyperspectral Pushbroom Imaging Systems
Ryan, Robert; Olive, Dan; ONeal, Duane; Schere, Chris; Nixon, Thomas; May, Chengye; Ryan, Jim; Stanley, Tom; Witcher, Kern; April 1, 1999; 2 pp.; In English; 1999 International Symposium on Spectral Sensing Research, 1999
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-05-00038-SSC; No Copyright; Avail: CASI; A01, Hardcopy

A new, easy-to-implement approach for achieving highly accurate spectral and radiometric calibration of array-based, hyperspectral pushbroom imagers is presented in this paper. The equivalence of the plane of the exit port of an integrating sphere to a Lambertian surface is utilized to provide a field-filling radiance source for the imager. Several different continuous wave lasers of various wavelengths and a quartz-tungsten-halogen lamp internally illuminate the sphere. The imager is positioned to "stare" into the port, and the resultant data cube is analyzed to determine wavelength calibrations, spectral widths of channels, radiometric characteristics, and signal-to-noise ratio, as well as an estimate of signal-to-noise

performance in the field. The "smile" (geometric distortion of spectra) of the system can be quickly ascertained using this method. As the price and availability of solid state laser sources improve, this technique could gain wide acceptance. Author

Calibrating; Imaging Techniques; Radiometers; Methodology; Luminaires

20040074223 Florida State Univ., Tallahassee, FL, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA

High Resolution Carbon Exchange over Large Scale Amazonia Based on Modeling and GOES Satellite-Derived Radiation Inputs: The Effects of Tropical Forest Conversion: Ecological Research in the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)

Cooper, Harry J.; Liu, Guo-Sheng; Smith, Eric A.; April 2004; 23 pp.; In English

Contract(s)/Grant(s): NCC5-292; No Copyright; Avail: CASI; A03, Hardcopy

Mr. Andrew Grose successfully defended his dissertation this April (2004) and received the Ph.D. degree as a result of his LBA research, which forms the bulk of this report. His dissertation is entitled Variability Of Carbon Exchange Over Large-Scale Ammonia Based On Coupled Carbon Assimilation-Hydrometeorological Modeling And Satellite-Derived Radiation-Precipitation Inputs. A summary of scientific results are also included.

Derived from text

Amazon Region (South America); Biosphere; High Resolution; Goes Satellites; Radiation Effects; Tropical Regions; Forests; Ecology

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*.

20040070726 NASA Lewis Research Center, Cleveland, OH, USA

Space Electrochemical Research and Technology: Abstracts

[1991]; 65 pp.; In English; Space Electrochemical Research and Technology Conference, 9-10 Apr. 1991, Cleveland, OH, USA; See also 20040070727 - 20040070753

Contract(s)/Grant(s): WU 506-41-21

Report No.(s): NASA-CP-10067; E-6089; No Copyright; Avail: CASI; A04, Hardcopy

This document contains abstracts of the proceedings of NASA's third Space Electrochemical Research and Technology (SERT) Conference, held at the NASA Lewis Research Center on April 9-10,1991. The objective of the conference was to assess the present status and general thrust of research and development in those areas of electrochemical technology required to enable NASA missions into the next century. The conference provided a forum for the exchange of ideas and opinions of those actively involved in the field, in order to define new opportunities for the application of electrochemical processes in future NASA missions. Papers were presented in three technical areas: the electrochemical interface, the next generation in aerospace batteries and fuel cells, and electrochemistry for non-energy storage applications.

Author

Electrochemistry; Energy Storage; NASA Programs

20040070730 NASA Lewis Research Center, Cleveland, OH, USA

Some Recent Studies With the Solid-Ionomer Electrochemical Capacitor

Sarangapani, S.; Forchione, J.; Griffith, A.; LaConti, A.; Baldwin, R.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 33; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Giner, Inc., has developed a high-energy-density, all-solid-ionomer electro-chemical capacitor, completely free of liquid electrolyte. The novel features of this device include: (1) a three-dimensional metal oxide-particulate-ionomer composite electrode structure and (2) a unitized repeating cell element. The composite electrode structures are bonded to opposite sides of a thin sheet of a solid proton-conducting ionomer membrane and form an integrally bonded membrane and electrode assembly (MEA). Individual MEAs can be stacked in series as bipolar elements to form a multiple cell device. The discharge characteristics and energy storage properties of these devices are described. Typical capacitance measured for a unit cell is 1 F/cm. Life testing of a multicell capacitor on an intermittent basis has shown that, over a 10,000-hour period, the capacitance

and resistance of the cell has remained invariant. There has been no maintenance required on the device since it was fabricated. Other multicell units of shorter life duration have exhibited similar reliable performance characteristics. Recent work has focused on increasing the capacitance of the unitized structure and improving the low-temperature characteristics. The approaches and experimental results will be presented. Some possible advanced NASA applications for these unique all-solid-ionomer devices will be discussed.
Author
Fabrication; Density; Electrochemical Capacitors; Membranes; Energy Storage; Electrolytes; Electrodes

20040070732 Communications Satellite Corp., Clarksburg, MD, USA
Physical and Chemical Analysis of a Ni/H2 Cell
Vaidyanathan, H.; Earl, M.; Kirkendall, T.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 13; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

A cycled nickel-hydrogen (Ni/H2) cell was subjected to destructive physical analysis to determine the reason for a capacity loss after 5,967 cycles at 60-percent depth of discharge. The positive plates in the cell were analyzed in terms of chemical composition, active material utilization, charge efficiency, and thickness increase. The microstructure of a cross section of the positive plate was determined by back-scattered electron image analysis. There were no indications of a soft short, which is consistent with the measured charge retention of 79 percent in 72 hours of charge stand. However, electrode stack displayed evidence of rapid oxygen reaction with hydrogen. Numerous cracks were seen in the Gore-Tex backing, as well as burn holes in the negative electrode and burn marks and melting in the gas distribution screen. The charge efficiency of the positive plate in flooded KOH was 84 to 90 percent at 50-percent state-of-charge condition, whereas an uncycled electrode has an efficiency of 100 percent at the same state of charge. The active material utilization of the plate during flooded KOH capacity discharge was 82 percent, which is also low. The positive plate thickness increase was 10.5 percent. The results of the study suggest that the capacity loss in the cell is traceable to low charge acceptance and low active material utilization at the positive plate. Microstructural analysis has given preliminary indications that a new phase of active material is formed with cycling.
Author
Destructive Tests; Nickel Hydrogen Batteries

20040070734 Los Alamos National Lab., NM, USA
Regenerative Space Fuel Cell Power/Advanced Stack Testing
Vanderborgh, N. E.; Hedstrom, J. C.; Huff, J. R.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 25; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Regenerative fuel cells (RFC) provide power generation and storage capabilities. A technology assessment and tradeoff study had evaluated contemporary electrochemical technologies for the following RFC system characteristics: 25 kWe continuous, stand-alone operation, lunar and martian surface compatibility, 65% system turnaround efficiency, 500 Wh/kg martian surface, and 800 Wh/kg lunar surface. Operational RFC systems must include compact reactant storage. Minimum mass systems utilize highly efficient fuel cells, operating at a voltage of N.9 V/cell. Studies are also underway to evaluate PEM fuel cell stack hardware under high PEM and alkaline technologies have both been evaluated. This study identified lifetime and reliability of both component and system as concerns. The study results show that, due to the long lunar night, reactant storage considerations dominate the mass and volume budgets. Inefficiencies in electrolysis hardware are compensated by larger primary power components. Thermal management of RFC systems with liquid water requires novel RFC system designs.
Author
Regenerative Fuel Cells; Technology Assessment

20040070735 Ergenics Power Systems, Inc., Ringwood, NJ, USA
PEM Fuel Cells for Passive Operation
Adlhart, O.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 35; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

High thermal efficiency and operational reliability are crucial elements for the applicability of PEM fuel cells for aerospace requirements. Passive systems operating at moderate current densities are needed for these missions. EPSI has developed a passive H2/O PEM cell technology. It relies on dead end reactant supply, internal reactant pre-humidification, and waste heat dissipation by radiation or conduction to a cooling loop. A unique feature of the EPSI technology is the use of

pressure enhanced wicking for product water removal. This process utilizes the mobility of product water in hydrophilic, porous collector structures, its transport in suitable wicking manifolds, and its eventual rejection from the stack in a gas/water separation unit as liquid water. The porous structures of the sell stack are separated by nonporous metallic gas separation members. They assure high shock and vibration tolerance. Devices with up to 1kW rating have been developed. Specifically, a 200 watt, 28 volt system is under advanced development for the Space Station EMU (Extravehicular Mobility Unit). In this case, since volume is important, the PEN cell is integrated with a hydride hydrogen storage subsystem. The paper describes design and performance features of EPSI PEM fuel cell hardware.
Author
Fuel Cells; Reliability; Thermodynamic Efficiency; Hydrogen; Extravehicular Mobility Units; Current Density

20040070736 Johnson Controls, Inc., Milwaukee, WI, USA
Multiple Cell Common Pressure Vessel Nickel-Hydrogen Battery
Zagrodnik, Jeffrey P.; Eskra, Michael D.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 39; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Johnson Controls, Inc:, has developed a multiple cell CPV Nickel Hydrogen battery that offers significant weight, volume, and cost advantages for aerospace applications. The baseline design was successfully demonstrated through the testing of a 26-cell prototype, which completed over 7,000 44% depth-of-discharge LEO cycles at COMSAT Laboratories. Prototype design using both nominal 5 and 10 in. diameter vessels are currently being developed for a variety of space applications.
Author
Nickel Hydrogen Batteries; Costs; Cycles; Performance Tests; Prototypes; Technology Utilization

20040070742 Los Alamos National Lab., NM, USA
Inelastic Neutron Scattering Studies on Nickel Hydroxides From Cycled Ni-Positive Plates of Ni-H2 Batteries
Eckert, Juergen; Varma, Ravi; Diebolt, Lisa; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 17; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

We have carried out inelastic neutron scattering (INS) studies on several samples of nickel hydroxide from cycled battery plate materials as well as beta-Ni(OH)2 in an effort to determine the form and importance of excess protons in the lattice on the battery activity. Apart from several vibrational bands identifiable with varying relative amounts of alpha- and beta-phase Ni(OH)2, additional features can be identified in the spectra whose intensities correlate strongly with the cycling history of the materials. We will describe the possible origin of these bands and attendant implications for battery cycleability.
Author
Inelastic Scattering; Neutron Scattering; Nickel Compounds; Nickel Hydrogen Batteries

20040070743 Rockwell International Corp., Canoga Park, CA, USA
Regenerative Fuel Cell Architectures for Lunar Surface Stationary and Mobile Power
Harris, D. W.; Gill, S. P.; Nguyen, T. M.; Vrolyk, J. J.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 27; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Power needs projected for the lunar and Mars exploration missions range from a few kilowatts for initial manned outposts and rovers to hundreds of kilowatts for permanent bases and in situ resource utilization. The 354 hour lunar night presents a formidable challenge in energy storage systems for nonnuclear power systems. The photovoltaic/Regenerative Fuel Cell (PV/RFC) is currently being considered as an option to meet the initial low power requirements. For lunar applications, the RFC mass can be a critical drive in the overall PV/RFC system mass. hydrogen/oxygen (H2/O) reactants and storage are the dominant components from a mass standpoint. reduce the reactant and storage mass and, thereby, result in mass savings for the overall PV/RFC system. For the long duration nighttime operation missions, it is important, therefore, to examine options which may Various RFC configurations for both the stationary and the mobile lunar missions have been examined using Rocketdyne's RFC computer model. For the stationary applications, A GaAs/Ge PV array with a 3000-psi gas storage proton exchange membrane (PEM) RFC providing 25 kWe during the day and 12.5 kWe at night was designed. PV/RFC systems utilizing supercritical H/O2 storage and cryogenic H2/O storage for the RFCs were then compared with &e baseline high pressure gas storage RFC system. Preliminary results indicate that for long duration nighttime operation missions, the supercritical H2/O2 storage RFC systems offer over 20% mass advantage over the high pressure gas storage, while the mass savings for the cryogenic H2/O2 storage RFC systems can be as high as 50%.
Author
Regenerative Fuel Cells; Lunar Exploration

20040070745 ElectroChem, Inc., Woburn, MA, USA

High Performance Oxygen Electrodes for PEM Fuel Cells

Jalan, V.; Desai, M.; Morrisaeu, B.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 31; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The objective of this research is to attain the highest level of performance in proton exchange membrane (PEM) based fuel cells for eros ace applications. Platinum black electrodes with a loading of 10 mg Pt/sq cm on three different backing materials were fabricated by ElectroChem and evaluated in single cells under a variety of operating conditions. Using hydrogen and oxygen pressurized to 5 atm, a current density of 2000 mA/sq cm was achieved at a sell potential of 0.7 V and a cell temperature of 95 C. This is significantly higher than the best performance reported for this type of fuel cell under any operating conditions. Optimization of the electrode structure and the nature of the electrode/membrane interface are particularly crucial to the achievement of high power density, as is the use of an improved membrane, like those being produced experimentally by Du Pont and Dow Chemical Company. Other important factors include the operating pressure, cell temperature, control of reactant gas humidification, and gaskets/seals. This work demonstrates that the power density of PEM fuel cells may be improved by increasing platinum loading while maintaining a high degree of platinum loading while power is a substantial reduction in both mass and volume for power plant of the same capacity.

Author

Backups; Current Density; Electrodes; Fuel Cells; Membranes; Oxygen; Platinum Black; Protons

20040070747 SRI International Corp., Menlo Park, CA, USA

An AC Impedance Study of the Ni/NiCl2 Electrode of Sodium/Metal Chloride Cells

Dougherty, B. J.; McKubre, M. C. H.; Smedley, S. I.; Tanzella, F.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 49-50; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

There is a growing interest in the use of the sodium/metal chloride cells as alternatives to sodium/sulphur cells, in many applications. Among the potential advantages of the Zebra cell over its sodium/sulphur counterpart are a lower operating temperature, easier construction, safer operation, and greater cycle life. These attributes make the sodium/metal chloride cell an excellent candidate for use in space vehicles. We have used ac impedance spectroscopy to elucidate the reaction mechanism of the Ni/NiCl2, electrode, and to examine the influence of the electrode porosity and morphology on the operation of this electrode. As a result, we have developed a novel cell design and electrode construction technique. The electrodes are constructed in the half-charged state by mixing together the appropriate ratio of Ni, NaCl, NiCl2, and NaAlCl4 powders. In general, this ratio is chosen so as to produce an electrode in which 30% of the metal is converted to the metal chloride when the cell is fully charged. With the exception of NaAlCl4, all powder samples are dried at 110 C prior to electrode construction. The NaAlCl4 is used as received. The preparation of the electrode mixture is carried out inside an argon-filled glove box. Once the powders have been mixed, they are packed directly into the electrode chambers of the electrochemical cell, which is then sealed and transferred from the glove box to a furnace at 250 C. The electrochemical cell used in this study contains two back-to-back Ni/NiCl2 electrodes, separated by a disc of beta"-alumina. Under an applied current or voltage, one electrode is discharged while the other is charged. The impedances of both half-cells and the whole cell are measured simultaneously, using a four-channeled Solartron 1254 FRA, as a function of the state of discharge of the cell and cycle number. This approach enables us to deduce the mechanisms of both the charge and discharge reactions, and to follow changes in the effective resistance of the beta"-alumina.

Author (revised)

Electrical Impedance; Electrodes; Alternating Current; Sodium Chlorides

20040070748 NASA Lewis Research Center, Cleveland, OH, USA

Performance of a Dual Anode Nickel-Hydrogen Cell

Gahn, Randall F.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 37; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Nickel-hydrogen batteries are presently being used for energy storage on satellites in low Earth orbit and in geosynchronous orbit, and have also been selected for use on the proposed Space Station Freedom. Development continues on the cell technology in order to improve the specific energy and lengthen the cycle life. An experimental study was conducted to compare the voltage performance of a nickel-hydrogen cell containing a dual anode with the standard cell design which uses a single hydrogen electrode. Since the principle voltage loss in a nickel-hydrogen cell is attributed to the mass transport and resistive polarization parameters of the nickel electrode, addition of a hydrogen electrode on the other side of the nickel electrode should reduce the electrochemical polarizations by a factor of two. A 3.5 in. diameter boilerplate cell with

a single 30 mils thick nickel electrode was cycled under various current conditions to evaluate its performance with a single anode and then with a double anode. A layered separator consisting of one Zircar cloth separator and one radiation-grafted polyethylene separator were used between the electrodes. The electrolyte was 26% KOH, and the tests were done at room temperature. The discharge voltage characteristics were determined as a function of current and depth-of-discharge. At the 4C discharge rate and 50% DOD, the voltage of the dual anode cell was 100 mV higher than the single anode cell. At 75% DOD the dual anode cell voltage was about 130 mV higher than the standard cell design. Resistances of the two c ell designs obtained from the slope of the mid-discharge voltages plotted against various currents indicated that the dual anode cell resistance was one-half of the state-of-the-art cell.
Author
Performance Prediction; Anodes; Nickel Hydrogen Batteries; Cell Anodes; Electrolytic Cells; Life (Durability)

20040070752 Minnesota Univ., Minneapolis, MN, USA
Lithium Polymer Batteries
Owens, Boone B.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 53-54; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

Lithium batteries offer many advantages including high specific energy, high output cell voltages, very low self-discharge rates and, in some cases, the ability to operate at low or high extremes of temperature. Ambient temperature rechargeable lithium batteries have been an active research area during the past fifteen years. These batteries may be categorized as: (1) Liquid depolarizer batteries that use (electroactive) inorganic liquids as the electrolyte; (2) Polymer cathode batteries that use organic liquid electrolytes combined with solid polymer redox cathodes; (3) Solid cathode batteries that use organic liquid electrolytes with solid insertion cathodes; (4) Polymer electrolyte batteries that use sol id polymer electrolytes with solid insertion (intercalation) cathodes. Rechargeable coin cells (with Li alloy anodes) are available from several manufacturers, and larger cells will become available as the technology evolves. A unique class of rechargeable lithium batteries is the 'polymer electrolyte' group. This group is similar to the above indicated 'solid cathode' class, except that the electrolyte is a solid high molecular weight material instead of a liquid low molecular weight organic compound (or mixture). Two significant properties result from this. First, the solid electrolyte has a much lower vapor pressure and in principle, during times of abuse, will be safer with respect to volatilization, explosion, and ignition. Second, because the electrolyte is a solid polymeric material, it can be fabricated in the form of a thin film and no other separator element is required. As a result, the very thin electrolyte, combined with thin electrode structures, allows superior high rate performance and improved lithium plating morphology.
Author (revised)
Lithium Batteries; Polymers

20040070753 Texas A&M Univ., College Station, TX, USA
High Energy Efficiency and High Power Density Proton Exchange Membrane Fuel Cells: Electrode Kinetics and Mass Transport
Srinivasan, Supramaniam; Velev, Omourtag; Parthasarathy, Arvind; Manko, David J.; Appleby, A. John; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 21; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

High energy efficiency and high power density fuel cells are vitally needed for space and terrestrial, particularly transportation, applications. Of the essential criteria for the attainment of high energy efficiencies and high power densities are (1) low activation overpotentials - the major contributor to activation overpotential is the oxygen reduction reaction which has an exchange current density of at least three orders of magnitude less than that of hydrogen oxidation; (2) minimal mass transport overpotential - the structure of the state-of-the-art fuel cell electrodes is such that there is minimal mass transport up to high current density in low to medium temperature acid and alkaline electrolyte fuel cells; and (3) negligible ohmic overpotential, the main cause of which is the resistance of the electrolyte. Of all types of fuel cells (i.e., with acid, alkaline, molten carbonate, solid oxide, and solid polymer electrolytes), only the alkaline and solid polymer electrolyte fuel cells have demonstrated high energy efficiencies and high power densities. The alkaline hydrogen/oxygen fuel cell systems have been and are being successfully used to provide auxiliary power in space vehicles (Apollo, Space Shuttle). This paper presents (1) the methods used to attain high energy efficiencies and high power densities in proton exchange membrane fuel cells with high and low platinum loading electrodes; (2) a novel microelectrode method using pseudo-steady state, chronoamperometric, and AC impedance techniques to determine (i) the electrode kinetic parameters for oxygen reduction at the Pt/proton exchange membrane interface, and (ii) the solubilities and diffusion coefficients of oxygen in the membrane; (3) evidence for the lack of net water transport from anode to cathode during fuel cell operation; and (4) modeling and experimental analyses of the

cell potential vs. current density plots in a proton exchange membrane fuel cell, which reveals the needed research and development to further increase energy efficiencies and power densities.
Author (revised)
Fuel Cells; Electrodes; Kinetics; Transport Theory

20040074129 Center for Army Analysis, Fort Belvoir, VA
Renewable Energy Analysis for Strategic Responsiveness 2 (REASR 2)
Jones, Hugh W.; Dec. 2002; 106 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422774; CAA-R-04-8; No Copyright; Avail: CASI; A06, Hardcopy

The analysis of renewable energy within a hybrid electric generator system for remote military applications has not been studied. This report highlights the potential of new, photovoltaic thin-film composite arrays to augment fossil fuel generators for military power applications in remote areas. Because the photovoltaic phenomena works only during daylight hours and is also dependent on latitude for sun power, this study examined renewable hybrid electric generation in areas of poor sun (Hanau, Germany) and in areas of good sun (Ft. Irwin, California). This report investigates the value-added that renewable energy can bring to tactical operation centers and remote power stations (for purposes of homeland security) in terms of increased operational readiness, reduced cost, energy savings and pollution abatement.
DTIC
Energy Conversion; Renewable Energy

45
ENVIRONMENT POLLUTION

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

20040068277 Eastern Research Group, Inc., Morrisville, NC
Urban Air Toxics Monitoring Program, 2001
Nov. 2002; In English
Report No.(s): PB2004-104011; No Copyright; Avail: National Technical Information Service (NTIS)

The contents of this report provide both a qualitative overview of air pollution at selected urban locations and a quantitative analysis of the factors that appear to affect urban air quality most significantly. This report also focuses on data trends at each of the 43 different air sampling locations, a site-specific approach that allows for much more detailed analyses of the factors (e.g., motor vehicle emission sources, industrial sources, natural sources) that affect air quality differently from one urban center to the next. Ultimately, the contents of this report should offer participating agencies useful insights into important air quality issues.
NTIS
Air Quality; Environmental Monitoring; Air Sampling

20040068301 Eastern Research Group, Inc., Morrisville, NC
Urban Air Toxics Monitoring Program (UATMP), 2002
Oct. 2003; In English
Report No.(s): PB2004-104012; No Copyright; Avail: National Technical Information Service (NTIS)

The contents of this report provide both a qualitative overview of air pollution at selected urban locations and a quantitative analysis of the factors that appear to affect urban air quality most significantly. This report also focuses on data trends at each of the 56 different air sampling locations, a site-specific approach that allows for much more detailed analyses of the factors (e.g., motor vehicle emission sources, industrial sources, natural sources) that affect air quality differently from one urban center to the next. Ultimately, the contents of this report should offer participating agencies useful insights into important air quality issues.
NTIS
Air Quality; Quantitative Analysis; Exhaust Emission; Environmental Monitoring

20040070705 NASA Ames Research Center, Moffett Field, CA, USA

Environment Partitioning and Reactivity of Polybrominated Diphenylethers

Hua, Inez; Iraci, Laura T.; Jafvert, Chad; Bezares-Cruz, Juan; March 1, 2004; 1 pp.; In English; American and Canadian Geophysical Union Meeting, 17-21 May 2004, Montreal, Canada

Contract(s)/Grant(s): RTOP 622-67-21-10; No Copyright; Avail: Other Sources; Abstract Only

Polybrominated diphenyl ethers (PBDEs) are an important class of flame retardants. Annual global demand for these compounds was over 67,000 metric tons in 2001. PBDEs have recently been extensively investigated as environmental contaminants because they have been detected in air, sediment, and tissue samples from urban and remote areas. Important issues include quantifying PBDE partitioning in various environmental compartments, and elucidating transformation pathways. The partitioning of PBDE congeners to aerosols was estimated for 16 sites in the USA, Canada, and Mexico. The aerosol particles were PM2.5, the total suspended particle (TSP) concentration varied between 3.0 - 55.4 micro g/cubic meter, and the organic fraction ranged from 11 - 41%; these data are published values for each site. It is estimated that the largest fraction of each PBDE associated with the aerosol particles occurs in Mexico City, and the smallest fraction in Colorado Plateau. Although the organic fraction in Mexico City is about 60% of that observed in the Colorado Plateau, the TSP is larger by a factor of about 18.5, and it is the difference in TSP that strongly influences the fraction of particle-bound PBDE in this case. PBDE partitioning to PM2.5 particles also varies seasonally because of temperature variations. For the less brominated congeners the percentage that is particle-bound is relatively low, regardless of air temperature. In contrast, the heavier congeners exhibit a significant temperature dependence: as the temperature decreases (fall, winter) the percentage of PBDE that is particle-bound increases. The partitioning calculations complement experimental data indicating that decabromodiphenyl ether (DBDE) dissolved in hexane transforms very rapidly when irradiated with solar light. DBDE is the most highly brominated PBDE congener (10 bromine atoms) and occurs in the commercial formulation which is subject to the largest global demand.

Author

Bromine; Congeners; Contaminants; Diphenyl Compounds; Ethers; Reactivity; Global Air Pollution

20040070706 NASA Ames Research Center, Moffett Field, CA, USA

Brown Cloud Pollution and Smog Ozone Transport 6,000 km to the Tropical Atlantic: Mechanism and Sensing

Chatfield, Robert B.; Thompson, Anne M.; Guan, Hong; Witte, Jacquelyn C.; Hudson, Robert D.; [2004]; 1 pp.; In English; Quadrennial Ozone Symposium 2004, 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

We have found repeated illustrations in the maps of Total Tropospheric Ozone (TTO) of apparent transport of ozone from the Indian Ocean to the Equatorial Atlantic Ocean. Most interesting are examples that coincide with the INDOEX observations of late northern winter. Three soundings with the SHADOZ (Southern Hemisphere Additional Ozonesondes) network help confirm and quantify degree of influence of pollution, lightning, and stratospheric sources, suggesting that perhaps 40% of increased Atlantic ozone could be Asian pollution during periods of maximum identified in the TTO maps. This analysis also indicates a mechanism for such extended transport. We outline recurrent periods of apparent ozone transport from Indian to Atlantic Ocean regions outside the late-winter period. Clearly brown-cloud aerosol affects tropospheric ozone, both limiting its chemical production and also potentially obscuring its detection by the TOMS instrument. Introductory statistical studies will be presented, evaluating the role of tropopause meteorology, aerosol, and other factors in the modifying the relationship between true tropospheric ozone measured by SHADOZ and the TTO product, with suggestions for extending the product.

Author

Ozone; Pollution Transport; Smog; Air Pollution; Gas Transport

20040070986 Health Effects Inst., Boston, MA, USA

Peroxides and Macrophages in the Toxicity of Fine Particulate Matter in Rats

Laksin, D. L.; Morio, L.; Hooper, K.; Li, T. H.; Buckley, B.; Dec. 2003; In English

Report No.(s): PB2004-103505; No Copyright; Avail: National Technical Information Service (NTIS)

This study was conducted to determine: (1) whether tissue injury induced by aerosols is medicated by cytotoxic hydrogen peroxide carried into the lower lung by fine particles and (2) whether exposure of rats to fine particulate matter (PM) leads to accumulation of activated macrophages in the lung.

NTIS

Exposure; Hydrogen Peroxide; Injuries; Lungs; Toxins and Antitoxins

20040070987 Lawrence Livermore National Lab., Livermore, CA

Measuring the Effect of Fuel Chemical Structure on Particulate and Gaseous Emissions using Isotope Tracing

Buchholz, B. A.; Mueller, C. J.; Martin, G. C.; Upatnieks, A.; Dibble, R. W.; Sep. 11, 2003; In English

Report No.(s): DE2003-15004942; UCRL-JC-155257; No Copyright; Avail: National Technical Information Service (NTIS)

Using accelerator mass spectrometry (AMS), a technique initially developed for radiocarbon dating and recently applied to internal combustion engines, carbon atoms within specific fuel molecules can be labeled and followed in particulate or gaseous emissions. In addition to examining the effect of fuel chemical structure on emissions, the specific source of carbon for PM can be identified if an isotope label exists in the appropriate fuel source. Existing work has focused on diesel engines, but the samples (soot collected on quartz filters or combustion gases captured in bombs or bags) are readily collected from large industrial combustors as well.

NTIS

Carbon; Chemical Composition; Combustion Products; Exhaust Gases; Molecules; Soot

20040070988 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Numerical Simulation of CO2 Leakage from a Geologic Disposal Reservoir, Including Transitions from Super- to Sub-Critical Conditions, and Boiling of Liquid CO2

Pruess, K.; 2003; In English

Report No.(s): DE2003-813575; LBNL-52423; No Copyright; Avail: National Technical Information Service (NTIS)

The critical point of CO2 is at temperature and pressure conditions of T(sub crit)= 31.04 C, P(sub crit)= 73.82 bar. At lower (subcritical) temperatures and/or pressures, CO2 can exist in two different phase states, a liquid and a gaseous state, as well as in two-phase mixtures of these states. Disposal of CO2 into brine formations would be made at supercritical pressures. However, CO2 escaping from the storage reservoir may migrate upwards towards regions with lower temperatures and pressures, where CO2 would be in subcritical conditions.

NTIS

Carbon Dioxide; Numerical Analysis; Leakage; Reservoirs

20040071037 Texas A&M Univ., College Station, TX

Evaluation of the Air Quality and Noise Impacts of Regional Jet Service at Commercial Airports Serving Small Cities in Texas

Borowiec, J. D.; White, L. D.; Mar. 2004; 86 pp.; In English

Report No.(s): PB2004-105724; SWUTC/04/167121-1; No Copyright; Avail: CASI; A05, Hardcopy

Commercial airline passenger service in small markets is entering a phase that has the potential to change the industry in ways not seen since airline deregulation. The initiation of regional jet service to and from communities that previously had limited commercial service opens up a wide range of opportunities that support economic growth and trade for many communities as service levels increase and new city pairs are introduced. Along with the opportunities, however, have come a new set of high profile environmental issues that, until now, small cities have not had to deal with. These are primarily aircraft noise and exhaust emissions from arriving and departing aircraft but also include emissions from ground support equipment (GSE) and vehicles accessing the airport. In this research, a base year reflecting the current use of turbo-prop aircraft was developed. Fleet mixes for the forecasted years were developed using the appropriate operations and enplanement forecasts.

NTIS

Air Quality; Evaluation; Noise (Sound); Aircraft Noise

20040073466 NASA Langley Research Center, Hampton, VA, USA

Large-scale Distribution of CH4 in the Western North Pacific: Sources and Transport from the Asian Continent

Bartlett, Karen B.; Sachse, Glen W.; Slate, Thomas; Harward, Charles; Blake, Donald R.; Journal of Geophysical Research; September 23, 2003; ISSN 0148-0227; Volume 108, No. D20, pp. 28-1 - 28-15; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC1-02023; Copyright; Avail: Other Sources

Methane (CH4) mixing ratios in the northern Pacific Basin were sampled from two aircraft during the TRACE-P mission (Transport and Chemical Evolution over the Pacific) from late February through early April 2001 using a tunable diode laser system. Described in more detail by Jacob et al., the mission was designed to characterize Asian outflow to the Pacific, determine its chemical evolution, and assess changes to the atmosphere resulting from the rapid industrialization and increased

energy usage on the Asian continent. The high-resolution, high-precision data set of roughly 13,800 CH4 measurements ranged between 1602 ppbv in stratospherically influenced air and 2149 ppbv in highly polluted air. Overall, CH4 mixing ratios were highly correlated with a variety of other trace gases characteristic of a mix of anthropogenic industrial and combustion sources and were strikingly correlated with ethane (C2H6) in particular. Averages with latitude in the near-surface (0-2 km) show that CH4 was elevated well above background levels north of 15 deg N close to the Asian continent. In the central and eastern Pacific, levels of CH4 were lower as continental inputs were mixed horizontally and vertically during transport. Overall, the correlation between CH4 and other hydrocarbons such as ethane (C2H6), ethyne (C2H2), and propane (C3H8) as well as the urban/industrial tracer perchloroethene (C2Cl4), suggests that for CH4 colocated sources such as landfills, wastewater treatment, and fossil fuel use associated with urban areas dominate regional inputs at this time. Comparisons between measurements made during TRACE-P and those of PEM-West B, flown during roughly the same time of year and under a similar meteorological setting 7 years earlier, suggest that although the TRACE-P CH4 observations are higher, the changes are not significantly greater than the increases seen in background air over this time interval.
Author
Atmospheric Composition; Methane; Pollution Monitoring; Air Pollution; Geographic Distribution

20040073632 Air Force Research Lab., Wright-Patterson AFB, OH
Animal Noise Monitor: Assessment of Accelerometers for Determining Animal Behavior
Downing, Micah; Mar. 2000; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422514; AFRL-HE-WP-TR-2004-0017; No Copyright; Avail: CASI; A03, Hardcopy

The Environmental Impact Analysis Process (EIAP) requires that the Department of Defense be able to assess the impacts of noise on animals. The National Park Service and Fish and Wildlife Service, who have oversight on DoD environmental documents, have expressed concern about noise impacts on wildlife from military overflights. The USAF undertook an effort to develop an animal noise monitor that would measure directly the noise impact and determine the activity condition of the animal. This effort was to examine the use of accelerometers for determining the activity level of wildlife, especially Bighorn sheep, mule deer and prong horned antelope. This effort was able to show the correlation of accelerometer data with observed behavior from wildlife experts. Three approaches for implementing accelerometers into an overall system design are proposed.
DTIC
Accelerometers; Animals; Environmental Surveys; Noise Pollution; Wildlife

20040074168 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Elevated Tropospheric Ozone over the Atlantic
Chandra, S.; Ziemke, J. R.; Tie, X.; 2003; 1 pp.; In English; Fall 2000 AGU Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Tropospheric column ozone (TCO) is derived from differential measurements of TOMS total column ozone and Microwave Limb Sounder stratospheric column ozone. It is shown that TCO during summer months over the Atlantic and Pacific Oceans in northern midlatitudes is about the same (50 to 60 Dobson Units) as over the continents of North America, Europe, and Asia, where surface emissions of nitrogen oxides from industrial sources, biomass and biofuel burning and biogenic emissions are significantly larger. This nearly uniform zonal variation in TCO is modulated by surface topography of the Rocky and Himalayan mountains, and Tibetan plateau where TCO is reduced by 20 to 30 Dobson Units. The zonal variation in TCO is well simulated by a global chemical transport model called MOZART-2 (Model of Ozone and Related Chemical Tracers, version 2). The model results are analyzed to delineate the relative importance of various processes contributing to observed zonal characteristics of TCO.
Author
Troposphere; Total Ozone Mapping Spectrometer; Ozone; Atmospheric Composition; Biomass Burning; Topography

20040074243 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Human-Induced Climate Variations Linked to Urbanization: From Observations to Modeling
Shepherd, J. Marshall; Jin, Menglin; [2004]; 1 pp.; In English; AGU Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The goal of this session is to bring together scientists from interdisciplinary backgrounds to discuss the data, scientific approaches and recent results focusing on the impact of urbanization on the climate. The discussion will highlight current observational and modeling capabilities being employed for investigating the urban environment and its linkage to the change

in the Earth's climate system. The goal of the session is to identify our current stand and the future direction on the topic. Urbanization is one of the extreme cases of land use change. Most of population of the world has moved to urban areas. By 1995, more than 70% of population of North America and Europe were living in cities. By 2025, the United Nations estimates that 60% of the worlds population will live in cities. Although currently only 1.2% of the land is urban, better understanding of how the atmosphere-ocean-land-biosphere components interact as a coupled system and the influence of human activities on this system is critical. Our understanding of urbanization effect is incomplete, partly because human activities induce new changes on climate in addition to the original natural variations, and partly because previously few data available for study urban effect globally. Urban construction changes surface roughness, albedo, heat capacity and vegetation coverage. Traffic and industry increase atmospheric aerosol. It is suggested that urbanization may modify rainfall processes through aerosol-cloud interactions or dynamic feedbacks. Because urbanization effect on climate is determined by many factors including land cover, the city's microscale features, population density, and human lifestyle patterns, it is necessary to study urban areas over globe.
Derived from text
Climate; Feedback; Urban Development; Populations; Land Use

20040074255 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Adjoint-Based Analysis of the Sampling Footprints of Tall Tower, Aircraft and Potential Future Lidar Observations of CO2
Andrews, Arlyn; Kawa, Randy; Zhu, Zhengxin; Burris, John; Abshire, Jim; [2004]; 1 pp.; In English; Fall AGU 2003, 8-12 Dec. 2003, San Fransico, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A detailed mechanistic understanding of the sources and sinks of CO2 will be required to reliably predict future CO2 levels and climate. A commonly used technique for deriving information about CO2 exchange with surface reservoirs is to solve an 'inverse problem', where CO2 observations are used with an atmospheric transport model to find the optimal distribution of sources and sinks. Synthesis inversion methods are powerful tools for addressing this question, but the results are disturbingly sensitive to the details of the calculation. Studies done using different atmospheric transport models and combinations of surface station data have produced substantially different distributions of surface fluxes. Adjoint methods are now being developed that will more effectively incorporate diverse datasets in estimates of surface fluxes of CO2. In an adjoint framework, it will be possible to combine CO2 concentration data from longterm surface and aircraft monitoring stations with data from intensive field campaigns and with proposed future satellite observations. We have recently developed an adjoint for the GSFC 3-D Parameterized Chemistry and Transport Model (PCTM). Here, we will present results from a PCTM Adjoint study comparing the sampling footprints of tall tower, aircraft and potential future lidar observations of CO2. The vertical resolution and extent of the profiles and the observation frequency will be considered for several sites in North America.
Author
Carbon Dioxide; Optical Radar; Parameterization; Footprints; Satellite Observation

20040074328 NASA Glenn Research Center, Cleveland, OH, USA
Underexpanded Screeching Jets From Circular, Rectangular, and Elliptic Nozzles
Panda, J.; Raman, G.; Zaman, K. B. M. Q.; May 2004; 19 pp.; In English; 3rd AIAA/CEAS Aeroacoustics Conference, 12-14 May 1997, Atlanta, GA, USA
Contract(s)/Grant(s): WBS 714-08-14
Report No.(s): NASA/TM-2004-212481; AIAA Paper 97-1623; E-14019; No Copyright; Avail: CASI; A03, Hardcopy

The screech frequency and amplitude, the shock spacing, the hydrodynamic-acoustic standing wave spacing, and the convective velocity of large organized structures are measured in the nominal Mach number range of 1.1 less than or = Mj less that or = l0.9 for supersonic, underexpanded jets exhausting from a circular, a rectangular and an elliptic nozzle. This provides a carefully measured data set useful in comparing the importance of various physical parameters in the screech generation process. The hydrodynamic-acoustic standing wave is formed between the potential pressure field of large turbulent structures and the acoustic pressure field of the screech sound. It has been demonstrated earlier that in the currently available screech frequency prediction models replacement of the shock spacing by the standing wave spacing provides an exact expression. In view of this newly found evidence, a comparison is made between the average standing wavelength and the average shock spacing. It is found that there exists a small, yet important, difference, which is dependent on the azimuthal screech mode. For example, in the flapping modes of circular, rectangular, and elliptic jets, the standing wavelength is slightly longer than the shock spacing, while for the helical screech mode in a circular jet the opposite is true. This difference accounts for the departure of the existing models from predicting the exact screech frequency. Another important parameter, necessary in screech prediction, is the convective velocity of the large organized structures. It is demonstrated that the presence of the

hydrodynamic-acoustic standing wave, even inside the jet shear layer, becomes a significant source of error in the convective velocity data obtained using the conventional methods. However, a new relationship, using the standing wavelength and screech frequency is shown to provide more accurate results.
Author
Supersonic Jet Flow; Circular Cylinders; Rectangular Plates; Elliptical Cylinders; Nozzle Design; Mathematical Models; Pressure Distribution; Sound Waves; Jet Aircraft Noise

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*.

20040068131 California Univ., Los Angeles, CA, USA
FAST/Polar Conjunction Study of Field-Aligned Auroral Acceleration and Corresponding Magnetotail Drivers
Schriver, D.; Ashour-Abdalla, M.; Strangeway, R. J.; Richard, R. L.; Klezting, C.; Dotan, Y.; Wygant, J.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. A9, pp. 21-1 - 21-21; In English
Contract(s)/Grant(s): NAG5-10473; NAG5-11989; NAG5-11704; Copyright; Avail: Other Sources

The discrete aurora results when energized electrons bombard the Earth's atmosphere at high latitudes. This paper examines the physical processes that can cause field-aligned acceleration of plasma particles in the auroral region. A data and theoretical study has been carried out to examine the acceleration mechanisms that operate in the auroral zone and to identi@ the magnetospheric drivers of these acceleration mechanisms. The observations used in the study were collected by the Fast Auroral Snapshot (FAST) and Polar satellites when the two satellites were in approximate magnetic conjunction in the auroral region. During these events FAST was in the middle of the auroral zone and Polar was above the auroral zone in the near-Earth plasma sheet. Polar data were used to determine the conditions in the magnetotail at the time field-aligned acceleration was measured by FAST in the auroral zone. For each of the magnetotail drivers identified in the data study, the physics of field-aligned acceleration in the auroral region was examined using existing theoretical efforts and/or a long-system particle in cell simulation to model the magnetically connected region between the two satellites. Results from the study indicate that there are three main drivers of auroral acceleration: (1) field-aligned currents that lead to quasistatic parallel potential drops (parallel electric fields), (2) earthward flow of high-energy plasma beams from the magnetotail into the auroral zone that lead to quasistatic parallel potential drops, and (3) large-amplitude Alfven waves that propagate into the auroral region from the magnetotail. The events examined thus far confm the previously established invariant latitudinal dependence of the drivers and show a strong dependence on magnetic activity. Alfven waves tend to occur primarily at the poleward edge of the auroral region during more magnetically active times and are correlated with intense electron precipitation. At lower latitudes away from the poleward edge of the auroral zone is the primary field-aligned current region which results in the classical field-aligned acceleration associated with the auroral zone (electrons earthward and ion beams tailward). During times of high magnetic activity, high-energy ion beams originating from the magnetotail are observed within, and overlapping, the regions of primary and return field-aligned current. Along the field lines where the high-energy magnetotail ion beams are located, field-aligned acceleration can occur in the auroral zone leading to precipitating electrons and upwelling ionospheric ion beams. Field-aligned currents are present during both quiet and active times, while the Alfven waves and magnetotail ion beams were observed only during more magnetically active events.
Author
Auroras; Magnetohydrodynamic Waves; Potential Fields; Acceleration (Physics); Auroral Zones

20040070832 Massachusetts Inst. of Tech., Cambridge, MA, USA
Relief Evolution in Tectonically Active Mountain Ranges
Whipple, Kelin X.; May 14, 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10389; SENH99-0209-0172; No Copyright; Avail: CASI; A01, Hardcopy

The overall aims of this 3-yr project, as originally proposed were to: (1) investigate quantitatively the roles of fluvial and glacial erosion in the evolution of relief in mountainous regions, and (2) test rigorously the quality and accuracy of SRTM topographic data in areas of rugged relief - both the most challenging and of greatest interest to geomorphic, neotectonic, and hazards applications. Natural laboratories in both the western US and the Southern Alps of New Zealand were identified as most promising. The project has been both successful and productive, despite the fact that no SRTM data for our primary field sites in New Zealand were released on the time frame of the work effort. Given the delayed release of SRTM data, we pursued

the scientific questions of the roles of fluvial and, especially, glacial erosion in the evolution of relief in mountainous regions using available digital elevation models (DEMs) for the Southern Alps of New Zealand (available at both 25m and 50m pixel sizes), and USGS 10m and 30m DEMs within the Western US. As emphasized in the original proposal, we chose the emphasis on the role of glacial modification of topographic relief because there has been little quantitative investigation of glacial erosion processes at landscape scale. This is particularly surprising considering the dramatic sculpting of most mid- and high-latitude mountain ranges, the prodigious quantities of glacially-derived sediment in terrestrial and marine basins, and the current cross-disciplinary interest in the role of denudational processes in orogenesis and the evolution of topography in general. Moreover, the evolution of glaciated landscapes is not only a fundamental problem in geomorphology in its own right, but also is at the heart of the debate over Late Cenozoic linkages between climate and tectonics.
Derived from text
Glaciers; Erosion; Topography; Tectonics; Geomorphology; Geological Surveys

20040070915 Boston Univ., Boston, MA, USA
Deriving Albedo from Coupled MERIS and MODIS Surface Products
Gao, Feng; Schaaf, Crystal; Jin, Yu-Fang; Lucht, Wolfgang; Strahler, Alan; [2004]; 17 pp.; In English; MERIS Users Workshop, 10-14 Nov. 2004, Frascati, Italy; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-11263; No Copyright; Avail: CASI; A03, Hardcopy

MERIS Level 2 surface reflectance products are now available to the scientific community. This paper demonstrates the production of MERIS-derived surface albedo and Nadir Bidirectional Reflectance Distribution Function (BRDF) adjusted reflectances by coupling the MERIS data with MODIS BRDF products. Initial efforts rely on the specification of surface anisotropy as provided by the global MODIS BRDF product for a first guess of the shape of the BRDF and then make use all of the coincidently available, partially atmospherically corrected, cloud cleared, MERIS observations to generate MERIS-derived BRDF and surface albedo quantities for each location. Comparisons between MODIS (aerosol-corrected) and MERIS (not-yet aerosol-corrected) surface values from April and May 2003 are also presented for case studies in Spain and California as well as preliminary comparisons with field data from the Devil's Rock Surfrad/BSRN site.
Author
Spectral Reflectance; MODIS (Radiometry); Bidirectional Reflectance; Aerosols; Albedo; Distribution Functions

20040070920 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stormtime Particle Energization with High Temporal Resolution AMIE Potentials
Khazanov, George V.; Liemohn, Michael W.; Fok, Mei-Ching; Newman, Timothy S.; Ridley, Aaron J.; [2004]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Simulations were conducted to investigate the influence of rapid electric field fluctuations on electron energization in the inner magnetosphere based on the assimilative mapping of ionospheric electrodynamics (AMIE) technique. Simulations for four different magnetic storms were run, namely those that occurred on May 15, 1997, May 4, 1998, September 25, 1998, and October 19, 1998. Here, we have examined the formation of high energy (10-1000 keV) electrons in the inner magnetosphere during these storm events with our recently-developed relativistic radiation belt transport code. The point of this numerical experiment is to show that a simulation of a real event must have the high time resolution electric field input files in order to produce the seed population for the radiation belts, which are often observed to increase in the days following a magnetic storm. Specifically, a cadence of the global electric field pattern of 5 minutes or less produces inner magnetospheric fluxes that are larger (by up to several orders of magnitude) than fluxes produced with a longer cadence. Differences were particularly large relative to simulation results with a 3-hour time cadence, analogous to a Kp-driven electric field model.
Author
Temporal Resolution; Computerized Simulation; Magnetic Storms; Electrodynamics; Ionospheres; Thematic Mapping

20040070944 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Accuracy and Precision in the Southern Hemisphere Additional Ozonesondes (SHADOZ) Dataset 1998-2000 in Light of the JOSIE-2000 Results
Witte, J. C.; Thompson, A. M.; Schmidlin, F. J.; Oltmans, S. J.; McPeters, R. D.; Smit, H. G. J.; 2003; 1 pp.; In English; Fall AGU Meeting 2003, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A network of 12 southern hemisphere tropical and subtropical stations in the Southern Hemisphere ADditional OZonesondes (SHADOZ) project has provided over 2000 profiles of stratospheric and tropospheric ozone since 1998. Balloon-borne electrochemical concentration cell (ECC) ozonesondes are used with standard radiosondes for pressure,

temperature and relative humidity measurements. The archived data are available at:http: //croc.gsfc.nasa.gov/shadoz. In Thompson et al., accuracies and imprecisions in the SHADOZ 1998- 2000 dataset were examined using ground-based instruments and the TOMS total ozone measurement (version 7) as references. Small variations in ozonesonde technique introduced possible biases from station-to-station. SHADOZ total ozone column amounts are now compared to version 8 TOMS; discrepancies between the two datasets are reduced 2\% on average. An evaluation of ozone variations among the stations is made using the results of a series of chamber simulations of ozone launches (JOSIE-2000, Juelich Ozonesonde Intercomparison Experiment) in which a standard reference ozone instrument was employed with the various sonde techniques used in SHADOZ. A number of variations in SHADOZ ozone data are explained when differences in solution strength, data processing and instrument type (manufacturer) are taken into account.
Author
Atmospheric Composition; Atmospheric Temperature; Data Processing; Ozone; Pressure Measurement; Total Ozone Mapping Spectrometer; Troposphere; Stratosphere

20040070945 NASA Marshall Space Flight Center, Huntsville, AL, USA
Differential Velocity between Solar Wind Protons and Alpha Particles in Pressure Balance Structures
Yamauchi, Yohei; Suess, Steven T.; Steinberg, John T.; Sakurai, Takashi; Journal of Geophysical Research; 2004; ISSN 0148-0227; Volume 109; 1 pp.; In English; Ulysses Science Working Team Meeting, 22-23 Apr. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Pressure balance structures (PBSs) are a common high-plasma beta feature in high-latitude, high-speed solar wind. They have been proposed as remnants of coronal plumes. If true, they should reflect the observation that plumes are rooted in unipolar magnetic flux concentrations in the photosphere and are heated as oppositely directed flux is advected into and reconnects with the flux concentration. A minimum variance analysis (MVA) of magnetic discontinuities in PBSs showed there is a larger proportion of tangential discontinuities than in the surrounding high-speed wind, supporting the hypothesis that plasmoids or extended current sheets are formed during reconnection at the base of plumes. To further evaluate the character of magnetic field discontinuities in PBSs, differential streaming between alpha particles and protons is analyzed here for the same sample of PBSs used in the MVA. Alpha particles in high-speed wind generally have a higher radial flow speed than protons. However, if the magnetic field is folded back on itself, as in a large-amplitude Alfven wave, alpha particles will locally have a radial flow speed less than protons. This characteristic is used here to distinguish between folded back magnetic fields (which would contain rotational discontinuities) and tangential discontinuities using Ulysses high-latitude, high-speed solar wind data. The analysis indicates that almost all reversals in the radial magnetic field in PBSs are folded back field lines. This is found to also be true outside PBSs, supporting existing results for typical high-speed, high-latitude wind. There remains a small number of cases that appear not to be folds in the magnetic field and which may be flux tubes with both ends rooted in the Sun. The distinct difference in MVA results inside and outside PBSs remains unexplained.
Author
Alpha Particles; Protons; Solar Wind; Pressure

20040073558 Naval Research Lab., Washington, DC
Atmospheric Photo Ionization of Argon with a Short Pulse Laser
Manheimer, Wallace; Mar. 28, 2004; 17 pp.; In English
Report No.(s): AD-A422355; NRL/MR/6707--04-8751; No Copyright; Avail: CASI; A03, Hardcopy

One of the goals of the NRL laser-atmospheric propagation program is to produce a plasma spot, at a controlled range with a combination of longitudinal compression of a laser pulse over long distance, followed by transverse self focusing over short distance. The ease by which one can accomplish this depends, at least in part, on the ionization mechanism. This report suggests that photo ionization of the argon component, via a four photon resonant excitation, followed by ionization of the highly excited state could be easier to accomplish than ionization of the oxygen by a direct four photon process, a seemingly more obvious choice. The reason is that the former is a resonant process, while the latter is not. While detailed calculations are not performed, initial crude calculations indicate that the rate via the argon channel could exceed the rate via the oxygen channel by several orders of magnitude.
DTIC
Argon; Atmospheric Circulation; Atmospheric Ionization; Gas Ionization; Pulsed Lasers

20040073763 Georgia Tech Research Inst., Atlanta, GA

Mitigation of Atmospheric Effects on Imaging Systems

Gimmestad, Gary G.; Belen'kii, Mikhail S.; Mar. 31, 2004; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-1-0503

Report No.(s): AD-A422695; ARO-40432.1-C1; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric effects such as refractive turbulence and aerosol obscuration can seriously degrade the performance of military optical systems. A complete understanding of these effects is therefore essential for optimizing the design of such systems, and it is also necessary for developing mitigation techniques. The project described here was a three- year theoretical and experimental investigation to develop and validate a physical understanding of several atmospheric effects that are important for current and future Army optical systems. a) An investigation of turbulence-induced waviness in images of edges, and techniques for its mitigation. b) An investigation of the degradation of optical images by atmospheric turbulence and a validation of the predicted dependence of the atmospheric Modulation Transfer Function (MTF) on the inner scale of turbulence.

DTIC

Atmospheric Effects; Atmospheric Refraction; Images; Imaging Techniques; Optical Equipment; Optical Radar; Refractivity

20040073817 Science Applications International Corp., San Diego, CA

Analysis and Simulation of Cavity-Decoupled Chemical Explosions

Stevens, J. L.; Rimer, N.; Xu, H.; Murphy, J. R.; Barker, B. W.; Baily, E.; Oct. 24, 2003; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-01-C-0069; Proj-DTRA

Report No.(s): AD-A422856; SAIC-03/2050; AFRL-VS-HA-TR-2004-1030; No Copyright; Avail: CASI; A03, Hardcopy

We analyze data from two sets of decoupled chemical explosions. NORSAR has obtained data from seven decoupled chemical explosions conducted from 1987-2002 in Alvdalen, Sweden, recorded both in he near field and on regional seismic stations NORES, HAGFORS, and NORSAR. The explosions were conducted in three granite chambers at a depth of approximately 100 meters in chambers with volumes of 200, 300 and 1000 m and yields ranging from 2500 kg to 10,000 kg. The smallest explosion in the largest chamber is almost fully decoupled while the other explosions are partially coupled, overdriven by up to a factor of 25. The data show that decoupling remains fairly constant for overdrive up to about a factor of 10, then decreases rapidly at higher yields. 1D and 3D simulations of these explosions are performed to model the data. IDG has digitized a set of surface seismic data recorded from a series of Soviet high-explosive cavity decoupling tests conducted in a mine in Kirghizia in the summer of 1960.

DTIC

Cavities; Chemical Explosions; Explosions; Simulation

20040073820 Science Applications International Corp., San Diego, CA

Improved Focal Depth Determination for Use in Seismic Monitoring of the Underground Nuclear Explosions

Murphy, J. R.; Barker, B. W.; Marshall, M. E.; Rodi, W. L.; Nov. 19, 2003; 60 pp.; In English

Contract(s)/Grant(s): DTRA01-01-C-0056; Proj-DTRA

Report No.(s): AD-A422863; AFRL-VS-HA-TR-2004-1031; No Copyright; Avail: CASI; A04, Hardcopy

Seismic event location remains as one of the most important discriminants for separating natural tectonic and explosive events. For example, it has been estimated that approximately 8O%of known global earthquakes have focal depths greater than 50 km or are located more than 25 km at sea. Since underwater nuclear explosions can be confidently identified to very low yields using hydroacoustic data, it follows that the vast majority of earthquakes can potentially be identified on the basis of location alone. This is an important observation since global monitoring of underground nuclear testing may require the screening of tens of thousands of seismic events per year and, in order to perform this function efficiently, it will be necessary to have simple and robust discriminants available which can be used to eliminate the vast majority of these events from more detailed consideration. However, in order to be useful for such discrimination purposes, the uncertainties associated with seismic locations must be well defined and reliable and this has proved to be difficult to accomplish.

DTIC

Depth Measurement; Nuclear Explosions; Seismology; Underground Explosions

20040074128 USA Combined Forces Command, San Francisco, CA

Metrics to Monitor Governance and Reconstruction in Afghanistan: Development of Measures of Effectiveness for Civil-Military Operations and a Standardized Tool to Monitor Governance Quality

Mar. 12, 2004; 108 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422444; USACAPOC-TR-04-01; No Copyright; Avail: CASI; A06, Hardcopy

Metrics were developed to assess and monitor in a statistically valid manner the development of good governance in Afghanistan. Measures of effectiveness (MOE) were developed for civil-military operations in Afghanistan. This report documents: 1) methods to develop MOE% which may be used to the develop MOE for any type of operation; 2) the civil-military end state defined in the process; 3) a comprehensive system of MOE for Afghanistan; 4) a new assessment tool% the Assessment of Governance Quality Indicators which allows assessment and monitoring of governance development; and S) a national sampling strategy to monitor governance development throughout Afghanistan. Methods and metrics documented here have applicability for both the military and the civilian assistance community as well as for operations in other countries. This report represents work performed primarily by the staff of the Coalition Joint Civil-Military Operations Task Force (CJCMOTF) in support of Operation Enduring Freedom in Afghanistan during the period July 2003 through January 2004. The work involved close cooperation between CJCMOTF other elements of the Coalition military civilian US Government Agencies and the United Nations Assistance Mission Afghanistan.

DTIC

International System of Units; Military Operations; Procurement; Standardization

20040074174 Hokkaido Univ., Sapporo, Japan

Geophysical Bulletin of Hokkaido University, No. 67

Koyama, Junji, Editor; Harimaya, Toshio, Editor; Kasahara, Minoru, Editor; Shimamura, Hideki, Editor; Sasatani, Tsutomu, Editor; Hayashi, Yoshiyuki, Editor; Nishida, Yasunori, Editor; Watanabe, Shigeto, Editor; Oshima, Hiromitsu, Editor; Ikeda, Ryuji, Editor, et al.; March 2004; ISSN 0439-3503; 383 pp.; In Japanese; Copyright; Avail: Other Sources

This bulletin issue, No.67, March 2004, included the following reports:Effect of Thermal History on Viscosity Increase at Low Temperatures;Improvement of Crustal Activity Monitoring System using New Wideband Stationary Magneto-telluric Observation Equipment; Monitoring of Ground Temperature, Resistivity, and Self-potential Variations in Geothermal Field of Nishiyama, Usu volcano; Resistivity Structure of Hokkaido Komagatake Volcano using Wide Band MT Method --The Result of 1D Inversion and the Estimation of Influences of the Ocean; H20 Emission Rate of Volcanic Plume during the 2000-2001 Miyakejima Volcanic Activity; Does the geostrophic flow in Earth's core work as a symmetry breaker for the generation of net helicity?;Apprehensions for Inappropriate Analogy: Examples in Discussion of Caldera Formation; Recent seismic activities at active volcanoes in Hokkaido;Recent seismic activities at active volcanoes in Hokkaido-Tarumaesan.

Derived from text

Volcanic Eruptions; Geothermal Resources

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040068392 NASA Ames Research Center, Moffett Field, CA, USA

African Equatorial and Subtropical Ozone Plumes: Recurrences Timescales of the Brown Cloud Trans-African Plumes and Other Plumes

Chatfield, Robert B.; Thompson, Anne M.; Guan, Hong; Witte, Jacquelyn C.; [2004]; 1 pp.; In English; American Geophysical Union Spring Meeting, 17-21 May 2004, Montreal, Canada

Contract(s)/Grant(s): 21-622-55-54; No Copyright; Avail: Other Sources; Abstract Only

We have found repeated illustrations in the maps of Total Tropospheric Ozone (TTO) of apparent transport of ozone from the Indian Ocean to the Equatorial Atlantic Ocean. Most interesting are examples that coincide with the INDOEX observations of late northern winter, 1999. Three soundings associated with the SHADOZ (Southern Hemisphere Additional Ozonesondes) network help confirm and quantify degree of influence of pollution, lightning, and stratospheric sources, suggesting that perhaps 40% of increased Atlantic ozone could be Asian pollution during periods of maximum identified in the TTO maps. We outline recurrent periods of apparent ozone transport from Indian to Atlantic Ocean regions both during and outside the late-winter period. These are placed in the context of some general observations about factors controlling recurrence timescales for the expression of both equatorial and subtropical plumes. Low-level subtropical plumes are often controlled by

frontal systems approaching the Namib coast; these direct mid-level air into either easterly equatorial plumes or westerly mid-troposphere plumes. Equatorial plumes of ozone cross Africa on an easterly path due to the occasional coincidence of two phenomena: (1) lofting of ozone to mid and upper levels, often in the Western Indian Ocean, and (2) the eastward extension of an Equatorial African easterly jet.
Author
Ozone; Plumes; Troposphere; Pollution Transport

20040070716 New Hampshire Univ., Durham, NH, USA
Tropospheric Methane Over the Pacific Basin During TRACE-P
Bartlett, Karen B.; Talbot, Robert W.; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NCC1-02023; No Copyright; Avail: Other Sources; Abstract Only

We received funding for the acquisition, statistical analysis, interpretation, and publication of atmospheric methane data collected during the Transport and Chemical Evolution over the Pacific (TRACE-P) mission, flown February through April of 2001. These high precision measurements were made aboard the NASA DC-8 and P-3B aircraft using a fast response, tunable diode laser system, the DACOM instrument. Our analysis focused on the vertical and geographical distribution of this key trace gas, particularly in the context of other data available from the region such as those from the Pacific NOAA CMDL surface sites, and earlier NASA aircraft missions (such as PEM-West A and B). The paper reporting these results, "Large-Scale Distribution of CH4 in the Western Pacific: Sources and Transport from the Asian Continent" by authors K.B. Bartlett, G.W. Sachse, T. Slate, C. Harward, and D.R. Blake, is attached. The dataset of roughly 13,800 CH4 measurements ranged between 1602 ppb in stratospherically impacted air and 2149 ppb in highly polluted air. Overall, we found that CH4 concentrations were highly correlated with trace gases characteristic of a mix of anthropogenic industrial and combustion sources. They were strikingly correlated with ethane (C2H6) in particular, whose major sources are natural gas leakage and biomass burning. Correlation between the two hydrocarbons indicated that these sources may dominate for CH4 as well at this time.
Author
Methane; Troposphere; Pacific Ocean; Statistical Analysis; Data Acquisition; Natural Gas; Atmospheric Composition

20040070760 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A LEO Hyperspectral Mission Implementation for Global Carbon Cycle Observations
Gervin, Janette C.; Esper, Jaime; McClain, Charles R.; Hall, Forrest G.; Middleton, Elizabeth M.; Gregg, Watson W.; Mannino, Antonio; Knox, Robert G.; Huemmrich, K. Fred; 2004; 1 pp.; In English; IGARSS 2004: 2004 IEEE international Geoscience and Remote Sensing Symposium, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

For both terrestrial and ocean carbon cycle science objectives, high resolution (less than l0 nm) imaging spectrometers capable of acquiring multiple regional to global scale observations per day should enable the development of new remote sensing measurements for important but as yet unobservable variables, with the overall goal of linking both terrestrial and ocean carbon cycle processes to climate variability. For terrestrial research, accurate estimates of carbon, water and energy (CWE) exchange between the terrestrial biosphere and atmosphere a needed to id- the geographical locations and temporal dynamics of carbon sources/sinks and to improve regional climate models and climate change assessments. It is an enormous challenge to estimate CWE exchange from the infrequent temporal coverage and sparse spectral information provided by most single polar-orbiting, earth-looking satellite. The available satellite observations lack a sufficient number of well-placed narrow bands from which to derive spectral indices that capture vegetation responses to stress conditions associated with down-regulation of photosynthesis. Physiological status can best be assessed with spectral indices based on continuous, narrow bands in the visible/near infrared spectra, as can seasonal and annual terrestrial productivity. For coastal and ocean constituents, narrow-band observations in the ultraviolet and visible are essential to investigate the variability, dynamics and biogeochemical cycles of the world's coastal and open ocean regions, which will in turn help in measuring ocean productivity and predicting the variability of ocean carbon uptake and its role in climate change.
Derived from text
Biogeochemistry; Biosphere; Carbon Cycle; Satellite Observation; Marine Biology

20040070949 NASA Marshall Space Flight Center, Huntsville, AL, USA
Proposed Plan for Adopting Updated Range Reference Atmospheres
Keller, Vernon; Burns, Lee; April 2004; 14 pp.; In English; 2004 DOD Climatology Workshop, 28-30 Apr. 2004, Asheville, NC, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Terrestrial and Planetary Environments Team at Marshall Space Flight Center (MSFC) proposes to facilitate validation, documentation, and adoption of updated Range Reference Atmospheres (RRAs). This viewgraph presentation describes the plan, focusing on seven tasks: 1) Document data sources; 2) Document analytical models; 3) Document data processing procedures; 4) Compare updates to 1983 versions; 5) Compile written documentation; 6) Obtain approval for final volumes; 7) Publish new RRA datasets/documents.
CASI
Reference Atmospheres; Data Processing

20040071022 Lawrence Livermore National Lab., Livermore, CA
Cloud-Resolving Model Intercomparison with the ARM Summer 1997 IOP Data
Xu, K. M.; Johnson, D. E.; Tao, W. K.; Krueger, S. K.; Khairoutdinov, M.; Mar. 12, 2000; In English
Report No.(s): DE2003-15005419; UCRL-JC-145023; No Copyright; Avail: National Technical Information Service (NTIS)
The Atmospheric Radiation Measurement (ARM) Program's Single Column Model (SCM) working group conducted its intercomparison study of midlatitude summertime continental convection using the July 1995 Intensive Operational Period (IOP) data set (Ghan et al. 2000). Only one cloud-resolving model (CRM) participated in the study. On the other hand, several CRMs participated in the GEWEX (Global Energy and Water-cycle Experiment) Cloud System Study (GCSS) Working Group 4's intercomparison study of tropical deep convection (Krueger and Lazarus 1998; Redelsperger et al. 2000). Both groups decided to have a joint intercomparison project to maximize the resources and advance our understanding of midlatitude continental convection. This joint project compares the cloud-resolving and single-column simulations of summertime continental cumulus convection observed at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site during the ARM Summer 1997 IOP. This paper reports the findings and results of cloud-resolving simulations, while Cederwall et al. (2000) reports the SCM part of the project. Seven CRMs are participating in this project.
NTIS
Atmospheric Radiation; Clouds (Meteorology); Models; Radiation Measurement

20040071052 California Energy Commission, Sacramento, CA, USA
Climate Change and California
Nov. 2003; In English
Report No.(s): PB2004-102571; CEC/100-03-017F; No Copyright; Avail: National Technical Information Service (NTIS)
Climate change represents a significant risk to California as a result of a warming and increasingly variable climate. The signs of a global warming trend continue to become more evident and much of the scientific debate is now focused on expected rates at which future changes will occur. Rising temperatures and sea levels, and changes in hydrological systems are threats to California's economy, public health, and environment. In 1988, the California Legislature recognized that climate change could adversely affect the state and called for an assessment of impacts and identification of potential strategies. Since then California has inventoried its greenhouse gas emissions, improved energy efficiency and conservation, created a voluntary greenhouse gas registry, established ambitious goals for renewable energy, and is now preparing regulations to achieve reductions in greenhouse gas emissions from motor vehicles. While California has been a leader in addressing climate change, more can be done to better prepare for an uncertain climate future and improve the resiliency of the state's economy. Taking appropriate steps to address risks posed by climate change can help insure a more sustainable future and benefit the state's citizenry and natural and economic resources.
NTIS
Climate Change; Greenhouse Effect

20040071055 Yale Univ., New Haven, CT, USA
Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy
Wilson, T.; Williams, L.; Smith, J.; Aug. 2003; In English
Report No.(s): PB2004-102566; No Copyright; Avail: National Technical Information Service (NTIS)
This project is the most detailed study ever undertaken on the potential effect of climate change on California. This work examines a broad array of potentially affected sectors as well as the interactions between climate change and increased population, economic growth, and technological change. It considers a wide range of climate change scenarios, ranging from warmer and much wetter to warmer and much drier. Most climate models estimate that precipitation will increase. Climate change is likely to have substantial impacts on California. The location of natural vegetation will change dramatically. Productivity could increase under wetter conditions and biodiversity could be reduced under drier conditions. The combined

effects of climate change and urbanization on vegetation could adversely affect some critical systems. Timber production may initially increase and then decrease, but producers and consumers may be more affected by changes in global timber prices. Higher temperatures will cause the snowpack to melt earlier in the year, increasing flood risks. Changes in the water supply are very sensitive to changes in precipitation. Agriculture will most likely demand more water, although population and economic growth will decrease the sector's allocation of water. Climate change could affect agriculture more favorably in northern California than in the south, but changes in technology may have a far greater impact statewide.
NTIS
Climate Change; Public Health

20040071059 Lawrence Livermore National Lab., Livermore, CA
Final Report for LDRD Project 'A New Era of Research in Aerosol/Cloud/Climate Interactions at LLNL'
Chuang, C.; Bergman, D.; Dignon, J.; Connell, P.; Jan. 31, 2002; In English
Report No.(s): DE2004-15002147; UCRL-ID-146980; No Copyright; Avail: National Technical Information Service (NTIS)

One of the largest uncertainties in simulations of climate change over the industrial period is the impact of anthropogenic aerosols on the Earth's radiation budget. Much of this uncertainty arises from the limited capability for either precisely linking precursor gases to the formation and size distribution of the aerosols or quantitatively describing the existing levels of global aerosol loading. This project builds on our aerosol and chemistry expertise to address each of these uncertainties in a more quantitative fashion than is currently possible. With the current LDRD support, we are in the process to implement an aerosol microphysics module into our global chemistry model to more fundamentally and completely describe the processes that determine the distribution of atmospheric aerosols. Using this new modeling capability, in conjunction with the most current version of NCAR climate model, we will examine the influence of these processes on aerosol direct and indirect climate forcing.
NTIS
Atmospheric Chemistry; Air Pollution; Climate Change; Research and Development; Aerosols

20040073468 Massachusetts Inst. of Tech., Cambridge, MA, USA
Evolution of Topography in Glaciated Mountain Ranges
Brocklehurst, Simon H.; August 26, 2002; 1 pp.; In English
Contract(s)/Grant(s): NAG5-10389; No Copyright; Avail: Other Sources; Abstract Only

This thesis examines the response of alpine landscapes to the onset of glaciation. The basic approach is to compare fluvial and glacial laudscapes, since it is the change from the former to the latter that accompanies climatic cooling. This allows a detailed evaluation of hypotheses relating climate change to tectonic processes in glaciated mountain belts. Fieldwork was carried out in the eastern Sierra Nevada, California, and the Sangre de Cristo Range, Colorado, alongside digital elevation model analyses in the western US, the Southern Alps of New Zealand, and the Himalaya of northwestern Pakistan. hypothesis is overstated in its appeal to glacial erosion as a major source of relief production and subsequent peak uplift. Glaciers in the eastern Sierra Nevada and the western Sangre de Cristos have redistributed relief, but have produced only modest relief by enlarging drainage basins at the expense of low-relief topography. Glaciers have lowered valley floors and ridgelines by similar amounts, limiting the amount of "missing mass' that can be generated, and causing a decrease in drainage basin relief. The principal response of glaciated landscapes to rapid rock uplift is the development of towering cirque headwalls. This represents considerable relief production, but is not caused by glacial erosion alone. Large valley glaciers can maintain their low gradient regardless of uplift rate, which supports the "glacial buzzsaw" hypothesis. However, the inability of glaciers to erode steep hillslopes as rapidly can cause mean elevations to rise. Cosmogenic isotope dating is used to show that (i) where plucking is active, the last major glaciation removed sufficient material to reset the cosmogenic clock; and (ii) former glacial valley floors now stranded near the crest of the Sierra Nevada are at varying stages of abandonment, suggesting a cycle of drainage reorganiszation and relief inversion due to glacial erosion similar to that observed in river networks. Glaciated landscapes are quite distinct from their fluvial counterparts in both landforms and processes. Given the scarcity of purely fluvial, active mountain ranges, it is essential that glacial erosion be considered amongst the processes sculpting active orogenic belts.
Author
Evolution (Development); Topography; Glaciers; Mountains; Digital Elevation Models

20040073540 Naval Postgraduate School, Monterey, CA
Prediction of Tropical Cyclone Formation in the Western North Pacific Using the Navy Global Model
Bower, Caroline A.; Mar. 2004; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422293; No Copyright; Avail: CASI; A07, Hardcopy

The Tropical Cyclone Vortex Tracking Program is used to identify vortices in the western North Pacific from the Navy Operational Global Atmospheric Prediction System (NOGAPS) analyses and forecasts during May - October 2002 and 2003. Based on the NOGAPS analyses, several parameters are different between the 23 vortices that developed into storms% during 2002 according to the Joint Typhoon Warning Center (JTWC) and the 231 vortices that did not develop. After eliminating 127 vortices that did not persist at least 24 h, this left 104 non developing cases. For the developing circulations, the average 850-mb relative vorticity value at the first JTWC-warning time was 5.0 x 10(-5) s(-1), with an easterly deep layer wind shear of-1.8 m s(-1).
DTIC
Cyclones; Navy; Tropical Storms

20040073680 Washington Univ., Seattle, WA
International Arctic Buoy Programme Data Report 1 January 2002 - 31 December 2002
Ortmeyer, Mark; Rigor, Ignatius; May 2003; 221 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0698
Report No.(s): AD-A422579; APL-UW-TM-5-03; No Copyright; Avail: CASI; A10, Hardcopy
This report presents data collected by the International Arctic Buoy Programme (IABP) between 1 January 2002 and 31 December 2002. The network of automatic data buoys deployed by the IABP monitors synoptic-scale fields of pressure, temperature, and ice motion throughout the Arctic Basin.
DTIC
Arctic Regions; Buoys; Meteorological Parameters

20040073691 Washington Univ., Seattle, WA
International Arctic Buoy Programme Data Report 1 January 2000 - 31 December 2000
Rigor, Ignatius; Ortmeyer, Mark; Apr. 2001; 205 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0698
Report No.(s): AD-A422591; APL-UW-TM-4-01; No Copyright; Avail: CASI; A10, Hardcopy
A network of automatic data buoys to monitor synoptic-scale fields of pressure, temperature, and ice motion throughout the Arctic Basin was recommended by the U.S. National Academy of Sciences in 1974. Based on the Academy's recommendation, the Arctic Ocean Buoy Programme was established by the Polar Science Center, University of Washington, in 1978 to support the Global Weather Experiment. Operations began in early 1979, and the program continued through 1990 under funding from various agencies. In 1991, the Arctic Ocean Buoy Programme was succeeded by the International Arctic Buoy Programme (IABP), but the basic objective remains - to establish and maintain a network of drifting buoys in the Arctic Ocean with which to provide data needed for real-time operations and meteorological and oceanographic research. The IABP is funded and managed by participants of the program, including operational and research agencies, meteorological and oceanographic institutes, and government and nongovernmental organizations. The participants represent eight countries and one international agency. This report is the twentieth in a series of data reports beginning in 1979; it covers the period from 1 January 2000 through 31 December 2000.
DTIC
Arctic Regions; Buoys; Marine Meteorology; Meteorological Parameters; Meteorology; Oceanography

20040073708 Army Cold Regions Research and Engineering Lab., Hanover, NH
The CRREL Cold Regions Tactical Shelter
Flanders, Stephen N.; Tobiasson, Wayne; Jul. 1977; 6 pp.; In English
Report No.(s): AD-A422612; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Low Temperature Environments; Shelters

20040073729 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Dust Storm Forecasting for Al Udeid AB, Qatar: An Empirical Analysis
Bartlett, Kevin S.; Mar. 2004; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422645; AFIT/GM/ENP-04-01; No Copyright; Avail: CASI; A06, Hardcopy
Dust storms are extreme weather events that have strong winds laden with visibility reducing and operations limiting dust, The Central Command Air Forces (CENTAF) 28th Operational Weather Squadron (OWS) is ultimately responsible for

forecasting weather in the vast, data denied region of Southwest Asia in support of daily military and humanitarian operations. As a result, the 28th OWS requests a simplified forecasting tool to help predict mesoscale dust events that affect coalition operations at Al Udeid AB, Qatar. This research satisfies the 28th OWS request through an extensive statistical analysis of observational data depicting seasonal dust events over the past 2 years. The resultant multiple linear regression best fit model combines 28 easily attainable model outputs, satellite imagery, surface and upper air observations, and applies a linear transformation equation. The best fit model derived provides the end user with a numerical visibility prediction tool for Al Udeid AB that is verified against a seasonally divided and independent validation data set that yields an R2 of 0.79 while maintaining < 800 m accuracy.
DTIC
Dust Storms; Forecasting; Weather Forecasting

20040073767 Army Research Lab., Adelphi, MD
Toward Improving the Efficiency and Realism of Coupled Meteorological Acoustic Computer Models for the Forest Canopy
Arnold, Tunick; Apr. 2004; 24 pp.; In English
Report No.(s): AD-A422715; ARL-MR-586; No Copyright; Avail: CASI; A03, Hardcopy

Several physics-based computer models have been developed to calculate one-and two-dimensional forest canopy micrometeorology and turbulence for future U. S. Army acoustic application research. Individual computer codes have incorporated various computational methods on a uniform grid to solve the meteorological fields. However, it may be possible to improve the efficiency and realism of the coupled meteorological acoustic computer models by introducing variable grid. Variable grid will allow for better distribution of grid points and will extend calculations higher into the boundary layer above the forest. A finer grid inside the forest and a coarser grid above the forest will help to resolve important meteorological (and acoustic) scales and processes. Therefore, the following report presents results from some preliminary tests to incorporate this important feature into numerical codes. First, several simpler physics-based diffusion models are developed to benchmark fundamental (numerical) techniques. Both explicit and implicit differencing schemes are examined. In addition, numerical stability criteria for these calculations are demonstrated. Then, successful preliminary tests on these codes are extended to more complicated meteorological acoustic models for the forest canopy.
DTIC
Acoustic Properties; Acoustics; Canopies (Vegetation); Computer Programs; Computerized Simulation; Forests; Meteorological Parameters

20040073770 Army Research Lab., White Sands Missile Range, NM
Forecast Model Uncertainty; MM5 Accuracy Over Utah
Sauter, Barbara; Mar. 2004; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422720; ARL-TR-3170; No Copyright; Avail: CASI; A03, Hardcopy

Researchers are investigating various approaches to determine and portray weather forecast uncertainty. Methods requiring extensive computing power on the battlefield or massive data communications to the end user will not be implemented in the near future. This study investigated weather forecast uncertainty through a compilation of forecast errors in the Penn State/National Center for Atmospheric Research fifth-generation Mesoscale Model (MM5) over 50 winter days in Utah. The percentage of forecasts meeting the Army s stated accuracy requirements for temperature, dew-point temperature, wind speed, and wind direction is highlighted.
DTIC
Data Transmission; Forecasting; Weather Forecasting

20040074154 National Defense Univ., Washington, DC
Global Warming Could Have a Chilling Effect on the Military (Defense Horizons, Number 33, October 2003)
Pittenger, Richard F.; Gagosian, Robert B.; Dec. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422382; No Copyright; Avail: CASI; A02, Hardcopy

Most debates and studies addressing potential climate change have focused on the buildup of industrial greenhouse gases in the atmosphere and a gradual increase in global temperatures. But this "slow ramp" climate change scenario ignores recent and rapidly advancing evidence that Earth's climate repeatedly has become much colder, warmer, wetter, or drier-in time spans as short as three to 10 years. Earth's climate system appears to have sensitive thresholds, the crossing of which shifts the system into different modes of operation and triggers rapid, non-linear, and not necessarily global changes.

This new paradigm of abrupt climate change does not appear to be on the radar screens of military planners, who treat climate change as a long term, low-level threat, with mostly sociological, not national security, implications. But intense and abrupt climate changes could escalate environmental issues into unanticipated security threats, and could compromise an unprepared military. The global ocean circulation system, often called the Ocean Conveyor, can change rapidly and shift the distribution patterns of heat and rainfall over large areas of the globe. The North Atlantic region is particularly vulnerable to abrupt regional coolings linked to ocean circulation changes. Global warming and ocean circulation changes also threaten the Arctic Ocean's sea ice cover. Beyond the abrupt climatic impacts, fundamental changes in ocean circulation also have immediate naval implications. Recent evidence suggests that the oceans already may be experiencing large-scale changes that could affect Earth's climate. Military planners should begin to consider potential abrupt climate change scenarios and their impacts on national defense.
DTIC
Cooling; Global Warming; Greenhouse Effect; Horizon; Military Operations; Security

20040074160 Army Engineer Research and Development Center, Vicksburg, MS
Typhoon-Induced Stage-Frequency Relationships for the Island of Rota, Commonwealth of the Northern Mariana Islands
Thompson, Edward F.; Scheffner, Norman; Feb. 2004; 142 pp.; In English
Report No.(s): AD-A422625; ERDC/CHL-TR-04-1; No Copyright; Avail: CASI; A07, Hardcopy

A set of typhoon-induced stage-frequency relationships was developed for inhabited coasts of the island of Rota, Commonwealth of the Northern Mariana Islands. The objective was to assist the Honolulu District in estimating extreme maximum inundation levels and maximum still-water levels with return period of up to 500 years. Calculations of surge, wind and pressure field, and wave characteristics were performed for 28 historical storms and four hypothetical variations of historical storms through application of numerical models. Wave-induced ponding, setup, and runup were calculated at 87 profile locations specified by the Honolulu District. The Empirical Simulation Technique was applied to calculate stage-frequency relationships based on historical storm parameters and calculated response to the storms. These relationships were calculated from the maximum total water levels computed for each storm (including storm surge, ponding, and runup) and from the maximum still-water levels for each storm (including storm surge, ponding, and wave setup). The methodology was calibrated to observations so that stage- frequency values for maximum total water level are expected to represent maximum debris line inundation levels.
DTIC
Frequencies; Islands; Typhoons

20040074236 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observations of the Upper Tropospheric Water Vapor Feedback in UARS MLS and HALOE Data
Dessler, A. E.; Minschwaner, K. R.; [2004]; 1 pp.; In English; FAll AGU 2003, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

One of the biggest uncertainties in climate science today concerns the water vapor feedback. Most GCMs hold relative humidity fixed as the climate changes, which provides a strong positive feedback to warming due from anthropogenic greenhouse gas emissions. Some in the community, on the other hand, have speculated that tropospheric specific humidity will remain fixed as the climate changes. Observational studies have attempted to resolve this disagreement, but the results have been inconclusive, and few of the studies have focused on the upper troposphere (UT). This is a significant oversight: the surface temperature is especially sensitive to changes in water vapor in the UT owing to the cold temperatures found there. We present an analysis of UARS MLS and HALOE water vapor measurements at 21 5 hPa. We find strong evidence that the water vapor feedback in the UT is positive, but not as strong as fixed relative humidity scenarios. This suggests that GCMs are overestimating the sensitivity of the climate.
Author
Water Vapor; Troposphere; Climate Change; Feedback; Greenhouse Effect

20040074238 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust Transport and Deposition Observed from the Terra-MODIS Space Observations
Kaufman, Y. J.; Koren, I.; Remer, L. A.; Tanre, D.; Fan, Ginoux; Fan, S.; [2004]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Meteorological observations, in situ data and satellite images of dust episodes were used already in the 1970s to estimate

that 100 tg of dust are transported from Africa over the Atlantic Ocean every year between June and August and deposited in the Atlantic Ocean and the Americas. Desert dust is a main source of nutrients to oceanic biota and the Amazon forest, but deteriorates air quality and caries pathogens as shown for Florida. Dust affects the Earth radiation budget, thus participating in climate change and feedback mechanisms. There is an urgent need for new tools for quantitative evaluation of the dust distribution, transport and deposition. The Terra spacecraft launched at the dawn of the last millennium provides first systematic well calibrated multispectral measurements from the MODIS instrument, for daily global analysis of aerosol. MODIS data are used here to distinguish dust from smoke and maritime aerosols and evaluate the African dust column concentration, transport and deposition. We found that 230+/-80 tg of dust are transported annually from Africa to the Atlantic Ocean, 30 tg return to Africa and Europe, 70 tg reach the Caribbean, 45 tg fertilize the Amazon Basin, 4 times as previous estimates thus explaining a paradox regarding the source of nutrition to the Amazon forest, and 120+/-40 tg are deposited in the Atlantic Ocean. The results are compared favorably with dust transport models for particle radius less than or equal to 12 microns. This study is a first example of quantitative use of MODIS aerosol for a geophysical study.
Author
Dust; Earth Radiation Budget; Meteorological Parameters; Air Quality; Aerosols; Pathogens

20040074242 NASA Goddard Space Flight Center, Greenbelt, MD, USA
New Measurements of Aerosol Vertical Structure from Space using the NASA Geoscience Laser Altimeter System (GLAS): Applications for Aerosol Transport Models
Welton, E. J.; Spinhime, J.; Palm, S.; Hlavka, D.; Hart, W.; Ginoux, P.; Chin, M.; Colarco, P.; [2004]; 1 pp.; In English; AGU Meeting, 8-12 Dec. 2003, San Fransico, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In the past, satellite measurements of aerosols have only been possible using passive sensors. Analysis of passive satellite data has lead to an improved understanding of aerosol properties, spatial distribution, and their effect on the earth,s climate. However, direct measurement of aerosol vertical distribution has not been possible using only the passive data. Knowledge of aerosol vertical distribution is important to correctly assess the impact of aerosol absorption, for certain atmospheric correction procedures, and to help constrain height profiles in aerosol transport models. On January 12,2003 NASA launched the first satellite-based lidar, the Geoscience Laser Altimeter System (GLAS), onboard the ICESat spacecraft. GLAS is both an altimeter and an atmospheric lidar, and obtains direct measurements of aerosol and cloud heights. Here we show an overview of GLAS, provide an update of its current status, and discuss how GLAS data will be useful for modeling efforts. In particular, a strategy of using GLAS to characterize the height profile of dust plumes over source regions will be presented, along with initial results. Such information can be used to validate and improve output from aerosol transport models. Aerosol height profile comparisons between GLAS and transport models will be shown for regions downwind of aerosol sources. We will also discuss the feasibility of assimilating GLAS profiles into the models in order to improve their output.
Author
Aerosols; Radar Measurement; Wind Direction; Vertical Distribution; Geophysics; Atmospheric Models

20040074244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Energy Balance, Climate, and Life - Work of M. Budyko
Cahalan, Robert F.; [2004]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

This talk will review the work of Mikhail I. Budyko, author of "Climate and Life" and many other works, who died recently at age 81, in St Petersburg, Russia. He directed the Division for Climate Change Research at the State Hydrological Institute. We will explore Budyko's work in clarifying the role of energy balance in determining planetary climate, and the role of climate in regulating Earth s biosphere.
Author
Energy Budgets; Balance; Climate Change

20040074248 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Above-Cloud Precipitable Water Retrievals using the MODIS 0.94 micron Band with Applications for Multi-Layer Cloud Detection
Platnick, S.; Wind, G.; [2004]; 2 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In order to perform satellite retrievals of cloud properties, it is important to account for the effect of the above-cloud atmosphere on the observations. The solar bands used in the operational MODIS Terra and Aqua cloud optical and

microphysical algorithms (visible, NIR, and SWIR spectral windows) are primarily affected by water vapor, and to a lesser extent by well-mixed gases. For water vapor, the above-cloud column amount, or precipitable water, provides adequate information for an atmospheric correction; details of the vertical vapor distribution are not typically necessary for the level of correction required. Cloud-top pressure has a secondary effect due to pressure broadening influences. For well- mixed gases, cloud-top pressure is also required for estimates of above-cloud abundances. We present a method for obtaining above-cloud precipitable water over dark Ocean surfaces using the MODIS 0.94 pm vapor absorption band. The retrieval includes an iterative procedure for establishing cloud-top temperature and pressure, and is useful for both single layer water and ice clouds. Knowledge of cloud thermodynamic phase is fundamental in retrieving cloud optical and microphysical properties. However, in cases of optically thin cirrus overlapping lower water clouds, the concept of a single unique phase is ill- defined and depends, at least, on the spectral region of interest. We will present a method for multi-layer and multi-phase cloud detection which uses above-cloud precipitable water retrievals along with several existing MODIS operational cloud products (cloud-top pressure derived from a C02 slicing algorithm, IR and SWIR phase retrievals). Results are catagorized by whether the radiative signature in the MODIS solar bands is primarily that of a water cloud with ice cloud contamination, or visa-versa. Examples in polar and mid-latitude regions will be shown.
Author
Cloud Physics; Cirrus Clouds; Atmospheric Correction; Vertical Distribution

20040074250 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Spatially Complete Surface Albedo Data Sets: Value-Added Products Derived from Terra MODIS Land Products
Moody, E. G.; King, M. D.; Platnick, S.; Schaaf, C. B.; Gao, F.; [2004]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Spectral land surface albedo is an important parameter for describing the radiative properties of the Earth. Accordingly it reflects the consequences of natural and human interactions, such as anthropogenic, meteorological, and phenological effects, on global and local climatological trends. Consequently, albedos are integral parts in a variety of research areas, such as general circulation models (GCMs), energy balance studies, modeling of land use and land use change, and biophysical, oceanographic, and meteorological studies. The availability of global albedo data over a large range of spectral channels and at high spatial resolution has dramatically improved with the launch of the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument aboard NASA s Earth Observing System (EOS) Terra spacecraft in December 1999. However, lack of spatial and temporal coverage due to cloud and snow effects can preclude utilization of official products in production and research studies. We report on a technique used to fill incomplete MOD43 albedo data sets with the intention of providing complete value-added maps. The technique is influenced by the phenological concept that within a certain area, a pixel s ecosystem class should exhibit similar growth cycle events over the same time period. The shape of an area s phenological temporal curve can be imposed upon existing pixel-level data to fill missing temporal points. The methodology will be reviewed by showcasing 2001 global and regional results of complete albedo and NDVl data sets.
Author
Spatial Resolution; Albedo; Data Acquisition; Snow; Climatology; Clouds (Meteorology)

20040074253 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The CEOP Inter-Monsoon Studies (CIMS)
Lau, William K. M.; [2003]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Prediction of climate relies on models, and better model prediction depends on good model physics. Improving model physics requires the maximal utilization of climate data of the past, present and future. CEOP provides the first example of a comprehensive, integrated global and regional data set, consisting of globally gridded data, reference site in-situ observations, model location time series (MOLTS), and integrated satellite data for a two-year period covering two complete annual cycles of 2003-2004. The monsoon regions are the most important socio-economically in terms of devastation by floods and droughts, and potential impacts from climate change md fluctuatinns nf the hydrologic cyc!e. Scientifically, it is most challenging, because of complex interactions of atmosphere, land and oceans, local vs. remote forcings in contributing to climate variability and change in the region. Given that many common features, and physical teleconnection exist among different monsoon regions, an international research focus on monsoon must be coordinated and sustained. Current models of the monsoon are grossly inadequate for regional predictions. For improvement, models must be confronted with relevant observations, and model physic developers must be made to be aware of the wealth of information from existing climate data, field measurements, and satellite data that can be used to improve models. Model transferability studles must be conducted. CIMS is a major initiative under CEOP to engage the modeling and the observational communities to join in a coordinated

effort to study the monsoons. The objectives of CIMS are (a) To provide a better understanding of fundamental physical processes (diurnal cycle, annual cycle, and intraseasonal oscillations) in monsoon regions around the world and (b) To demonstrate the synergy and utility of CEOP data in providing a pathway for model physics evaluation and improvement. In this talk, I will present the basic concepts of CIMS and the key scientific problems facing monsoon climates and provide examples of common monsoon features, and possible monsoon induced teleconnections linking different parts of the world. Author

Climate Models; Monsoons; Teleconnections (Meteorology); Hydrology

20040074256 Maryland Univ., College Park, MD, USA

What is the Spatial Relationship between the Water Minimum and Convection in the TTL?

Dessler, A. E.; Bhartia, P. K., Technical Monitor; 2003; 1 pp.; In English; Fall AGU 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Recently, it has been argued that the region where water vapor is a minimum in the tropical tropopause layer is located downstream of convection. If true, this would suggest that in situ dehydration was playing a role in regulating water vapor near the tropical tropopause. In this presentation, I will use UARS MLS water vapor measurements, as well as various proxies for convection, to argue that the water vapor minimum is closely collocated with convection. I will also provide potential explanations as to why previous analyses have reached a different conclusion.
Author

Water Vapor; Tropopause; Dehydration; Convection

20040074257 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Comparison of TOMS Version 8 Total Column Ozone Data with Data from Groundstations

Labow, G. J.; McPeters, R. D.; Bhartia, P. K.; [2004]; 1 pp.; In English; Fall AGU 2003, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Nimbus-7 and Earth Probe Total Ozone Mapping Spectrometer (TOMS) data have been reprocessed with a new retrieval algorithm, (Version 8) and an updated calibration procedure. These data have been systematically compared to total ozone data from Brewer and Dobson spectrophotometers for 73 individual ground stations. The comparisons were made as a function of latitude, solar zenith angle, reflectivity and total ozone. Results show that the accuracy of the TOMS retrieval'is much improved when aerosols are present in the atmosphere, when snow/ice and sea glint are present, and when ozone in the northern hemisphere is extremely low. TOMS overpass data are derived from the single TOMS best match measurement, almost always located within one degree of the ground station and usually made within an hour of local noon. The version 8 Earth Probe TOMS ozone values have decreased by an average of about 1% due to a much better understanding of the calibration of the instrument. The remaining differences between TOMS and ground stations suggest that there are still small errors in the TOMS retrievals. But if TOMS is used as a transfer standard to compare ground stations, the large station-to-station differences suggest the possibility of significant instrument errors at some ground stations.
Author

Aerosols; Total Ozone Mapping Spectrometer; Calibrating; Data Acquisition

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*.

20040068272 American Inst. of Aeronautics and Astronautics, Reston, VA, USA

Studying Gene Changes in Space

Flinn, Edward D.; Aerospace America; April 2004; ISSN 0740-722X; Volume 42, No. 4, pp. 24-25; In English; Copyright; Avail: Other Sources

An intriguing pair of test subjects are the first to be used as biological testing begins again in space. Bremer's yeast and fruit flies wi11 spearhead NASA s resumption of experiments on hoard the International Space Station In an experiment with brewer s yeast. typically used to make bread and beer, NASA scientists wi11 seek to better understand the effects of microgravity on genes.A different experiment will study the changes in several generations of fruit flies that NASA-supported

researchers will send to the ISS aboard the shuttle. With hoth, scientists hope to gain insight into how space travel might affect astronauts genes.
Author
Gene Expression; Microgravity

20040068281 Lawrence Livermore National Lab., Livermore, CA
Individual Radiation Protection Monitoring in the Marshall Islands: Enewtak Island Resettlement Support (May-December 2001)
Hamilton, T.; Hickman, D.; Conrado, C.; Brown, T.; Brunk, J.; Jun. 01, 2002; In English
Report No.(s): DE2003-15004810; UCRL-LR-149601; No Copyright; Avail: National Technical Information Service (NTIS)

The US Department of Energy (DOE) has recently implemented a series of strategic initiatives to address long-term radiological surveillance needs at former US test sites in the Marshall Islands. The plan is to engage local atoll communities in developing shared responsibilities for implementing radiation protection programs for resettled and resettling populations. Using pooled resources of the US Department of Energy and local atoll governments, individual radiation protection programs have been developed in whole-body counting and plutonium urinalysis to assess potential intakes of radionuclides from residual fallout contamination. The whole-body counting systems are operated and maintained by Marshallese technicians. Samples of urine are collected from resettlement workers and island residents under controlled conditions and analyzed for plutonium isotopes at the Lawrence Livermore National Laboratory using advanced accelerator based measurement technologies. This web site provides an overview of the methodologies, a full disclosure of the measurement data, and a yearly assessment of estimated radiation doses to resettlement workers and island residents
NTIS
Dosage; Radioactive Isotopes; Radiation Detectors; Radiation Protection

20040068283 NASA Ames Research Center, Moffett Field, CA, USA
Single-Trial Characterization of Evoked Responses: Bayesian Estimation and Differentially Variable Component Analysis
Knuth, Kevin H.; [2004]; 1 pp.; In English; EPIC XIV Meeting, 28-31 Mat. 2004, Leipzig, Germany; No Copyright; Avail: Other Sources; Abstract Only

Brain responses are dynamic, state dependent, and change over time. In acknowledging this, it is becoming increasingly more important to characterize single trial responses. Using Bayesian probability theory, I demonstrate how a more complex signal model that accounts for amplitude and latency variability in the single trial allows one to characterize and examine single trial responses. Furthermore, the fact that different neural ensembles exhibit differential variability patterns allows one to tease apart these mixed signals and isolate signals generated from different neural ensembles. This new technique, called differentially Variable Component Analysis (dVCA) allows one to separate, identify, and characterize single trial responses from simultaneously active sources. Interactions among the ensembles can be studied by examining their single trial properties. I will demonstrate the technique using simulations as well as intracortical field potentials recorded from a linear multi-electrode array in a macaque experiencing visual stimulation.
Author
Bayes Theorem; Brain; Signal Analysis

20040070835 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Software for Preprocessing Data from Rocket-Engine Tests
Cheng, Chiu-Fu; [2004]; 1 pp.; In English
Report No.(s): NASA/NP-2002-06-00023; SSC-00151; SSC-00153; SSC-00160; No Copyright; Avail: CASI; A01, Hardcopy

Three computer programs have been written to preprocess digitized outputs of sensors during rocket-engine tests at Stennis Space Center (SSC). The programs apply exclusively to the SSC E test-stand complex and utilize the SSC file format. The programs are the following: Engineering Units Generator (EUGEN) converts sensor-output-measurement data to engineering units. The inputs to EUGEN are raw binary test-data files, which include the voltage data, a list identifying the data channels, and time codes. EUGEN effects conversion by use of a file that contains calibration coefficients for each channel. QUICKLOOK enables immediate viewing of a few selected channels of data, in contradistinction to viewing only after post-test processing (which can take 30 minutes to several hours depending on the number of channels and other test parameters) of data from all channels. QUICKLOOK converts the selected data into a form in which they can be plotted in engineering units by use of Winplot (a free graphing program written by Rick Paris). EUPLOT provides a quick means for

looking at data files generated by EUGEN without the necessity of relying on the PV-WAVE based plotting software.
Author
Computer Programs; Preprocessing; Data Processing; Rocket Engines; Engine Tests

20040070912 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Basis for the Catalytic Activity of Human SER/THR Protein Phosphatase-5
Swingle, M. R.; Honkanen, R.; Ciszak, E.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Serinekhreonine protein phosphatase-5 (PP5) affects many signaling networks that regulate cell growth. Here we report the 1.6 Angstrom resolution crystal structure of PP5 catalytic domain with metal and phosphate ions in the active site. The structure reveals a mechanism for PPS-mediated catalysis that requires the precise positioning of two metal ions within a conserved Asp(sup 271)-M(sub 1),-M(sub 2)-His(sup 427)-W(sup 2)-His(sup 304)-Asp(sup 274) catalytic motif, and provides a structural basis for the exceptional catalytic proficiency of protein phosphatases placing them among the most powerful catalysts. Resolution of the entire C-terminus revealed a novel subdomain, and the structure of PP5 should aid development of specific inhibitors.
Author
Catalytic Activity; Crystal Structure; Proteins; Cells (Biology)

20040070914 NASA Marshall Space Flight Center, Huntsville, AL, USA
Function of Several Critical Amino Acids in Human Pyruvate Dehydrogenase Revealed by Its Structure
Korotchkina, Lioubov G.; Ciszak, E.; Patel, M.; 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Pyruvate dehydrogenase (E1), an alpha 2 beta 2 tetramer, catalyzes the oxidative decarboxylation of pyruvate and reductive acetylation of lipoyl moieties of the dihydrolipoamide acetyltransferase. The roles of beta W135, alpha P188, alpha M181, alpha H15 and alpha R349 of E1 determined by kinetic analysis were reassessed by analyzing the three-dimensional structure of human E1. The residues identified above are found to play a structural role rather than being directly involved in catalysis: beta W135 is the center residue in the hydrophobic interaction between beta and beta' subunits; alpha P188 and alpha M181 are critical for the conformation of the TPP-binding motif and interaction between alpha and beta subunits; alpha H15, is necessary for the organization of the N-terminus of alpha and alpha'; subunits and alpha R349 supports the interaction of the C-terminus of the alpha subunits with the beta subunits. Analysis of several critical E1 residues confirms the importance of residues distant from the active site for subunit interactions and enzyme function.
Author
Amino Acids; Enzymes; Pyruvates

20040070916 NASA Marshall Space Flight Center, Huntsville, AL, USA
Enzymatic Properties of an Alkaline and Chelator Resistant Proportional to alpha-Amylase from the Alkaliphilic Bacillus sp. Isolate L1711
Bernhardsdotter, Eva C. M. J.; Pusey, Marc L.; Ng, Joseph D.; Garriott, Owen K.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

An alkaliphilic amylase producing bacterium, Bacillus sp. strain L1711, was selected among 13 soda lakes isolates. When grown at pH 10.5 and 370 C, strain L1711 produced multiple forms of amylases in the culture broth. One of these, BAA, was purified from the culture supernatant by QAE column chromatography and preparative native gel electrophoresis. The molecular weight of BAA was determined to be 51 kDa by denaturing gel electrophoresis. The pH optima for activity below and above 40 C were 9.5-10.0 and 7.0-7.5 respectively. BAA was stable in the pH range 6-11 and was completely inactivated at 55?C. The thermostability was not increased in the presence of Ca(2+). The enzyme was strongly inhibited by Ca(2+), Zn(2+), Mg(2+), Mn(2+), Ba(2+) and Cu(2+), whereas the presence of Na(+), Co2+ and EDTA (10 mM) enhanced enzymatic activity. The K(sub m) and specific activity of BAA on soluble starch were 1.9 mg/ml and 18.5 U/mg respectively. The main end products of hydrolysis were maltotetraose, maltose and glucose .
Author
Bacillus; Bacteria; Chelation; Enzyme Activity; Enzymes; Ph; Alkalinity

20040070917 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cloning and Characterization of an Alpha-amylase Gene from the Hyperthermophilic Archaeon Thermococcus Thioreducens
Bernhardsdotter, Eva C. M. J.; Pusey, Marc L.; Ng, Joseph D.; Garriott, Owen K.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The gene encoding an extracellular a-amylase, TTA, from the hyperthermophilic archaeon Thermococcus thioreducens was cloned and expressed in Escherichia coli. Primary structural analysis revealed high similarity with other a-amylases from the Thermococcus and Pyrococcus genera, as well as the four highly conserved regions typical for a-amylases. The 1374 bp gene encodes a protein of 457 amino acids, of which 435 constitute the mature protein preceded by a 22 amino acid signal peptide. The molecular weight of the purified recombinant enzyme was estimated to be 43 kDa by denaturing gel electrophoresis. Maximal enzymatic activity of recombinant TTA was observed at 90 C and pH 5.5 in the absence of exogenous Ca(2+), and the enzyme was considerably stable even after incubation at 90 C for 2 hours. The thermostability at 90 and 102 C was enhanced in the presence of 5 mM Ca(2+). The extraordinarily high specific activity (about 7.4 x 10(exp 3) U/mg protein at 90 C, pH 5.5 with soluble starch as substrate) together with its low pH optimum makes this enzyme an interesting candidate for starch processing applications.
Author
Cloning (Biology); Genes; Thermophiles; Microbiology

20040070921 Loma Linda Univ., CA, USA
Hypergravity-Induced Changes in Hematological and Lymphocyte Function Parameters in a Mouse Model
Gridley, Daila S.; Miller, Glen M.; Nelson, Gregory A.; Pecaut, Michael J.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P61-P62; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; NCC9-79; NCC9-149; Copyright; Avail: CASI; A01, Hardcopy

The purpose of this study was to quantify hypergravity-induced changes in hematological and lymphocyte characteristics. Mice were subjected to 1, 2, and 3G and euthanized on days 1 , 4, 7, 10, and 21. The data show that increased gravitational force resulted in persistent hypothermia. Red blood cell (RBC) counts, hematocrit, and hemoglobin were reduced by day 21, whereas hemoglobin and RBC volume were low at most times of measurement. A transient increase was noted in platelet numbers in the 3G group. Fluctuations in spontaneous blastogenesis of lymphocytes were dependent upon centrifugation time and not gravity. Changes in splenocyte responses to T and B cell mitogens due to gravity were also noted. Cytokine production was primarily affected during the first week; IL-2, IL-4 and TNF-alpha were increased, whereas IFN-gamma was decreased. These findings indicate that altered gravity can influence both hematological and functional variables that may translate into serious health consequences.
Author
Gravitation; Health; Hematocrit; Hematology; High Gravity Environments; Lymphocytes; Mice

20040070923 NASA, USA
The Hematopoietic Stem Cell Therapy for Exploration of Deep Space
Ohi, Seigo; Roach, Allana-Nicole; Fitzgerald, Wendy; Riley, Danny A.; Gonda, Steven R.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P-63-P64; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS5-98051; NAG2-6072; NCC9-142; Copyright; Avail: Other Sources

It is hypothesized that the hematopoietic stem cell therapy (HSCT) might countermeasure various space-caused disorders so as to maintain astronauts' homeostasis. If this were achievable, the HSCT could promote human exploration of deep space. Using animal models of disorders (hindlimb suspension unloading system and beta-thalassemia), the HSCT was tested for muscle loss, immunodeficiency and space anemia. The results indicate feasibility of HSCT for these disorders. To facilitate the HSCT in space, growth of HSCs were optimized in the NASA Rotating Wall Vessel (RWV) culture systems, including Hydrodynamic Focusing Bioreactor (HFB).
Author
Cells (Biology); Therapy; Space Exploration; Anemias; Bioreactors; Hematopoietic System

20040070925 NASA Ames Research Center, Moffett Field, CA, USA
Effects of Hypergravity Rearing on Growth Hormone and Insulin-Like Growth Factor in Rat Pups
Baer, L. A.; Chowdhury, J. H.; Grindeland, R. E.; Wade, C. E.; Ronca, A. E.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. 67-68; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; NIMH-MH46485; RTOP 121-10-40; RTOP 121-10-50; RTOP 121-40-10; Copyright; Avail: Other Sources

Body weights of rat pups reared during exposure to hypergravity (hg) are significantly reduced relative to 1 g controls. In the present study, we examined in hg-reared rat pups two major contributors to growth and development, namely growth hormone (GH) and insulin-like growth factor-1 (IGF-1). Beginning on Gestational day (G)11 of the rats 22 day pregnancy, rat dams and their litters were continuously exposed to either 1.5-g or 2.0-g. On Postnatal day (P)l0, plasma GH and IGF-1 were analyzed using radioimmunoassay (RIA). Both hormones were significantly elevated in hg pups relative to 1-g control pups. Together, these findings suggest that GH and IGF-1 are not primary determinants of reduced body weights observed in hg-reared pups. The significant elevations in pup GH and IGF-1 may be related to increased physical stimulation in hypergravity.
Author
High Gravity Environments; Growth; Insulin; Rats; Pituitary Hormones

20040070926 NASA Ames Research Center, Moffett Field, CA, USA
Re-Adaptation to 1-G of Pregnant Rats Following Exposure to Spaceflight or Centrifugation
Johnson, K. E.; Ronca, A. E.; Alberts, J. R.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. 69-70; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; NCC2-870; NIH-MH46485; NIH-MH283555; RTOP 121-10-40; Copyright; Avail: Other Sources

Late-pregnant rat dams were flown on a 9-day Space Shuttle mission or exposed to 1.5, 1.75 or 2-g centrifugation and compared with 1 .O-g vivarium controls. Exposure to altered gravity began on the 11th day and recovery occurred on the 20th day of the dams' 22-day pregnancy. In the 1 st experiment, comparisons were made between Flight (FLT), Synchronous (SYN; identically-housed) and Vivarium (VIV) controls. In the 2nd experiment, comparisons were made between dams centrifuged at 2-G, 1.75-G, 1.5-G, Rotational controls (1.08-G) or Stationary controls (1 G). Within three hours of recovery from either spaceflight or centrifugation, the dams' locomotor behavior was videotaped for 2 min. FLT dams showed dramatically reduced movement relative to both SYN and VIV control conditions, with significantly greater amounts of locomotor activity observed in SYN as compared to VIV dams. Significantly greater locomotor activity was observed in SYN as compared to VIV controls. In the second experiment, no differences were observed between dams exposed either 1, 1.5, 1.75, or 2-G. In both studies, the dams showed similar patterns of hindlimb rearing. Together, these findings provide quantitative evidence for decreased locomotor activity during re-adaptation to 1-g following spaceflight, but not centrifugation.
Author
Adaptation; Exposure; Pregnancy; Rats; Space Flight

20040070928 California Univ., Irvine, CA, USA
Effects of Hindlimb Unweighting on Arterial Contractile Responses in Mice
Ma, Jia; Ren, Xin-Ling; Purdy, Ralph E.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P79-P80; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAG2-6072; NAG9-1149; Copyright; Avail: Other Sources

The aim of this work was to determine if hindlimb unweighting in mice alters arterial contractile responses. Sixteen male C57B/6 mice and 16 male Chinese Kunming mice were divided into control and 3 weeks hindlimb unweighting groups, respectively. Using isolated arterial rings from different arteries of mouse, effects of 3 weeks hindlimb unweighting on arterial contractile responsiveness were examined in vitro. The results showed that, in arterial rings from both C57B/6 and Chinese Kunming mice, maximum isometric contractile tensions evoked by either KCl or phenylephrine were significantly lower in abdominal aortic, mesenteric arterial and femoral arterial rings from hindlimb unweighting, compared to control mice. However, the maximal contractile responses of common carotid rings to KCl and PE were not significantly different between control and hindlimb unweighting groups. The sensitivity (EC(sub 50)) of all arteries to KCl or PE showed no significant differences between control and hindlimb unweighting mice. These data indicated that 3 weeks hindlimb unweighting results in a reduced capacity of the arterial smooth muscle of the hindquarter to develop tension. In addition, the alterations in arterial contractile responses caused by hindlimb unweighting in mice are similar as those in rats. Our work suggested that hindlimb unweighting mouse model may be used as a model for the study of postflight cardiovascular deconditioning.
Author
Abdomen; Arteries; Cardiovascular System; Deconditioning; Muscles; Neck (Anatomy)

20040070931 NASA Ames Research Center, Moffett Field, CA, USA

Intrauterine Pressure (IUP) Telemetry in Pregnant and Parturient Rats: Potential Applications for Spacecraft and Centrifugation Studies

Ronca, A. E.; Baer, L. A.; Wade, C. E.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P113-P114; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAG2-6072; NIMH-MH46485; 121-10-40; 121-10-50; 121-40-10; 121-10-30; Copyright; Avail: Other Sources

Rats exposed to spaceflight or centrifugation from mid-to late pregnancy undergo either more or fewer labor contractions at birth, respectively, as compared to those in normal Earth gravity (1-g). In this paper, we report the development and validation of a new telemetric method for quantifying intrauterine pressure (IUP) in freely-moving, late pregnant and parturient rats. We plan to utilize this technique for studies of labor in altered gravity, specifically, to ascertain forces of uterine during birth, which we believe may be changed in micro- and hypergravity. The technique we describe yields precise, reliable measures of the forces experienced by rat fetuses during parturition. A small, surgically-implantable telemetric pressure sensor was fitted within a fluid-filled balloon. The total volume of the sensor-balloon assembly matched that of a full term rat fetus. Real-time videorecordings of sensor-implanted rat dams and non- implanted control dams enabled us to characterize effects of the intrauterine implant on behavioral aspects of parturition. Contraction frequency, duration, pup-to-pup birth intervals and pup-oriented activities of the dams measured during the peri-birth period were unaffected by the sensor implant. These findings establish intrauterine telemetry as a reliable, non-invasive technique for quantifying intrauterine pressures associated with parturition on Earth and in altered gravity environments. This new technology, readily amenable to spaceflight and centrifugation platforms, will enable us to answer key questions regarding the role of altered labor frequency labor in the adaptation of newborn mammals to hypo- and hypergravity.

Author

Adaptation; Birth; Centrifuging; Gravitation; Implantation; Labor; Mammals; Pregnancy; Microgravity

20040070932 NASA Langley Research Center, Hampton, VA, USA

Pulsed Phase Lock Loop Device for Monitoring Intracranial Pressure During Space Flight

Ueno, Toshiaki; Macias, Brandon R.; Yost, William T.; Hargens, Alan R.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P-117-P-118; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA

Contract(s)/Grant(s): NAG2-6072; NAG1-02092; NCC2-1196; Copyright; Avail: Other Sources

We have developed an ultrasonic device to monitor ICP waveforms non-invasively from cranial diameter oscillations using a NASA-developed pulsed phase lock loop (PPLL) technique. The purpose of this study was to attempt to validate the PPLL device for reliable recordings of ICP waveforms and analysis of ICP dynamics in vivo. METHODS: PPLL outputs were recorded in patients during invasive ICP monitoring at UCSD Medical Center (n=10). RESULTS: An averaged linear regression coefficient between ICP and PPLL waveform data during one cardiac cycle in all patients is 0.88 +/- 0.02 (mean +/- SE). Coherence function analysis indicated that ICP and PPLL waveforms have high correlation in the lst, 2nd, and 3rd harmonic waves associated with a cardiac cycle. CONCLUSIONS: PPLL outputs represent ICP waveforms in both frequency and time domains. PPLL technology enables in vivo evaluation of ICP dynamics non-invasively, and can acquire continuous ICP waveforms during spaceflight because of compactness and non-invasive nature.

Author

Functional Analysis; Heart Diseases; In Vivo Methods and Tests; Intracranial Pressure; Regression Coefficients

20040071134 NASA Marshall Space Flight Center, Huntsville, AL, USA

Spirochaeta Americana sp. Nov., A New Haloalkaliphilic, Obligately Anaerobic Spirochaete Isolated from Soda Mona Lake in California

Hoover, Richard B.; Pikuta, Elena V.; Bej, Asim K.; Marsic, Damien; Whitman, William B.; Tang, Jane; Krader, Paul; International Journal of Systematic and Evolutionary Microbiology; 2003; Vol. 53, pp. 815-821; In English; Copyright; Avail: Other Sources

A novel, obligately anaerobic, mesophilic, haloalkaliphilic spirochaete, strain ASpG1(sup T), was isolated from sediments of the alkaline, hypersaline Mono Lake in California, USA. Cells of the Gram-negative strain were motile and spirochaete-shaped with sizes of 0.2-0.22 x 8-18 microns. Growth of the strain was observed between 10 and 44 C (optimum 37 C), in 2-12% (w/v) NaCl (optimum 3 % NaCl) and between pH 8 and 10.5 (optimum pH 9.5). The novel strain was strictly alkaliphilic, required high concentrations of carbonates in the medium and was capable of utilizing D-glucose, fructose,

maltose, sucrose, starch and D-mannitol. End products of glucose fermentation were H2, acetate, ethanol and formate. Strain ASpG1(sup T) was resistant to kanamycin and rifampicin, but sensitive to gentamicin, tetracycline and chloramphenicol. The G + C content of its DNA was 58.5 mol%. DNA-DNA hybridization analysis of strain ASpG1(sup T) with its most closely related species, Spirochaeta alkalica Z-7491(sup T) revealed a hybridization value of only 48.7 %. On the basis of its physiological and molecular properties, strain ASpG1(sup T) appears to represent a novel species of the genus Spirochaeta, for which the name Spirochaeta americana is proposed (type strain ASpG1(sup T) = ATCC 13AA-392(sup T) = DSM 14872(sup T)).
Author
Anaerobes; Bacteria; Mesophiles; Halophiles

20040073493 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cell Science and Cell Biology Research at MSFC: Summary
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 32; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The common theme of these research programs is that they investigate regulation of gene expression in cells, and ultimately gene expression is controlled by the macromolecular interactions between regulatory proteins and DNA. The NASA Critical Path Roadmap identifies Muscle Alterations and Atrophy and Radiation Effects as Very Serious Risks and Severe Risks, respectively, in long term space flights. The specific problem addressed by Dr. Young's research ("Skeletal Muscle Atrophy and Muscle Cell Signaling") is that skeletal muscle loss in space cannot be prevented by vigorous exercise. Aerobic skeletal muscles (i.e., red muscles) undergo the most extensive atrophy during long-term space flight. Of the many different potential avenues for preventing muscle atrophy, Dr. Young has chosen to study the beta-adrenergic receptor (betaAR) pathway. The reason for this choice is that a family of compounds called betaAR agonists will preferentially cause an increase in muscle mass of aerobic muscles (i.e., red muscle) in animals, potentially providing a specific pharmacological solution to muscle loss in microgravity. In addition, muscle atrophy is a widespread medical problem in neuromuscular diseases, spinal cord injury, lack of exercise, aging, and any disease requiring prolonged bedridden status. Skeletal muscle cells in cell culture are utilized as a model system to study this problem. Dr. Richmond's research ("Radiation & Cancer Biology of Mammary Cells in Culture") is directed toward developing a laboratory model for use in risk assessment of cancer caused by space radiation. This research is unique because a human model will be developed utilizing human mammary cells that are highly susceptible to tumor development. This approach is preferential over using animal cells because of problems in comparing radiation-induced cancers between humans and animals.
Author
Research and Development; Cells (Biology); Gene Expression; Macromolecules; NASA Programs

20040073512 NASA Marshall Space Flight Center, Huntsville, AL, USA
Laboratory and In-Flight In-Situ X-ray Imaging and Scattering Facility for Materials, Biotechnology and Life Sciences
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 23; In English; See also 20040073490; No Copyright; A01, Hardcopy; bstract only; Available from CASI only as part of the entire parent document.

We propose a multifunctional X-ray facility for the Materials, Biotechnology and Life Sciences Programs to visualize formation and behavior dynamics of materials, biomaterials, and living organisms, tissues and cells. The facility will combine X-ray topography, phase micro-imaging and scattering capabilities with sample units installed on the goniometer. This should allow, for the first time, to monitor under well defined conditions, in situ, in real time: creation of imperfections during growth of semiconductors, metal, dielectric and biomacromolecular crystals and films, high-precision diffraction from crystals within a wide range of temperatures and vapor, melt, solution conditions, internal morphology and changes in living organisms, tissues and cells, diffraction on biominerals, nanotubes and particles, radiation damage, also under controlled formation/life conditions. The system will include an ultrabright X-ray source, X-ray mirror, monochromator, image-recording unit, detectors, and multipurpose diffractometer that fully accommodate and integrate furnaces and samples with other experimental environments. The easily adjustable laboratory and flight versions will allow monitoring processes under terrestrial and microgravity conditions. The flight version can be made available using a microsource combined with multilayer or capillary optics.
Author
X Ray Imagery; In-Flight Monitoring; In Situ Measurement; Scattering; Life Sciences; Biotechnology

20040073519 NASA Marshall Space Flight Center, Huntsville, AL, USA
Biotechnology Protein Expression and Purification Facility

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 37; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The purpose of the Project Scientist Core Facility is to provide purified proteins, both recombinant and natural, to the Biotechnology Science Team Project Scientists and the NRA-Structural Biology Test Investigators. Having a core facility for this purpose obviates the need for each scientist to develop the necessary expertise and equipment for molecular biology, protein expression, and protein purification. Because of this, they are able to focus their energies as well as their funding on the crystallization and structure determination of their target proteins.

Author

Biotechnology; Molecular Biology; Proteins; Purification; Research Facilities

20040073521 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Building Blocks of Materials: Gathering Knowledge at the Molecular Level

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 35; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Two start-up positions were created within SD46 to pursue developments in the rapidly expanding areas of biomineralization and nano-technology. As envisioned by Dr. Sandor Lehoczy, the new laboratories to be developed must have the capacity to investigate not only processes associated with the self-assembly of molecules but also the examination of self-assembled structures. For these purposes, laboratories capable of performing the intended function, particularly light scattering spectroscopy and atomic force microscopy were created. What follows then are recent advances arising from the development of these new laboratories. With the implementation of the Atomic Force Microscopy Facility, examples of investigations that determine a correlation between the molecular structure of materials and their macroscopic physical properties are provided. In addition, examples of investigations with particular emphasis on the physical properties of protein crystals, at the molecular level, and subsequent macroscopic characteristics are as provided. Finally, progress in fabrication of technology at the nano-scale levels at the developmental stage is also presented.

Author

Calcification; Crystals; Molecular Structure; Molecules; Proteins; Self Assembly

20040073533 North Carolina State Univ., Raleigh, NC

Human Metabolism and Interactions of Deployment- Related Chemicals

Hodgson, Ernest; Aug. 2003; 85 pp.; In English

Contract(s)/Grant(s): DAMD17-00-2-0008

Report No.(s): AD-A419139; No Copyright; Avail: CASI; A05, Hardcopy

This study examines the human-metabolism and metabolic interactions of a subset of deployment-related chemicals, including chlorpyrifos, DEET, permethrin, pyridostigmine bromide, and sulfur mustard metabolites. Chiorpyrifos is metabolized by cytochiome P450 (CYP) isoforms with the ratio between activation and detoxication varying dramatically between different isoforms and polymorphisms. DEET is metabolized by several CYP isoforms while permethrin is first hydrolyzed then metabolized to phenozybenoic acid by alcohol and aldehyde dehydrogenases. Pyridostigmine bromide is not readily metabolized by human enzymes preparations. Chiorpyrifos and other organophosphorus compounds have considerable potential for interactions since they are potent inhibitors of DEET, carbaryl and testosterone metabolism by CYP.

DTIC

Bromides; Deployment; Metabolism

20040073549 Naval Submarine Medical Research Lab., Groton, CT

Stimulus-Frequency Otoacoustic Emissions: Validity and Reliability of SFOAES Implemented on Mimosa Acoustics SFOAE Measurement System V2.1.18

Lapsley-Miller, Judi A.; Boege, Paul; Marshall, Lynne; Shera, Christopher A.; Jeng, Patricia S.; Feb. 26, 2004; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422330; NSMRL-TR-1231; No Copyright; Avail: CASI; A03, Hardcopy

The validity and reliability of stimulus-frequency otoacoustic emissions (SFOAEs) were evaluated and determined with the Mimosa Acoustics SFOAE measurement system (v.2.1.18). Stimulus-frequency otoacoustic emissions are sounds made by healthy inner ears to tonal stimulation. They are thought to hold the potential for diagnosis and monitoring of noise- induced hearing loss in military hearing-conservation programs. By establishing the validity and reliability of the measurement,

changes in SFOAEs due to noise can be detected from artifact and test-retest variability. WU# 50309 Evoked Otoacoustic Emissions in Military Hearing Conservation Programs.
DTIC
Acoustic Emission; Acoustics; Audio Frequencies; Auditory Signals; Frequencies; Hearing; Noise (Sound); Reliability

20040073554 California Univ., Los Angeles, CA
Role of Androgen Receptor in Growth of Androgen Independent Prostate Cancer
Chen, Charlie D.; Jan. 2004; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0024
Report No.(s): AD-A422345; No Copyright; Avail: CASI; A02, Hardcopy

Hormone therapy is an effective treatment for advanced hormone sensitive (HS) prostate cancer. However, the treatment is short-lived and hormone refractory (HR) cancer eventually develops. Through gene profiling using seven pairs of HS and HR xenografts, we identified overexpression of androgen receptor (AR) is the only consistent change in the progression of prostate cancer. In the first grand period (01/02-10/03), we confirmed that AR protein is elevated in HR tumors. Using lentivirus and retrovirus systems, we were able to overexpress AR in HS prostate cancer cells. In vitro and in vivo experiments demonstrated that overexpression of AR is sufficient for HS-to-HR transition. We also developed a system (shRNA) to knockdown AR in HR LNCaP cells and shown that AR- knockdown abolished HR phenotype in vitro. In the last grand period (01/03-01/04), we demonstrated that overexpression of AR is required for hormone refractory prostate cancer in vivo using both LAPC4 and LNCaP cells. Although, we were unable to obtain conclusive results to determine the mechanisms for AR overexpression, we demonstrated that gene amplification is not the sole cause of the overexpression.
DTIC
Cancer; Hormones; Males; Prostate Gland

20040073572 Case Western Reserve Univ., Cleveland, OH
EphA2 Kinase Agonists as Novel Suppressors of Both Prostate Cancer Cell Motility and Growth: Structure-Function Relations and the Role of RAS/MPK pathway
Wang, Bingcheng; Sep. 2003; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9019
Report No.(s): AD-A422402; No Copyright; Avail: CASI; A04, Hardcopy

There are three goals in this proposal. 1) To establish the expression profile of EphA2 during TRAMP prostate cancer development and progression, which will help determine the optimal window of EphA2 targeting. 2) To target EphA2 with its native and artificial agonists to see if they can suppress TRAMP prostate cancer development and/or progression. 3) To investigate the role of EphA2 during prostate cancer development by crossing EphA2- null mice with TRAMP mice. During the past 6 months since this modified grant was reactivated, we have made significant progress breeding and genotyping large number of animals required for achieving the goals.
DTIC
Cancer; Locomotion; Prostate Gland; Suppressors

20040073573 Texas Univ. Health Science Center, San Antonio, TX
Cell Motility and Invasiveness of Neurofibromin- Deficient Neural Crest Cells and Malignant Triton Tumor Lines
Vogel, Kristine S.; Oct. 2003; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9499
Report No.(s): AD-A422403; No Copyright; Avail: CASI; A03, Hardcopy

Our purpose is to examine the role of the NF1 gene product, neurofibromin, in modulating the migratory and invasive properties of neural crest cells (NCC) and neural crest-derived sarcoma cells. As a negative regulator of Ras signaling, neurofibromin may influence the responses of NC- derived cells to growth factors and extracellular matrix (ECM) molecules that affect motility. We use embryonic NCC and NC- derived sarcoma lines isolated from cisNf1;p53 mice to compare integrin ECM receptor expression patterns, ECM adhesion preferences, migration on ECM substrata, invasion through ECM barriers, and dispersal along NCC pathways in vivo for wild- type and neurofibromin-deficient cells. In the past year, we have completed studies on the invasiveness of branchial arch mesenchymal cells and trigeminal neural crest cells isolated from Nf-/-, +/-, and +/+ mouse embryos. Consistent with published results for neurofibromin deficient astrocytes, mast cells, and

Schwann cells, our data indicate that Nf1 mutant cranial neural crest cell populations are more invasive through laminin and fibronectin matrices.
DTIC
Diseases; Genetics; Locomotion; Tumors

20040073574 Minnesota Univ., Duluth, MN
Coordinate Expression of the PDK4 Gene: a Means of Regulating Fuel Selection in a Hibernating Mammal
Buck, Michael J.; Squire, Teresa L.; Andrews, Matthew T.; Jan. 2002; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0014
Report No.(s): AD-A422404; ARO-41650.3-LS; No Copyright; Avail: CASI; A02, Hardcopy

Hibernation in mammals requires a metabolic shift away from the oxidation of carbohydrates and toward the combustion of stored fatty acids as the primary source of energy during torpor. A key element involved in this fuel selection is pyruvate dehydrogenase kinase isoenzyme 4 (PDK4). PDK4 inhibits pyruvate dehydrogenase and thus minimizes carbohydrate oxidation by preventing the flow of glycolytic products into the tricarboxylic acid cycle. This paper examines expression of the PDK4 gene during hibernation in heart, skeletal muscle, and white adipose tissue (WAT) of the 13-lined ground squirrel, Spermophilus tridecemlineatus. During hibernation PDK4 mRNA levels increase 5-fold in skeletal muscle and 15-fold in WAT compared with summer-active levels. Similarly, PDK4 protein is increased threefold in heart, fivefold in skeletal muscle, and eightfold in WAT. High levels of serum insulin, likely to have an inhibitory effect on PDK4 gene expression, are seen during fall when PDK4 mRNA levels are low. Coordinate upregulation of PDK4 in three distinct tissues suggests a common signal that regulates PDK4 expression and fuel selection during hibernation.
DTIC
Hibernation; Mammals

20040073575 Pittsburgh Univ., Pittsburgh, PA
The Pittsburgh Breast Cancer Consortium
Brufsky, Adam M.; Aug. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0374
Report No.(s): AD-A422407; No Copyright; Avail: CASI; A02, Hardcopy

The University of Pittsburgh Cancer Institute, the Magee-Women's Hospital, the Hematology Oncology Associates of the UPCI (HOA), the Pittsburgh Clinical Research Network, Inc. (PCRN), the Magee Woman care Breast Cancer Volunteer Program, and the Pittsburgh Branch of the National Association for the Advancement of Colored People (NAACP) have collaborated to form the Pittsburgh Breast Cancer Consortium (PBCC). The focus of this partnership is the rapid clinical development of new agents for the treatment of metastatic breast cancer (MBC). The PBVV id conducting innovative phase I and phase II clinical trials testing new approaches in the treatment of MBC.
DTIC
Cancer; Mammary Glands; Organizations

20040073581 Evanston Northwestern Healthcare Research Inst., Evanston, IL
Role of Heregulin in the Neovascularization of Breast Carcinoma Cancer
Menendez, Javier A.; Lupu, Ruth; Aug. 2003; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0305
Report No.(s): AD-A422418; No Copyright; Avail: CASI; A03, Hardcopy

Several oncogenes, growth factors, hormones and hypoxia have been shown to up-regulate Vascular Endothelial Growth Factor (VEGF), an essential angiogenic factor for the progression of breast carcinomas. We previously demonstrated that he angiogenic factor CCN1 (CYR61), a member of the CCN family of growth regulators, is differentially expressed in breast cancer cells overexpressing Heregulin (HRG), a member of the epidermal growth factor-like growth factor family that regulates angiogenesis via up-regulation of VEGF expression and secretion. More recently, we found that CCN1- induced tumors in ovariectomized athymic nude mice did resemble human invasive carcinomas with increased vascularization and overexpression of VEGF.
DTIC
Angiogenesis; Cancer; Mammary Glands

20040073582 Scripps Research Inst., La Jolla, CA

Blocking Blood Supply to Breast Carcinoma with a DNA Vaccine Encoding VEGF Receptor-2

Xiang, Rong; Apr. 2004; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0562

Report No.(s): AD-A422420; No Copyright; Avail: CASI; A03, Hardcopy

The major goal of cancer immunology is to induce a tumor protective immune response that could effectively eradicate growth and dissemination of metastases. In our second fiscal year, we demonstrated proof of concept indicating that effective suppression of tumor angiogenesis can be achieved with a DNA vaccine encoding either muring VEGF receptor-2 (Flk-1) or Flk-1 minigenes designed to induce CTL- mediated immune responses by targeting proliferation endothelial cells in the tumor vasculature. In fact, CTL- medicated killing of endothelial cells indicated a breaking of peripheral immune tolerance against FLK-1 or fragments of this self-antigen resulting in markedly reduced dissemination of metastases. Angiogenesis in the vasculature was suppressed without impairment of fertility, neuromuscular performance or hematopoiesis and with only a slight delay in wound healing. Furthermore, a similar strategy was performed by targeting the transcription factor Fra-1 co-expressing secretory IL-18, in breast cancer model, which was highly effective in suppression or eradicating aggressive metastases by inducing anti- angiogenesis coupled with pronounced activation of T and NK cells. We demonstrated that this combination could not only suppress D2F2 breast cancer growth and metastases, but also induces a long-lived T cell memory. DTIC

Blocking; Blood Volume; Cancer; Coding; Deoxyribonucleic Acid; Mammary Glands; Vaccines

20040073584 Cincinnati Univ., OH

Conditional Estrogen Receptor Knockout Mouse Model for Studying Mammary Tumorigenesis

Khan, Sohaib A.; Jan. 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0057

Report No.(s): AD-A422422; No Copyright; Avail: CASI; A03, Hardcopy

In addition to accomplish the main goal of this grant proposal, i.e. to generating mice with estrogen receptor (ER) alpha gene ablation in the mammary gland of mice, we have also carried out other tasks. A summary of our findings follows: (1) In order to identify targets of ER-alpha, ER-beta genes, we used microarray and profiled the targets for estrogen and bis phenol-A. This will be of help in understanding the mechanism by which different ligands function in the breast cancer cells. (2) We identified the F- domain of ER-alpha as playing an important role in the regulation of ER activity. (3) We constructed ER-alpha targeting vectors and generated ER-alpha embryonic cell lines. (4) We generated floxed ER-alpha mice, which will be used to generate tissue specific mice (e.g. mammary). Thus these tools and results will be of great use in understanding breast cancer disease process with reference to the role of estrogen receptor. DTIC

Cancer; Estrogens; Knockout Mice; Mammary Glands

20040073585 California Univ., San Diego, La Jolla, CA

The Contribution of Hypoxia-Inducible Factor (HIF) -1 Alpha to Normal Mammary Gland Development and Mammary Tumorigenesis

Seagroves, Tiffany N.; Oct. 2003; 41 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0186

Report No.(s): AD-A422423; No Copyright; Avail: CASI; A03, Hardcopy

During pregnancy the mammary epithelium and its supporting vasculature rapidly expand to prepare for lactation. To investigate the role of oxygenation and metabolism in these processes the oxygen-responsive component of the hypoxia-inducible factor (HIF)-1 complex, HIF-1 alpha, was deleted in the murine mammary gland using the Cre/loxP system. Although vascular density remained similar, loss of HIF-1 alpha impaired mammary differentiation and lipid metabolism, culminating in lactation failure and changes in milk composition (Objectives #1) . Next, we investigated the effects of deletion of the von Hipple Lindau (VHL) gene in the mammary gland, in order to stimulate constitutive over- expression of HIF-1 alpha the mammary epithelium, to determine if HIF-1 alpha contributes to mammary gland tumorigenesis (Revised Objective #2) . Preliminary results from this work indicate that VHL is also an important mediator of normal mammary gland differentiation, confirming that regulation of the hypoxic response is critical for normal mammary gland development. The ultimate goal is of these experiments is to determine the role of HIF-1 alpha over-expression during mammary gland tumorigenesis. DTIC

Cancer; Hypoxia; Mammary Glands

20040073586 Department of the Army, Washington, DC
The Physiologic Effects of Wounds, Surgery in World War II (Medical Department, USA Army)
Jan. 1952; 385 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422425; No Copyright; Avail: CASI; A17, Hardcopy

The volumes comprising the history of the Medical Department of the U. S. Army in World War II are divided into two series: (1) The Administrative and Operational series which constitutes a part of the general series of the history of the U. S. Army in World War 11, published under the direction of the Office of the Chief of Military History, and (2) the Professional, or clinical and technical series, published as The Medical Department of the USA Army under the direction of the Office of The Surgeon General. Both series are being prepared by the Historical Unit, Army Medical Service. This volume is one of a number of surgical volumes to be published in the latter series.
DTIC
Medical Services; Military Operations; Physiological Effects; Surgery; United States

20040073607 Army Research Inst. of Environmental Medicine, Natick, MA
Characterization of Uncertainties in a Thermal Strain Prediction Model for Military Applications
Yokota, Miyo; Matthew, William T.; Berglund, Larry G.; Buller, Mark J.; Hoyt, Reed W.; Dec. 2003; 38 pp.; In English
Report No.(s): AD-A422466; USARIEM-T04-03; No Copyright; Avail: CASI; A03, Hardcopy

Thermoregulatory prediction models are increasingly needed for accurate physiological status and risk assessment to prevent heat and cold injuries among deployed soldiers. These biophysical prediction models can provide consistent and repeatable simulations over a wide range of working and environmental conditions to assess physiological risks because they are rationally based on thermodynamics and heat transfer coupled with active physiological control systems and biophysical properties. In contrast, a statistical regression prediction model (8) is limited to the test conditions used in its development. However, it is important to evaluate model predictions of physiological responses in real field situations for its acceptance and useful application. Recent improvements in physiological data collection methods, physiological sensors and communication devices have facilitated the military field evaluation process. Comparisons of physiological data with model predictions provide the analytical basis needed to identify uncertainties and characterize model performance.
DTIC
Mathematical Models; Military Technology; Physiological Effects

20040073615 Tulane Univ., New Orleans, LA
Involvement of a Human Endogenous Retrovirus in Breast Cancer
Garry, Robert F.; Aug. 2003; 101 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0472
Report No.(s): AD-A422489; No Copyright; Avail: CASI; A06, Hardcopy

Our overall goal is to determine whether human mammary tumor virus (HMTV) sequences, present as an endogenous retrovirus, are involved in a subset of human breast cancers. In studies completed for first specific aim, samples form a cohort (>200) of breast cancer and appropriate control patients were obtained. Tn studies under the second specific aim, we identified and sequenced HMTV nucleic acids in breast cancer tissue, control tissue, and blood of patients form our cohorts. Results form a subset of blinded blood samples found that blood from approximately 20% of controls and 70% of breast cancer patients were positive for HMTV sequences. The third specific aim was to construct DNA and CDNA libraries from tissues positive for HNTV proviurses. As this task ahs been accomplished by others (Pogo and Mason), we are focused on confirming the blinded PCR results in the entire cohort, which is nearly completed. The studies under specific aim four, to express HMTV proteins in an insect cell system, and to characterize the immunological reactions of breast cancer patients and controls against HMTV proteins, are in progress. If a definite link is established, HMTV will provide a target for vaccine development and breast cancer therapy.
DTIC
Cancer; Mammary Glands

20040073638 Navy Personnel Research Studies and Technology, Millington, TN
Pregnancy and Parenthood: Results of the 2001 Survey
Uriell, Zannette A.; Apr. 2004; 78 pp.; In English
Report No.(s): AD-A422521; NPRST-AB-04-3; No Copyright; Avail: CASI; A05, Hardcopy

The 2001 Survey of Pregnancy and Parenthood is the sixth in a series of Navy-wide surveys that began in 1988. A

stratified random sample of 9,975 female and 6,985 male active duty Navy personnel were mailed surveys in July 2001. The response rates were 46 percent for females and 38 percent for males. Survey data were statistically weighted to allow generalizations to be made to the Navy population. Among the major findings: rates of single parenthood have decreased for both men and women; Family Care Certificate compliance is lower for men than for women; most Sailors make it their responsibility to discuss birth control with their partner and most say they usually use birth control; less than half of female officers and 59 percent of enlisted women would feel comfortable going to a corpsman about birth control. Point-in- time pregnancy rates for E-5 to E-6 and 0-4 and 0-5 have increased. About 36 percent of enlisted pregnancies are planned. The most recent pregnancy of 92 percent of female officers and 66 percent of female enlisted did not occur while they were in a sea duty unit.
DTIC
Pregnancy; Surveys

20040073639 Army Aeromedical Research Lab., Fort Rucker, AL
Speech Intelligibility in Noise Using Throat and Acoustic Microphones
Acker-Mills, Barbara E.; Houtsma, Adrianus J.; Ahroon, William A.; Apr. 2004; 23 pp.; In English
Contract(s)/Grant(s): Proj-878
Report No.(s): AD-A422522; USAARL-2004-13; No Copyright; Avail: CASI; A03, Hardcopy

Rotary-wing aircraft crew are exposed to high levels of ambient noise that can cause hearing loss and impede speech communication. Existing technology generally focuses on the listener and devices that can increase the signal-to-noise ratio and decrease noise-induced hearing loss. However, speech intelligibility is still dependent on the quality of the original speech signal. Throat microphones greatly reduce ambient noise in the original signal, thus enhancing the signal-to-noise ratio for the listener, but higher frequencies are eliminated which may negatively affect speech intelligibility. Speech intelligibility for signals generated by an acoustic microphone, a throat microphone, and the two microphones together was assessed using the Modified Rhyme Test (MRT). Stimulus words were digitally recorded in a reverberant chamber with broadband noise intensity at 90 dB(A) and 106 dB(A). Listeners completed the MRT task in the same seflings, thus simulating typical environments of a rotary- wing aircraft. Results show that speech intelligibility is much worse for the throat microphone than for the acoustic microphone, particularly for the higher noise level. In addition, no benefit is gained by adding the throat microphone signal to the acoustic microphone signal.
DTIC
Intelligibility; Microphones; Signal Transmission; Sound Waves; Throats

20040073640 Mount Sinai School of Medicine, New York, NY
Genetic Factors in Breast Cancer: Center for Interdisciplinary Biobehaviorial Research
Bovbjerg, Dana H.; Ambrosone, Christine; Valdimarsdottir, Heiddis; Jandorf, Lina; McGovern, Margaret; Oct. 2003; 294 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0334
Report No.(s): AD-A422523; No Copyright; Avail: CASI; A13, Hardcopy

The central goal of the Breast Cancer Behavioral Center is to further our understanding of the impact of biobehavioral factors on genetic aspects of breast cancer in African American women. The Center has three aims: 1) To support an integrated, interdisciplinary, Program of Research consisting of three synergistic Research Projects (with 4 supporting Cores), each of which addresses an important cancer topic and includes psychological and/or behavioral issues. Thus, we propose research projects with implications for breast cancer etiology, behavioral issues, and their interaction; 2) To encourage the development of interdisciplinary thinking among the faculty involved in the Program of Research that can serve as a model for other institutions. Thus, we propose to demonstrate, by example, the utility of an interdisciplinary approach by working together on an integrated project that addresses important issues of interest to all members of the research team. We propose to bridge the gap between biobehavioral research and epidemiologic approaches. 3) To facilitate the development of truly interdisciplinary perspectives among new investigators in breast cancer research. Thus, we propose to provide interdisciplinary training through both didactic and "hands- on" research, as well as informal seminars to outstanding young investigators who represent the future of the field.
DTIC
Cancer; Epidemiology; Genetics; Mammary Glands; Medical Science

20040073663 Naval Medical Research Inst., Camp Lejeune, NC

Understanding, Predicting, and Reducing Appointment No-Shows in a Military Medical Treatment Facility

Bertrand, Andrew H.; May 2000; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422554; No Copyright; Avail: CASI; A04, Hardcopy

Appointment non-compliance can disrupt the efficient operation of a medical facility. At Naval Hospital, Camp Lejeune, the appointment non-compliance rate for 1999 was 11.3%. Although not markedly high, Naval Hospital leaders believed more could be done to increase appointment compliance. The goal of this study was to identify potential predictors of appointment no-shows at the Naval Hospital and suggest methods to effectively address the issue.

DTIC

Health; Medical Services; Predictions

20040073665 Michigan Univ., Ann Arbor, MI

Computer-Aided Characterization of Breast Masses on Volumetric Ultrasound Images: An Adjunct to Mammography

Sahiner, Berkman; Oct. 2003; 62 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0328

Report No.(s): AD-A422556; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this project is to develop computer vision techniques for the analysis of sonographic images of breast masses, and to combine computerized sonographic and mammographic analyses. The techniques developed in this project are aimed at providing a second opinion to the radiologists in the task of making a biopsy recommendation. In the second year of the project, we have (1) compared the accuracy of the classifier designed in the first year of this project to that of experienced radiologists; (2) conducted studies the effect of the developed classifier on radiologists' characterization of breast masses on ultrasound images; and (3) investigated methods for combining computer classification methods based on ultrasound and mammogram images. Our results indicate that the accuracy of our computer classifier is similar to that of experienced breast radiologists on our data set. We have also shown that experienced radiologists can significantly (p<O.0O6) improve their mass characterization accuracy on sonograms when aided by our algorithm. Our results on combining computer classification methods based on ultrasound and mammogram images indicate that multi-modality computer-aided diagnosis may further improve the classification accuracy.

DTIC

Cancer; Computer Techniques; Data Bases; Diagnosis; Mammary Glands; Sonograms; Ultrasonics

20040073666 Burnham Inst., La Jolla, CA

Are Microtubules Involved in Anoikis?

Frisch, Steven M.; Aug. 2003; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0170

Report No.(s): AD-A422557; No Copyright; Avail: CASI; A03, Hardcopy

This project is investigating the role of microtubule alterations in anoikis, with a view toward re- examining the mechanism of microtubule-targeting drugs such as taxol. During the past year, we have uncovered a new mechanism by which cell adhesion controls apoptosis. The death receptor adaptor protein FADD (FAS-associated death domain protein) is critical for anoikis as well as death ligand (e.g., FASL) induced apoptosis. Recently, we discovered that FADD is primarily in the nucleus of attached cells, where it is unavailable for apoptosis induction. Detachment of mammary epithelial cells form extracellular matrix, however, provokes the export of FADD form the nucleus, thus promoting apoptosis. Our preliminary work suggests that microtubule drugs can promote FADD export, suggesting a new mechanism by which the can promote apoptosis. This is expected to have major ramifications for optimizing the use of taxol or other microtubule drugs in connection with other agents that may promote apoptosis. During the latter year of the project, we found that a protein kinase known as Glycogen Synthase Kinase- 3 (GSK-3) phosphorylates FADD and that this phosphorylation is required for both the transport of FADD into and out of the nucleus. In that GSD-3 is a microtubule-regulatory kinase, this represents a new link between microtubules and apoptosis.

DTIC

Apoptosis; Drugs; Enzymes; Microstructure; Phosphorus

20040073670 Georgetown Univ. Hospital, Washington, DC

Short and Long-Term Disability and Workers' Compensation Health Care Programs: Management Project at Georgetown University Hospital

Whippen, Thomas; Jun. 2000; 79 pp.; In English

Report No.(s): AD-A422561; HCA-34-00; No Copyright; Avail: CASI; A05, Hardcopy

The financial challenges associated with the managed care environment in the health care industry have resulted in significant emphasis on cost reduction and improvement in business operations and strategies. Recent acquisition discussions between Georgetown University medical Center and MedStar provide an opportunity to reengineer the Workers' Compensation and Short and Long-Term Disability Programs. Reengineering efforts should be focused on improving services to the employees and reducing the direct and indirect costs associated with these programs. The literature and existing studies support the instruction of a managed care model focused on case management and medical management to reduce direct and indirect costs. The Workers' Compensation and Disability Programs can be organizationally consolidated with the Employee Health Services providing medical management.
DTIC
Cost Reduction; Disabilities; Health; Hospitals; Management Systems; Medical Services; Personnel

20040073683 California Univ., Berkeley, CA
Compact Positron Tomograph for Prostate Imaging
Huber, Jennifer S.; Jan. 2004; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0081
Report No.(s): AD-A422582; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to construct a functioning compact positron tomograph, whose geometry is optimized for detecting prostate tumors with molecular tracers such as 11Ccholine (carbon-11 choline), in order to confirm the presence, absence or progression of prostate cancer. When completed, the camera will consist of two banks of detectors mounted in a gantry. The bottom bank is fixed below the patient bed, and the top bank moves upward for patient access and downward for maximum sensitivity. During the first 22 months of funding, we have optimized and completed the tomograph design, fabricated all gantry components and nearly completed construction of the gantry and electronics housing, acquired and tested all detector modules and electronics, developed an iterative reconstruction algorithm for the special camera geometry, and simulated the reconstruction of realistic Monte Carlo data. Progress is on schedule.
DTIC
Cancer; Imaging Techniques; Positrons; Prostate Gland; Tomography

20040073688 Department of the Army, Washington, DC
Cold Injury, Ground Type in World War II (Medical Department, USA Army)
Whayne, Tom F.; DeBakey, Michael E.; Coates, John B., Jr.; McFetridge, Elizabeth M.; Jan. 1958; 582 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422588; No Copyright; Avail: CASI; A25, Hardcopy

The historical chapters of this volume set forth the important details of what happened concerning cold injury in all recorded wars of history as well as in World War I and World War II. Its possible causes and predisposing factors are set forth from every angle in the very complete chapter on epidemiology, in which the presentation is based on the concept that the same epidemiologic principles can be applied to trauma due to cold as are applied to infectious diseases and that the same general principles of control are operative. The clinical chapters clearly indicate the inadequacy of our basic knowledge of cold injury and the unsatisfactory results of present methods of treatment; they also point up the necessity for continued studies in these fields. The urgent necessity for preventing a repetition of past experiences is apparent in the chapter on costs.
DTIC
Injuries; Medical Services; Military Operations; United States

20040073694 Michigan Univ., Ann Arbor, MI
Acousto-Mechanical Imaging for Breast Cancer Detection
Emelianov, Stanislav Y.; May 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0562
Report No.(s): AD-A422594; No Copyright; Avail: CASI; A03, Hardcopy

The underlying hypothesis of our study is that quantitative breast elasticity imaging is possible and provides unique information, which could increase the detection, characterization and monitoring of potentially malignant masses in the breast. The purpose of this study is to develop a new modality of medical imaging for surrogate palpation of deep lying breast lesions, namely Acousto- Mechanical Imaging, or AMI, capable of producing high- resolution images of elastic (Young's or shear) moduli. In our method, the evaluation of mechanical structure and properties of an object is accomplished via the synergy of the surface stress pattern measured by the force sensor array and the internal strain obtained by an ultrasound imager. Acousto-

mechanical imaging, therefore, consists of three main components: evaluation of externally induced surface pressure and internal tissue motion; estimation of strain and stress tensor components; and reconstruction of the spatial distribution of the elastic modulus using displacement, strain and stress images. An ambitious research plan has been developed to address important engineering and clinical aspects of AMI. The overall program is designed to critically test the hypothesis that AMI can non-invasively detect and monitor breast lesions thus providing a valuable clinical tool for breast cancer diagnosis, monitoring and therapy.
DTIC
Cancer; Imaging Techniques; Mammary Glands

20040073735 Massachusetts Inst. of Tech., Cambridge, MA
Site Specific Incorporation of Amino Acid Analogues into Protiens In Vivo
RajBhandary, Uttam L.; Jan. 14, 2004; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0300
Report No.(s): AD-A422652; ARO-39867.9-LS; No Copyright; Avail: CASI; A03, Hardcopy

Our objective is to develop general methods for the site-specific incorporation of amino acid analogues into proteins in bacterial and in eukaryotic cells. The approach consists of the use of an amber suppressor transfer RNA (tRNA) aminoacylated with an amino acid analogue, with the help of a mutant aminoacyl-tRNA synthetase, to insert the amino acid analogue at a specific site in a protein. The site of insertion of the analogue is specified by an appropriately placed amber termination codon within the gene for the protein of interest. This approach has two key requirements: (1) an amber suppressor tRNA, which can not be aminoacylated by any of the endogenous aminoacyltRNA synthetases and (2) an aminoacyi-tRNA synthetase, which aminoacylates the amber suppressor tRNA but no other tRNA in the cell. Therefore, an important first goal is to identify such a 21st aminoacyl-tRNA synthetase tRNA synthetase-amber tRNA pair. This goal has been achieved. Several mutations have been introduced into yeast tyrosyl-tRNA synthetase (TyrRS) for isolating mutants that incorporate iodotyrosine into tRNA instead of tyrosine. Work on an alternative approach applicable to mammalian cells has led to a possible general approach for the introduction of two different amino acid analogues into a protein.
DTIC
Amino Acids; Analogs; In Vivo Methods and Tests; Proteins

20040073744 Michigan Univ., Ann Arbor, MI
Induced Expression of Androgen Receptor in Androgen Independent Prostate Cancer Cells Using an IkBalpha Super Repressor
Kalikin, Linda M.; Pienta, Kenneth J.; Sep. 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0077
Report No.(s): AD-A422666; No Copyright; Avail: CASI; A03, Hardcopy

Advanced prostate cancer continues to kill 29,000 men annually in the USA. Despite strides in obtaining extended remissions through the use of hormones and chemotherapeutic agents, there is still no curative therapy for this devastating disease. While most prostate cancers are responsive to androgens and while androgen withdrawal is the main form of treatment, the failure of primary hormone therapy is attributed to androgen-independent tumor expansion. Mechanisms for the transition from androgen-sensitive to androgen-refractory disease are currently not well understood. We proposed to investigate the role of TNF-alpha-mediated NF- icB signaling in androgen-sensitive and -insensitive prostate cancer, as many androgen-independent prostate cancer cell lines exhibit resistance to this pathway and as TNF-alpha is detected at high serum levels in relapsing prostate cancer patients compared to those in remission or untreated. We subsequently demonstrated activation of TNF-alpha-induced apoptosis with an IkB-alpha super repressor and relieved NF-KB repression of the androgen receptor in androgen-independent prostate cancer cell lines cells. During this current funding period we report generation of a non-invasive quantitative murine model for metastatic prostate cancer. Thus, we now are poised to evaluate these novel insights of androgen interactions in vivo, a critical step toward designing novel therapeutic strategies.
DTIC
Cancer; Chemotherapy; Hormones; Males; Prostate Gland

20040073747 Pennsylvania State Univ., University Park, PA
Effects of Moderate Aerobic Exercise Combined with Caloric Restriction on Circulating Estrogens and IGF-I in Premenopausal Women
Williams, Nancy I.; Oct. 2003; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0361
Report No.(s): AD-A422670; No Copyright; Avail: CASI; A03, Hardcopy

The proposal entitled "Effects of moderate aerobic exercise combined with caloric restriction on circulating estrogens and IGF-I in premenopausal women will provide important scientific contributions with respect to the primary prevention of breast cancer in women. Specifically, this study will examine potential mechanisms relating to the role of physical activity in the reduction of the risk of breast cancer by testing whether moderate aerobic exercise can reduce the levels of two hormonal biomarkers, circulating estrogens and insulin-like growth factor I (IGF-I). as expected caloric restriction combined with aerobic exercise training occurring 4 times per week has resulted in increases in aerobic capacity, weight loss ranging from 2.5-7.5 kg and loss of body fat raging form 3% to 7% over four months. Results for T3, IGF-1, and estrone look promising, although the number of subjects who have completed the study thus far is too low to test these changes statistically. Compliance to our dietary and exercise protocols has been excellent, with subjects completed 3.8/4 workouts per week, and meeting or exceeding their caloric intake goals. In conclusion, we are making good progress toward completion of this study.
DTIC
Aerobes; Circulation; Diets; Estrogens; Exercise Physiology; Females; Menstruation; Physical Exercise

20040073750 AMC Cancer Research Center, Lakewood, CO
Methylselenium and Prostate Cancer Apoptosis
Lu, Junxuan; Feb. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0007
Report No.(s): AD-A422674; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this research is to gain a better understanding of the biochemical pathways and molecular targets for the selective induction of apoptosis signaling and execution of PCa cells by methyl selenium (Se)/selenol. We hypothesized that methyl selenium inhibits PI3K-AKT survival pathway leading to the activation of caspase-dependent apoptosis execution in PCa cells. We have so far refined a methylselenol generation system based on methioninase with selenomethionine as substrate (Wang et al, Mol. Carcinogenesis, 2002) and studied the association of protein kinases and effects of PI3K inhibitors for apoptosis induction in DU145 cells by methyl Se and selenite (Jiang et al, Mol. Cancer Therapeutics, 2002). We compared the apoptosis responses of DU145 (androgen independent and mutant p53) and LnCaP (androgen dependent, wild type p53) PCa cell lines to methyl Se/selenol and to selenite. The LNCaP cells are PTEN mutant and possess high basal AKT activity and are more resistant to apoptosis induction by methyl Se, but was not cross resistant to cell death induction by selenite (AACR abstract, 2003). These studies lend additional credence to the role of PI3K-AKT in apoptosis signaling induction by the methyl Se pool. Furthermore, we have discovered a caspase-dependent apoptosis response induced by selenite in LNCaP cells, which is distinct from the lack of caspase involvement in DU145 cells after selenite exposure. This led to a hypothesis that p53 phosphorylation may play a crucial role in mediating apoptosis induced by a genotoxic Se agent through caspase-mediated execution (AACR Abstract, 2003). With the anticipation of fund transferred in 2004, we will initiate studies with transfections of mutant kinases/proteins to specifically address their roles in signaling pathways for apoptosis induction by selenium agents.
DTIC
Apoptosis; Cancer; Prostate Gland

20040073752 Pennsylvania State Univ., University Park, PA
Effects of Moderate Aerobic Exercise Combined with Caloric Restriction on Circulating Estrogens and IGF-I in Premenopausal Women
Williams, Nancy I.; Oct. 2003; 46 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0360
Report No.(s): AD-A422676; No Copyright; Avail: CASI; A03, Hardcopy

The proposal entitled "Effects of moderate aerobic exercise combined with caloric restriction on circulating estrogens and IGF-I in premenopausal women% will provide important scientific contributions with respect to the primary prevention of breast cancer in women. Specifically, this study will examine potential mechanisms relating to the role of physical activity in the reduction of the risk of breast cancer by testing whether moderate aerobic exercise can reduce the levels of two hormonal biomarkers, circulating estrogens and insulin-like growth factor I (IGF-I). as expected caloric restriction combined with aerobic exercise training occurring 4 times per week has resulted in increases in aerobic capacity, weight loss ranging from 2.5-7.5 kg and loss of body fat raging form 3% to 7% over four months. Results for T3, IGF-1, and estrone look promising, although the number of subjects who have completed the study thus far is too low to test these changes statistically. Compliance to our dietary and exercise protocols has been excellent, with subjects completed 3.8/4 workouts per week, and

meeting or exceeding their caloric intake goals. In conclusion, we are making good progress toward completion of this study.
DTIC
Aerobes; Circulation; Diets; Estrogens; Exercise Physiology; Females; Menstruation; Physical Exercise

20040073768 Wright State Univ., Dayton, OH
Low Level Chemical Toxicity: Relevance to Chemical Agent Defense
Morris, Mariana; Jul. 2003; 134 pp.; In English
Contract(s)/Grant(s): DAMD17-00-C-0020
Report No.(s): AD-A422716; No Copyright; Avail: CASI; A07, Hardcopy

A multidisciplinary project is underway to study the influence of low-level exposure to chemicals to which military personnel had contact during the Persian Gulf War. The research group includes investigator with expertise in neuroscience, molecular biology, enzymology, cardiovascular physiology and neuropharmacology. The overall objectives is to study the effect of chemical exposure from the single cell/gene level to the whole animal and ending with the human condition. Results include but are not limited to: proteomic changes have been identified that are different between pyridostigmine bromide and physostigmine; spectral analysis has showed dramatic alterations in heart rate variability and baroreflex index in mice challenged with stress and/or pyridostigmine; sarin and noise stress and also pyridostigmine bromide and DEET with noise stress induce significant decreases in electron transfer rates compared to noise stress alone, factors have been identified which will increase the reliability of correlations between enzymatic analyses and abnormal or disease states; modest gene expression changes have been determined using Mann-Whitney tests after eliminating those genes with expression levels that appear to represent inactive genes.
DTIC
Chemical Defense; Chemical Warfare

20040073772 Minnesota Univ., Minneapolis, MN
Metabolizing Enzyme 1 Polymorphisms and Prognosis Among Women Treated with Breast Cancer
Sweeney, Carol; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0128
Report No.(s): AD-A422722; No Copyright; Avail: CASI; A02, Hardcopy

This study will use archived tissue and data to examine survival of women treated for breast cancer in relation to inherited polymorphisms of drug metabolizing enzymes. During year 1, we completed compilation of tumor registry data for eligible subjects (Task 1 of the approved Statement of Work) and study start-up tasks, including IRB review, hiring study staff, creating data collection forms, establishing a study database, and training study staff on data collection procedures. Collection of tissue samples (Task 2 of the approved Statement of Work) has proceeded during year 2, including obtaining pathology slides and blocks, review of slides by the study pathologist, and abstracting information from pathology reports into the study database. As described in the statement of work, data collection tasks will continue into years 2 and 3, 50 no reportable scientific results are available at the end of year 2.
DTIC
Cancer; Enzymes; Females; Mammary Glands; Metabolism; Polymorphism; Prognosis; Tissues (Biology)

20040073784 Virginia Univ., Charlottesville, VA
Increasing Oxygen Consumption During Shock
Gainer, John L.; May 4, 2004; 9 pp.; In English
Contract(s)/Grant(s): N00014-95-1-0213
Report No.(s): AD-A422762; No Copyright; Avail: CASI; A02, Hardcopy

Whole-body oxygen consumption is decreased after hemorrhage. Typical methods for increasing oxygen consumption have involved increasing the blood oxygen concentration using enriched oxygen gases, hemoglobins and fluorocarbon compounds; however, clinical trials involving these have not been totally successful. Increasing the oxygen concentration increases its diffusion rate through blood plasma; however, an alternative method would be to increase the diffusion coefficient of oxygen itself. This was shown to be possible using a naturally- occurring compound called crocetin. Crocetin also increased whole-body oxygen consumption in hemorrhaged rats and resulted in an increased survival rate. However, this occurred over a relatively small concentration range. Thus, trans sodium crocetinate (TSC) was developed, which also increases oxygen consumption in rats after hemorrhage and increases survival. TSC has also been shown to increase blood pressure and to

reduce the acidosis that forms with hypoxia and to reduce damage to liver and kidney.
DTIC
Blood Plasma; Oxygen Consumption; Pathology

20040073786 Alabama Univ., Birmingham, AL
Genetic Radiotherapy of Prostate Cancer
Buchsbaum, Donald J.; Dec. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0001
Report No.(s): AD-A422767; No Copyright; Avail: CASI; A03, Hardcopy

A goal of this proposal is to achieve a high intratumoral concentration of 5-fluorouracil (5-FU) via molecular chemotherapy employing genetically modified adenoviral (Ad) vectors encoding the genes for somatostatin receptor subtype 2 (SSTr2) and cytosine deaminase (CD) which converts the prodrug 5-fluorocytosine (5-FC) to 5-FU under control of the cyclooxygenase-2 (Cox-2) tumor-specific promoter. The purpose of Specific Aim 1 was to develop, validate, and evaluate genetically modified Ad vectors that will increase expression levels of both SSTr2 and CD. We proposed to initially evaluate two novel two-gene Ad vectors: (1) a native fiber Ad (AdCMVCDCMVSSTr2) and (2) Ad under control of the Cox-2 promoter expressing CD and SSTr2. We have produced several vectors including AdCox-2LCDCox-2LS STr2, AdCox-2LS STr2Cox-2LCD, AdRGDCox- 2LCDCox-2LSSTr2, and AdRGDCox-2LCDCox-2LSSTr2. The vectors we developed were tested for SSTr2 and CD expression employing membrane receptor binding in vitro with 125I-somatostatin and 99mTc-P2O45 that binds to SSTr2, conversion of 5-FC to 5-FU, and cytotoxicity against Ad infected cells in the presence of 5-FC. The vectors were evaluated in vivo for SSTr2 expression and CD expression. Efforts are continuing to produce ROD modified vectors expressing CD and SSTr2 under control of the Cox-2L promoter to be used for therapy in local and metastatic models.
DTIC
Cancer; Genetics; Prostate Gland; Radiation Therapy

20040073787 California Univ., Irvine, CA
The Role of a LIM Only Factor, LMO-4 in Breast Cancer
Anderson, Bogi; Oct. 2003; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0182
Report No.(s): AD-A422769; No Copyright; Avail: CASI; A03, Hardcopy

LMO-4 is a transcription factor, which exhibits prominent expression in epithelial cells, including that of the breast. Since previous members of the LIM only (LMO) gene family are oncogenes in lymphocytes, we hypothesized that LMO- 4 may play a role in mammary gland development and cancer. We have now shown that expression of LMO-4 is associated with undifferentiated cellular stage of breast epithelial cells, such as that found during lobuloalveolar development in pregnancy and in breast cancer. Furthermore, the ErbB2 activator heregulin stimulates LMO4 expression in MCF-7 breast cancer cells, suggesting that LMO4 plays a role in this important oncogenic pathway. In protein interactions studies, we have found that LMO4 interacts with DNA-binding proteins, including GATA3. We have created transgenic mice in which we overexpress a dominant negative LMO-4 under the MMTV promoter (MMTV-engrailed-LMO4) to test the role of LMO4 in mammary gland development. Our results show significant inhibition of lobuloalveolar development in these MMTV-engrailed-LMO4 transgenic mice, indicating that LMO-4 plays roles in proliferation and/or invasion of breast epithelial cells. Because these cellular features are associated with breast carcinogenesis and because LMO4 is overexpressed in a subset of breast cancers, our studies implicate LMO4 as a possible oncogene in breast cancer.
DTIC
Cancer; Lymphocytes; Mammary Glands; Transcription (Genetics)

20040073788 Ohio State Univ., Columbus, OH
Alteration of the Endothelial Barrier by Breast Cancer Cells as a Mechanism of Tumor Resistance
Jones, Carleton B.; May 2002; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0588
Report No.(s): AD-A422770; No Copyright; Avail: CASI; A02, Hardcopy

The endothelial cells lining blood vessels that perfuse breast tumors present a barrier that antineoplastic agents must cross to reach the tumor cells. The purpose of this award was to provide preliminary data to support the hypothesis that tumor cells can modulate this barrier by secreting soluble factors, by affecting extracellular matrix, or by a combination of these factors. The specific aims of this project were to 1) determine tumor cell induced expression of multi-drug-resistance proteins in

endothelial cells; and 2) determine tumor cell mediated changes in Adriamycin transport across endothelial cells. Experiments performed to address aim 1 revealed no tumor mediated increases in p-gp protein (a classic multi-drug resistance protein) in endothelial cells.
DTIC
Cancer; Mammary Glands; Tumors

20040073789 Congressional Budget Office, Washington, DC
A CBO PAPER: Financing Long-Term Care for the Elderly
Apr. 2004; 55 pp.; In English
Report No.(s): AD-A422772; No Copyright; Avail: CASI; A04, Hardcopy

Over the next several decades, the population of U. S. seniors-people aged 65 and older is expected to grow rapidly, more than doubling by 2040 while the population as a whole grows by about one-third. That surge will probably produce a similar increase in the demand for long-term care (LTC) services-the personal assistance that enables people who are impaired to perform daily routines such as eating, bathing, and dressing. Today, seniors finance such services from a variety of sources, including personal savings, care donated by friends and family, private insurance, and public programs such as Medicaid and Medicare. This Congressional Budget Office (CBO) paper-prepared at the request of the House Budget Committee-summarizes the current state of financing for long- term care, identifies some of the issues affecting it both now and in the future, and considers policy alternatives that address the mix of private and governmental sources of financing for LTC costs. In keeping with CBO's mandate to provide objective, impartial analysis, this report contains no recommendations. Stuart Hagen of CBO's Health and Human Resources Division prepared the paper under the supervision of Steve Lieberman and James Baumgardner.
DTIC
Age Factor; Management Planning; Medical Services

20040073790 Utah State Univ., Logan, UT
Development of Laulimalide-Based Microtubule- Stabilizing Agents: New Chemistry for the Treatment of Breast Cancer
Davidson, Bradley S.; Jul. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0480
Report No.(s): AD-A422773; No Copyright; Avail: CASI; A02, Hardcopy

Through a collaborative research program involving Utah State University and the Cancer Research Center of Hawaii, we have discovered that the sponge-derived macrolides laulimalide and isolaulimalide are potent cytotoxins with paclitaxel-like antimicronibule-stabilizing activity. Laulimalide is a potent inhibitor of cellular proliferation with an IC50 in the low nanomolar range and it maintains activity against a drug resistant, P-glycoprotein over- expressing ovarian cancer cell line. Laulimalide represents a lead compound for new class of microtubule-stabilizing agents with activities that may prove therapeutically useful for the treatment of breast cancer. The aim of this project is to utilize a combinatorial solid-phase synthetic approach for the construction of a library of laulimalide analogs for structure activity relationship (SAR) studies. In an effort to discover a new chemotherapeutic agent for the treatment of breast cancer we propose to do the following: I) transfer our current solution-phase synthetic approach to solid phase, 2) using a split and pool strategy, prepare 260 laulimalide analogs, 3) test laulimalide analogs for microtubule-stabilizing activity, cytotoxicity against both drug-sensitive and drug-resistant breast cell lines, and 4) submit active analogs to the NCI for screening in the 60-cell line. Work to-date has been concentrated on the adaptation of our solution phase laulimalide synthetic methods for efficient conversion to the solid phase. Because of difficulties adding fragment C, a new retrosynthetic approach has been developed and is now being explored. It has the advantage that the coupling of fragment C to the resin-bound material will not involve the formation of a new asymmetric center, thus simplifying the reaction. Fragment B analogs have been prepared and coupled using a Juliea-Kocienski type reaction to an appropriate aldehyde and the first two laulimalide analogs have been screened for biological activity.
DTIC
Cancer; Mammary Glands; Stabilization

20040073791 California Univ., Los Angeles, CA
The UCLA-Community Breast Cancer Collaborative Clinical Translational Research Program
Glaspy, John A.; Oct. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0180
Report No.(s): AD-A422777; No Copyright; Avail: CASI; A02, Hardcopy

Our hypothesis has been that four elements are required to exploit the opportunities provided by recent advances: (1) the development of consortia of community physicians committed to the study of novel approaches to the treatment and prevention of breast cancer; (2) the provision of an infrastructure composed of clinical trials personnel; (3) the involvement of an academic center committed to community-based research and possessed of expertise in basic research, statistics, data management, and regulatory support; and (4) partnerships with pharmaceutical companies involved in the discovery and manufacture of novel agents. Since the initiation of this infrastructure award, we have continued to expand on our previous success in the UCLA-Community Oncology Research Network (UCLA-CORN) through: 1) the recruitment of additional research sites, increasing access for women from underserved populations, 2) the initiation of translational research protocols relevant to the breast cancer problem and 3) an overall increase in accrual to breast cancer research protocols in the UCLA-CORN.
DTIC
Cancer; Clinical Medicine; Mammary Glands

20040073792 California Univ., Irvine, CA
Functional Analysis of LIM Domain Proteins and Co- Factors in Breast Cancer
Wang, Ning; Andersen, Bogi; Oct. 2003; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0183
Report No.(s): AD-A422779; No Copyright; Avail: CASI; A03, Hardcopy

We identified a novel transcription factor, LMO-4, which exhibits prominent expression in epithelial cells, including that of the breast. Since previous members of the LIM only (LMO) gene family are oncogenes in lymphocytes, we hypothesized that LMO-4 may play a role in mammary gland development and cancer. We have created transgenic mice in which we overexpress a dominant negative LMO-4 under the MMTV promoter (MMTV-engrailed-LMO4) to test the role of LMO-4 in mammary gland development. Our results show significant inhibition of ductal development in virgin mice and alveolar development of pregnant mice, indicating that LMOA plays roles in proliferation and/or invasion of breast epithelial cells. Because these cellular features are associated with breast carcinogenesis and because LMO-4 is overexpressed in a subset of breast cancers, our studies implicate LMO4 as a possible oncogene in breast cancer. We have also created stable breast cancer cell lines in which we can induce expression of LMO4 and Clim2, and identified several cancer-related genes that are regulated by LMO4. In addition, we have shown that LMO4 interacts with the transcription factor GATA3 in breast cancer cells. We propose that LMO4 is involved in regulation of breast cancer cells by interacting with GATA3.
DTIC
Cancer; Functional Analysis; Mammary Glands; Proteins; Transcription (Genetics)

20040073815 Wisconsin Univ., Madison, WI
Ultra-Sensitive Microwave Detection of Protein Conformational Changes
Taylor, Kimberly M.; Weide, Daniel W. van der; Apr. 2, 2004; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0081
Report No.(s): AD-A422852; ARO-43067.1-EL; No Copyright; Avail: CASI; A02, Hardcopy

We are using pulsed and continuous-wave dielectric spectroscopy for sensing DNA and proteins with high frequency techniques. This is rarely used for proteins and other macromolecules due to their low permittivity. Water, however, is a strong dielectric and the shells of bound water surrounding a macromolecule in solution may be used as a reporter for changes in its conformation or activity. Such measurements have been pursued with resonant cavities or planar waveguides, but optical correlation has been lacking. An alternative is to employ a planar resonant slot antenna, using a network analyzer to measure the solution's properties in reflection. The slot antenna's window permits passage of a light beam, enabling simultaneous dielectric and optical spectroscopic measurements. Here we report two systems, both resonant in the 4-20 GHz regime. In the first, unfolding/folding thermodynamics of a protein in solution were measured using a slot antenna affixed to a UV/VIS cuvette. In the second system, a slot antenna was incorporated into the cell holder of a fluorescence polarization instrument and used to measure binding of synthetic hormones to various receptors. Results from dielectric measurements are in good agreement with results from optical spectroscopies.
DTIC
Microwaves; Proteins; Spectroscopy

20040073816 Naval Aerospace Medical Research Lab., New Orleans, LA
Bioman-An Improved Occupant-Crew Station Compliance Modeling System
Frisch, Georg D.; D'Aulerio, Louis A.; Feb. 1980; 8 pp.; In English
Report No.(s): AD-A422853; No Copyright; Avail: CASI; A02, Hardcopy

The need to visualize and interpret human body movement data from experiments and simulations has led to the development of a computerized, three-dimensional representation of tbe human body and crew station. While conventional charts and graphs can be used to follow movements of individual body parts, it has been our experience that only by observing the entire movement of the various body segments can experimental results be integrated with simulation studies. Such a process requires that program output be used to animate a realistically formed and jointed human body model incorporated within an existing or projected crew station. Animations are essential whenever the volume of data collected or generated is too great to assimilate piecemeal, or when the complexity of the motion under study leads to visualization difficulties in a two-dimensional graph. Dissatisfaction with existing body models and stick figure displays led to the development of a new human and crew station model for the computer with distinct advantages in display realism, movement definition, collision or interaction detection, and cost- effectiveness in a real-time animation play-back environment. Development of this program was meant to provide an improved method for evaluating the physical compatibility of crew members with crew stations under all types of G environ- ments.
DTIC
Crew Workstations; Display Devices; Human Body

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*.

20040070927 Hopital Bretonneau, Tours, France
Flow Redistribution Between Legs and Brain During STS 93 Re-Entry and Landing
Arbeille, P.; Meck, J.; Porcher, M.; Benavides, E.; Martin, D. S.; South, D. A.; Ribeiro, C.; Westover, A.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P73-P74; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAG2-6072; Copyright; Avail: Other Sources

The objective was to quantify bit by bit the arterial hemodynamic response to the successive acceleration induced fluid shifts during re-entry and landing. Method: The astronaut instrumented himself with a flat Doppler probe fixed on the skin, a blood pressure arm cuff, and 3 ECG electrodes. The ICMS (integrated cardiovascular monitoring system, 15x15x25 cu cm, battery powered) designed to monitor Blood pressure, ECG, cerebral and femoral flows was fixed below the astronaut sit in the middeck. Recordings started 5 minutes before de-orbiting (TIG) and stopped 5 min after wheels stop. Results. During re-entry blood pressure increased by 20% at TIG, and then by 25 to 30% during the highest Gz accelerations (approx 1 S g) . The cerebral flow remained decreased by 10 to 15% below inflight value all during the Entry and landing phases. Conversely the femoral flow increased at TIG and entry (+ l0 to 20%), recovered at 0.lg, and then decreased in proportion with the Gz acceleration (-10% to -40% from 0.5g to 1.5g). The reduction in Femoral flow was associated with an opposite variation in lower limb vascular resistance. Consequently the cerebral flow/femoral flow ratio decreased at TIG and entry (-20%), and then increased according to the Gz acceleration level (+ l0 to +40% from 0.5 to 1.5g). Conclusion: During orthostatic tests (Stand LBNP tests) the cerebral to femoral flow ratio allowed to quantify the efficiency of the flow redistribution between these 2 areas and predicted orthostatic intolerance. In the present case the astronaut was found orthostatically tolerant at postflight tilt tests, but we suggest that during re-entry this parameter could predict the occurrence of syncope in severely disadapted astronauts.
Author
Arteries; Blood Flow; Blood Pressure; Brain Circulation

20040070930 State Univ. of New York, Stony Brook, NY, USA
Development of a Vibration Based Countermeasure to Inhibit the Bone Erosion and Muscle Deterioration That Parallels Spaceflight
Kaplan, Tamara; Qin, Yi-Xian; Judex, Stefan; Rubin, Clinton; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P-105-P106; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; Copyright; Avail: Other Sources

The extent of bone and muscle loss in astronauts on missions longer than 30 days poses significant acute and chronic

health risks. Recent work in a variety of species has revealed that low magnitude, high frequency (25-90 Hz) mechanical stimulation is anabolic and may inhibit hypothesis that short-term, low-intensi(y mechanical in the lower limb that parallels extended exposure to microgravity. If this experiment is selected for flight, 12 right leg serves as a contralateral control. Each astronaut will undergo treatment for 10 minutes per day, five days Pre- and post-flight bone and muscle testing will be used to assess efficacy as well as intra-subject comparison of the experimental leg to the control leg.
Author
Bone Demineralization; Bones; Erosion; Muscles; Deterioration; Space Flight; Health

20040073648 Northeastern Univ., Boston, MA
Quantitative Characterization of Pulmonary Pressure-Volume Curve for Improved Care of Acute Lung Injury
Narusawa, Uichiro; Mar. 2003; 108 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0195
Report No.(s): AD-A422532; No Copyright; Avail: CASI; A06, Hardcopy

Continuous (sigmoidal (tangent-hyperbolic) and error-function) p-V model equations with four parameters are shown to represent clinical p-V curves accurately. The magnitudes of the four parameters, coupled with the normalized p-V equation, distinguish p-V data sets effectively. A mechanistic model of the total respiratory system is developed for the inflation process, relating characteristics of the p-V model equation to the internal respiratory conditions such as alveolar recruitment and elastic distension of tissues. The model is based on the principle of statistical mechanics applied to the total respiratory system as an ensemble of a large number of respiratory elements, each of which consists of a piston-spring subsystem. The ability of the mechanistic model to predict volume limits of the corresponding deflation process justifies its theoretical foundation.
DTIC
Arteries; Injuries; Lungs; Respiratory System; Stress (Physiology)

20040073818 Air Force Research Lab., Brooks AFB, TX
The Efficacy of Modafinil as an Operational Fatigue Countermeasure Over Several Days of Reduced Sleep During a Simulated Escape and Evasion Scenario
Whitmore, Jeffery; Doan, Brandon; Fischer, Joseph; French, Jonathan; Heintz, Tara; Apr. 2004; 31 pp.; In English
Contract(s)/Grant(s): F41624-97-D-6004; Proj-7757
Report No.(s): AD-A422857; AFRL-HE-BR-TR-2002-0021; No Copyright; Avail: CASI; A03, Hardcopy

The study presented was an assessment of the operational efficacy of modafinil for field environments, particularly focused on a type of environment which downed aircrew may encounter. This study was designed to examine the ability of modafinil to maintain alertness and performance over several days of reduced sleep in a field environment. The type of activity used in this study may be similar to some escape and evasion scenarios in which downed aircrew might find themselves. In addition, this type of environment and workload was similar to what some special forces personnel might experience. Results from this study will help in developing the operational guidelines for the special forces community and possibly provide support for the inclusion of modafinil in aircrew survival kits. In general, the cognitive and sleepiness data support the hypothesis that modafinil would partially attenuate the performance decrements associated with fatigue (both sleep loss and circadian variation) in this study. The trends are fairly consistent across tests even though statistically significant differences between the conditions are intermittent. One of the most significant findings was the acceptance of modafinil amongst E & E experts was overwhelmingly high, with few side effects reported, and their unanimous agreement that modafinil was useful for field operations.
DTIC
Countermeasures; Sleep

20040073819 Air Force Research Lab., Brooks AFB, TX
Effects of Fatigue on Simulation-Based Team Decision Making Performance
Barnes, Christopher; Coovert, Michael; Harville, Donald; Elliott, Linda; Apr. 2004; 15 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A422859; AFRL-HE-BR-TR-2004-0020; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a study examining the effects of fatigue on team decision-making performance in a command and control context. Ten three-person teams participated in an investigation of sleep deprivation on physiological state, cognitive function, and simulation-based performance. Teams participated in the study from 6:30 pm through 10:30 am the next morning. In this report, we describe preliminary analyses, focused on effects of sleep loss. Despite the small number of teams,

significant results were found with regard to time, scenario, oral temperature, and math total points.
DTIC
Decision Making; Human Performance; Simulation; Sleep Deprivation; Teams

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*.

20040068168 Research and Technology Organization, Neuilly-sur-Seine, France
Test Methodologies for Personal Protective Equipment Against Anti-Personnel Mine Blast
March 2004; 214 pp.; In English
Report No.(s): RTO-TR-HFM-089; AC/323(HFM-089)TP/51; Copyright; Avail: CASI; A10, Hardcopy

The protection of dismounted soldiers against anti-personnel (AP) land mines has been a focus of Military Forces for many years. Since World War II, a significant amount of resources has been invested in developing personal protective equipment (PPE) against this threat. However, the past ten years has seen an intensified effort to solve the problem, which has led to the emergence of new PPE. It was soon recognized that common international procedures to evaluate and assess the performance of this equipment was needed. In 2000, the NATO RTO decided to pool the knowledge and experience of its members to develop a common understanding of the physics at play during a mine explosion and the resulting human injuries. This database would then be used to define common methods to test PPE against AP mines. This was the mandate of Task Group HFM-089/TG-024. This report presents the results of TG-024. It provides background information about mine explosions and the injuries they inflict on their victims. This sets a reference against which the reader can assess the discussion on test methodologies. This discussion is broken down in three sections. The first describes the basic elements that a test methodology must have. The second addresses methods designed to test PPE that protects the lower extremities. The third is focussed on PPE that protects the upper body. Following this discussion, the report presents the TG recommendations with respect to test methods for the assessment of PPE performance against AP blast and fragmentation mines. Finally, conclusions are presented along with a brief recommendation for future work. The report is supplemented with several annexes that contain information relating to mines, past experience of the participating nations, mine injuries, etc., which were too detailed for inclusion in the main text.
Author
Explosions; Protection; Protectors; Military Personnel; Protective Clothing; Mines (Ordnance); Performance Tests

20040068298 Newcastle-upon-Tyne Univ., Newcastle
Human Compensation for Undependable Systems
Besnard, D.; Baxter, G.; Nov. 2003; 16 pp.; In English
Report No.(s): PB2004-105455; CS-TR-819; Copyright; Avail: National Technical Information Service (NTIS)

Randell's (2000) dependability fault-error-failure model was originally designed with the objective of describing the propagation of faults in technical systems. Conversely, Reason's (1990) swiss cheese model was intended to describe the organisational facet of systems' failures. However useful these two views have been, there has not been a lot of effort devoted to highlighting their common features. Moreover, these two models say little about the positive human contribution to the delivery of an acceptable service with undependable systems. The investigation of these two aspects forms the main focus of this paper. Our first objective will therefore be to integrate the two models. In doing so, we will also provide an answer to the problem of scale in the description of events in complex settings: organisational factors and pure technical causes could be integrated in the same descriptive picture. Our second objective will be to show that the dependability of the service of socio-technical systems is often a matter of human compensations for poorly designed systems. This claim will be supported by three concrete examples where human compensations have permitted a partly-automated system to deliver an acceptable service.
NTIS
Error Analysis; Flat Surfaces; Human Factors Engineering

20040073543 National Center of Hygiene, Medical Ecology and Nutrition, Sofia
Functional Determination of the Operator State in the Interaction of Humans with Automated Systems
Nikolova, Rouja; Radev, Valentin; Vukov, Mircho; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422309; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Automatic Control; Heart Rate; Human Performance; Man Machine Systems; Stress (Physiology); Stress (Psychology); Workloads (Psychophysiology)

20040073571 Army Research Lab., Aberdeen Proving Ground, MD
Validation of Improved Research Integration Tool (IMPRINT) Driving Model for Workload Analysis
Wojciechowski, Josephine Q.; Apr. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH70
Report No.(s): AD-A422389; ARL-TR-3145; No Copyright; Avail: CASI; A03, Hardcopy

The Human Research and Engineering Directorate of the U.S. Army Research Laboratory developed a model of the tasks and workload associated with driving a ground vehicle. The human performance modeling tool, Improved Performance Research Integration Tool (IMPRINT), was used to simulate the driving tasks. Perception, cognition, and motor control were represented in the IMPRINT driving model. Human processing, attention, and response were simulated as concurrent discrete events. Subsequently, the driving model was incorporated into other IMPRINT models used to investigate crew size and function allocation in Future Combat Systems (FCS) conceptual ground vehicles. Driving is a primary crew function in FCS ground vehicles. The results of this study indicated that a dedicated driver was recommended in combat vehicles. In all configurations tested, the driver was consistently the crew member with the highest workload. As expected, results of simulation runs were consistent with research on driving and distraction. Structural and output validation of the model was completed through literature review. Driving by itself is a high mental workload function. The human processing capacity is fully engaged in tasks when one is driving, with the primary load being in perception and cognition. Literature shows that performance will start to degrade if additional tasks are attempted during driving, especially if the tasks are highly perceptual or cognitive. This model provides a reasonably simple way to represent the driving function and can be used for investigating any system where driving is important. For FCS, this will include direct driving and teleoperations. Several additional validation studies are planned.
DTIC
Combat; Workloads (Psychophysiology)

20040073626 Space and Naval Warfare Systems Center, San Diego, CA
Advanced User Interface Design and Advanced Internetting for Tactical Security Systems
Murray, S. A.; Gage, D. W.; Bott, J. P.; Murphy, D. W.; Bryan, W. D.; Jun. 1998; 7 pp.; In English
Report No.(s): AD-A422503; No Copyright; Avail: CASI; A02, Hardcopy

In recent years military security forces have operated in a climate of increasing mission complexity and diversity. As a response to such challenges, the U.S. Army Training and Doctrine Command (TRADOC) approved a concept for a Family of Integrated Tactical Security Systems (FITSS) involving integrated security sensor systems to support future operations. In support of this concept the Defense Special Weapons Agency (DSWA), at the request of the U.S. Army Product Manager - Physical Security Equipment, initiated two exploratory development projects at SPAWAR Systems Center, San Diego, to develop an Advanced User Interface for Tactical Security (AITS) and a Tactical Sensor Internetting and Integration (TS2I2) capability. These projects are complementary in approach and application. AITS addresses the human factors and display technologies needed to effectively support tactical security personnel with sensor information in a clear, intuitive manner while TS2I2 is focused on a protocol architecture to support control of multiple tactical sensors using current communications resources. The concepts behind these projects and their current progress are described in this paper. (10 refs.)
DTIC
Architecture (Computers); Human-Computer Interface; Interoperability; Security; Warning Systems

20040073821 MicroOptical Engineering Corp., Westwood, MA
Micro-Controllable, Multi-Functional Interface Module for Digital MP: A wearable Computer Security Application
Spitzer, Mark B.; Rensing, Noa; May 2004; 45 pp.; In English
Contract(s)/Grant(s): DAAD16-00-C-9277
Report No.(s): AD-A422868; NATICK-TR-04/014; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this work was the creation of a wearable human-computer interface system. This system is intended to provide the dismounted soldier with a hands-free lightweight display, camera, and audio interface to a wearable computer. The display consists of a miniature flat panel LCD and optical system which magnifies it to create a 16-20 degree- wide image at a comfortable viewing distance. The display is mounted on or in eyeglasses for hands-free operation, and provides clear lines of sight around the display to allow the user to perform his or her duties. The headset also incorporates a high-resolution camera for reconnaissance and capture of images for face recognition. The user can communicate with the computer using either audio, including voice corumand and control, or with a pointing device for more discrete operation. An industrial design effort was undertaken to ensure the ergonomics of the final headset as well as aesthetic acceptability. Fiaally, the user interface software running on the wearable computer was optimized for operation in a wearable application.
DTIC
Computer Information Security; Digital Computers; Human-Computer Interface

20040074153 Dayton Univ. Research Inst., OH
User's Guide for Combiman Programs (COMputerized BIomechanical MAN-Model) Version 8
Krauskopf, P.; Quinn, J.; Berlin, R.; Stump, W.; Gibbons, L.; Feb. 1989; 381 pp.; In English
Contract(s)/Grant(s): F33615-84-C-0519; Proj-7184
Report No.(s): AD-A422586; UDR-TR-89-12; AAMRL-TR-89-024; No Copyright; Avail: CASI; A17, Hardcopy

This User's Guide describes the procedures to operate the Harry G. Armstrong Aerospace Medical Research Laboratory's (AAMRL) COMputerized BIomechanical MAN-model (COMBIMAN) programs. The guide is based on the program as of January 1989. It deals with the conventions used to develop and analyze crew stations, the generation of the man-model and the operation of the programs included in the COMBIMAN system. These programs include the interactive graphics program (CBM08) and the three key data base maintenance programs; CBMAM (creates and maintain anthropometric survey data bases), CBMCM2 (creates and maintains crew station configurations) and CBMODM (creates and maintains vision limit overlays). There are also complete descriptions for two other programs, CBMOFF and CADCBM. CBMOFF is a program for off-line plotting. CADCBM is used to convert drawings from a specific Computer-Aided Design (CAD) system drawing files for use with COMBIMAN programs. For users who do not have an on-line plotting capability, the program CBM08NOPL is included to use in place of CBMOS.
DTIC
Biodynamics; Computer Programs; Computerized Simulation

20040074158 National Defense Univ., Washington, DC
Defense Horizons. Number 25, March 2003. Biology and the Battlefield
Armstrong, Robert E.; Warner, Jerry B.; Mar. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422396; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
Biotechnology; Horizon

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040070919 Texas Univ. Health Science Center, Houston, TX, USA
Bioconvection in Cultures of the Calcifying Unicellular Alga Pleurochrysis Carterae
Montufar-Solis, Dina; Duke, P. Jackie; Marsh, Mary E.; Journal of Gravitational Physiology; July 2003; ISSN 1077-9248; Volume 10, No. 1, pp. P-19-P-20; In English; 24th Annual Gravitational Physiology Meeting, 4-9 May 2003, Santa Monica, CA, USA
Contract(s)/Grant(s): NAG2-6072; NAG2-1261; Copyright; Avail: CASI; A01, Hardcopy

The unicellular, marine, calcifying alga P leurochiysis carterae--a model to study cell morphogenesis, cell polarity, calcification, gravitaxis, reproduction and development-- has extremely flexible culture requirements. Support studies for a flight experiment addressing cell motility suggested that cell density (cells/ml) affects cell movement in P. carterae cultures through the gradual establishment of bioconvection as the culture grows. To assess the effect of cell density on direction of

the movement, without the effects of aging of the culture, swimming behavior was analyzed in aliquots from a series of dilutions obtained from a stock culture. Results showed that at low concentrations cells swim randomly. As the concentration increases, upswimming patterns overtake random swimming. Gradually, up and down movement patterns prevail, representative of bioconvection. This oriented swimming of P. carterae occurs in a wide range of concentrations, adding to the list of flexible requirements, in this case, cell concentration, to be used for spaceflight studies addressing cell motility and bioconvection in a unicellular model of biologically directed mineralization.
Author
Calcification; Low Concentrations; Polarity; Dilution; Algae

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*.

20040068169 NASA Ames Research Center, Moffett Field, CA, USA
Three-Dimensional High-Order Spectral Volume Method for Solving Maxwell's Equations on Unstructured Grids
Liu, Yen; Vinokur, Marcel; Wang, Z. J.; January 15, 2004; 1 pp.; In English; 2004 International Conference on Spectral and High Order Methods (ICOSAHOM), 21-25 Jun. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A01, Hardcopy

A three-dimensional, high-order, conservative, and efficient discontinuous spectral volume (SV) method for the solutions of Maxwell's equations on unstructured grids is presented. The concept of discontinuous 2nd high-order loca1 representations to achieve conservation and high accuracy is utilized in a manner similar to the Discontinuous Galerkin (DG) method, but instead of using a Galerkin finite-element formulation, the SV method is based on a finite-volume approach to attain a simpler formulation. Conventional unstructured finite-volume methods require data reconstruction based on the least-squares formulation using neighboring cell data. Since each unknown employs a different stencil, one must repeat the least-squares inversion for every cell at each time step, or to store the inversion coefficients. In a high-order, three-dimensional computation, the former would involve impractically large CPU time, while for the latter the memory requirement becomes prohibitive. In the SV method, one starts with a relatively coarse grid of triangles or tetrahedra, called spectral volumes (SVs), and partition each SV into a number of structured subcells, called control volumes (CVs), that support a polynomial expansion of a desired degree of precision. The unknowns are cell averages over CVs. If all the SVs are partitioned in a geometrically similar manner, the reconstruction becomes universal as a weighted sum of unknowns, and only a few universal coefficients need to be stored for the surface integrals over CV faces. Since the solution is discontinuous across the SV boundaries, a Riemann solver is thus necessary to maintain conservation. In the paper, multi-parameter and symmetric SV partitions, up to quartic for triangle and cubic for tetrahedron, are first presented. The corresponding weight coefficients for CV face integrals in terms of CV cell averages for each partition are analytically determined. These discretization formulas are then applied to the integral form of the Maxwell equations. All numerical procedures for outer boundary, material interface, zonal interface, and interior SV face are unified with a single characteristic formulation. The load balancing in a massive parallel computing environment is therefore easier to achieve. A parameter is introduced in the Riemann solver to control the strength of the smoothing term. Important aspects of the data structure and its effects to communication and the optimum use of cache memory are discussed. Results will be presented for plane TE and TM waves incident on a perfectly conducting cylinder for up to fifth order of accuracy, and a plane wave incident on a perfectly conducting sphere for up to fourth order of accuracy. Comparisons are made with exact solutions for these cases.
Author
Maxwell Equation; Unstructured Grids (Mathematics); Three Dimensional Models; Conservation Equations

20040068179 NASA Ames Research Center, Moffett Field, CA, USA
Unifying Temporal and Structural Credit Assignment Problems
Agogino, Adrian K.; Tumer, Kagan; 2004; 8 pp.; In English; Autonomous Agents and Multi-Agent Systems Conference, 19-23 Jul. 2004, New York, NY, USA; No Copyright; Avail: CASI; A02, Hardcopy

Single-agent reinforcement learners in time-extended domains and multi-agent systems share a common dilemma known as the credit assignment problem. Multi-agent systems have the structural credit assignment problem of determining the contributions of a particular agent to a common task. Instead, time-extended single-agent systems have the temporal credit assignment problem of determining the contribution of a particular action to the quality of the full sequence of actions. Traditionally these two problems are considered different and are handled in separate ways. In this article we show how these

two forms of the credit assignment problem are equivalent. In this unified frame-work, a single-agent Markov decision process can be broken down into a single-time-step multi-agent process. Furthermore we show that Monte-Carlo estimation or Q-learning (depending on whether the values of resulting actions in the episode are known at the time of learning) are equivalent to different agent utility functions in a multi-agent system. This equivalence shows how an often neglected issue in multi-agent systems is equivalent to a well-known deficiency in multi-time-step learning and lays the basis for solving time-extended multi-agent problems, where both credit assignment problems are present.
Author
Problem Solving; Functions (Mathematics); Complex Systems; Artificial Intelligence

20040068236 Lawrence Livermore National Lab., Livermore, CA
smesh User's Guide
Chand, K. K.; May 05, 2003; In English
Report No.(s): DE2003-15004624; UCRL-MA-153081; No Copyright; Avail: National Technical Information Service (NTIS)
smesh is a general purpose, interactive, 2D unstructured mesh generator based on Overture . It supports three kinds of mesh generation techniques : structured patches with transfinite interpolation (TFI); unstructured triangles based on an advancing front technique; and a Cartesian cutcell/triangle hybrid method. Meshes are generated in a generalized multi-block manner where each block, or region, can be one of the three mesh types. Geometry definitions can be created interactively by placing points and interpolating curves. Spacing information is provided by both the curve discretization (which can be stretched) and a user specified preferred grid spacing for a region. A mesh optimization procedure is available for the non-TFI regions for mesh quality improvement. Each mesh region is given an unique identifier and an optional string name. Meshes are exported to a modified ingrid format including mesh region identifiers and names. Facilities for command scripting and batch running are available.
NTIS
Computational Grids; Grid Generation (Mathematics); Quality Control; Unstructured Grids (Mathematics); User Manuals (Computer Programs)

20040068237 Lawrence Livermore National Lab., Livermore, CA
Multiresolution Image Cache for Volume Rendering
LaMar, E.; Pascucci, V.; Feb. 27, 2003; In English
Report No.(s): DE2003-15004623; UCRL-JC-151932; No Copyright; Avail: National Technical Information Service (NTIS)
The authors discuss the techniques and implementation details of the shared-memory image caching system for volume visualization and iso-surface rendering. One of the goals of the system is to decouple image generation from image display. This is done by maintaining a set of impostors for interactive display while the production of the impostor imagery is performed by a set of parallel, background processes. The system introduces a caching basis that is free of the gap/overlap artifacts of earlier caching techniques. instead of placing impostors at fixed, pre-defined positions in world space, the technique is to adaptively place impostors relative to the camera viewpoint. The positions translate with the camera but stay aligned to the data; i.e., the positions translate, but do not rotate, with the camera. The viewing transformation is factored into a translation transformation and a rotation transformation. The impostor imagery is generated using just the translation transformation and visible impostors are displayed using just the rotation transformation. Displayed image quality is improved by increasing the number of impostors and the frequency that impostors are re-rendering is improved by decreasing the number of impostors.
NTIS
Image Resolution; Memory (Computers)

20040068254 Lawrence Livermore National Lab., Livermore, CA
Multi-Layered Image Cache for Scientific Visualization
LaMar, E.; Pascucci, V.; Apr. 11, 2003; In English
Report No.(s): DE2003-15004385; UCRL-JC-152963; No Copyright; Avail: National Technical Information Service (NTIS)
We introduce a multi-layered image cache system that is designed to work with a pool of rendering engines to facilitate a frame-less, asynchronous rendering environment for scientific visualization. Our system decouples the rendering from the display of imagery at many levels; it decouples render frequency and resolution from display frequency and resolution; allows asynchronous transmission of imagery instead of the compute-send cycle of standard parallel systems; and allows local,

incremental refinement of imagery without requiring all imagery to be re-rendered.
NTIS
Imagery; Laminates; Flow Visualization

20040068265 Lawrence Livermore National Lab., Livermore, CA
Radar Imaging of Spheres in 3D Using MUSIC
Chambers, D. H.; Berryman, J. G.; Jan. 21, 2003; In English
Report No.(s): DE2003-15004917; UCRL-ID-151577; No Copyright; Avail: National Technical Information Service (NTIS)

We have shown that multiple spheres can be imaged by linear and planar EM arrays using only one component of polarization. The imaging approach involves calculating the SVD of the scattering response matrix, selecting a subset of singular values that represents noise, and evaluating the MUSIC functional. The noise threshold applied to the spectrum of singular values for optimal performance is typically around 1%. The resulting signal subspace includes more than one singular value per sphere. The presence of reflections from the ground improves height localization, even for a linear array parallel to the ground. However, the interference between direct and reflected energy modulates the field, creating periodic nulls that can obscure targets in typical images. These nulls are largely eliminated by normalizing the MUSIC functional with the broadside beam pattern of the array. The resulting images show excellent localization for 1 and 2 spheres. The performance for the 3 sphere configurations are complicated by shadowing effects and the greater range of the 3rd sphere in case 2. Two of the three spheres are easily located by MUSIC but the third is difficult to distinguish from other local maxima of the complex imaging functional. Improvement is seen when the linear array is replace with a planar array, which increases the effective aperture height. Further analysis of the singular values and their relationship to modes of scattering from the spheres, as well as better ways to exploit polarization, should improve performance. Work along these lines is currently being pursued by the authors.
NTIS
Radar Imagery; Spheres; Three Dimensional Models; Radiation Distribution

20040068304 NASA Ames Research Center, Moffett Field, CA, USA
Applications of Space-Filling-Curves to Cartesian Methods for CFD
Aftosmis, M. J.; Murman, S. M.; Berger, M. J.; December 28, 2003; 13 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 6-11 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): F19620-00-0099; DE-FG02-99ER-25053; DE-FC02-01ER-25472; 704-41-11
Report No.(s): AIAA Paper 2004-1232; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a variety of novel uses of space-filling-curves (SFCs) for Cartesian mesh methods in CFD. While these techniques will be demonstrated using non-body-fitted Cartesian meshes, many are applicable on general body-fitted meshes-both structured and unstructured. We demonstrate the use of single theta(N log N) SFC-based reordering to produce single-pass (theta(N)) algorithms for mesh partitioning, multigrid coarsening, and inter-mesh interpolation. The intermesh interpolation operator has many practical applications including warm starts on modified geometry, or as an inter-grid transfer operator on remeshed regions in moving-body simulations Exploiting the compact construction of these operators, we further show that these algorithms are highly amenable to parallelization. Examples using the SFC-based mesh partitioner show nearly linear speedup to 640 CPUs even when using multigrid as a smoother. Partition statistics are presented showing that the SFC partitions are, on-average, within 15% of ideal even with only around 50,000 cells in each sub-domain. The inter-mesh interpolation operator also has linear asymptotic complexity and can be used to map a solution with N unknowns to another mesh with M unknowns with theta(M + N) operations. This capability is demonstrated both on moving-body simulations and in mapping solutions to perturbed meshes for control surface deflection or finite-difference-based gradient design methods.
Author
Cartesian Coordinates; Computational Fluid Dynamics; Methodology; Hyperspaces; Curves (Geometry); Grid Generation (Mathematics)

20040068307 Environmental Protection Agency, Washington, DC
Information Strategic Plan: Modernizing the Safe Drinking Water Information System for the Public Water System Supervision Program
Jan. 2004; In English
Report No.(s): PB2004-104034; EPA/816-R-04-001; No Copyright; Avail: National Technical Information Service (NTIS)

This Information Strategic Plan describes OGWDW's approach for the application of technology to manage the data

flows currently received from states and Regions under the Public Water System Supervision (PWSS) Program. OGWDW will implement the first stage, addressing the public water system (PWS) facility and compliance data, by the end of 2004. This Information Strategic Plan document addresses modernizing the two existing Safe Drinking Water Information Systems supporting the data flow for the PWSS Program, SDWIS-FEDERAL and SDWIS-STATE.
NTIS
Information Systems; Information Management; Data Management; Potable Water

20040070708 NASA Ames Research Center, Moffett Field, CA, USA
Team Formation in Partially Observable Multi-Agent Systems
Agogino, Adrian K.; Tumer, Kagan; [2004]; 6 pp.; In English; International Joint Conference on Neural Networks, July 2004, Budapest, Hungary; No Copyright; Avail: CASI; A02, Hardcopy

Sets of multi-agent teams often need to maximize a global utility rating the performance of the entire system where a team cannot fully observe other teams agents. Such limited observability hinders team-members trying to pursue their team utilities to take actions that also help maximize the global utility. In this article, we show how team utilities can be used in partially observable systems. Furthermore, we show how team sizes can be manipulated to provide the best compromise between having easy to learn team utilities and having them aligned with the global utility, The results show that optimally sized teams in a partially observable environments outperform one team in a fully observable environment, by up to 30%.
Author
Artificial Intelligence; Functions (Mathematics); Dynamical Systems; Algorithms

20040070709 NASA Ames Research Center, Moffett Field, CA, USA
Reliability of Complex Nonlinear Numerical Simulations
Yee, H. C.; January 13, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

This work describes some of the procedure to ensure a higher level of confidence in the predictability and reliability (PAR) of numerical simulation of multiscale complex nonlinear problems. The focus is on relating PAR of numerical simulations with complex nonlinear phenomena of numerics. To isolate sources of numerical uncertainties, the possible discrepancy between the chosen partial differential equation (PDE) model and the real physics and/or experimental data is set aside. The discussion is restricted to how well numerical schemes can mimic the solution behavior of the underlying PDE model for finite time steps and grid spacings. The situation is complicated by the fact that the available theory for the understanding of nonlinear behavior of numerics is not at a stage to fully analyze the nonlinear Euler and Navier-Stokes equations. The discussion is based on the knowledge gained for nonlinear model problems with known analytical solutions to identify and explain the possible sources and remedies of numerical uncertainties in practical computations. Examples relevant to turbulent flow computations are included.
Author
Mathematical Models; Nonlinear Systems; Reliability Analysis; Computational Fluid Dynamics; Direct Numerical Simulation; Complex Systems

20040070711 NASA Ames Research Center, Moffett Field, CA, USA
Filtering in Hybrid Dynamic Bayesian Networks
Andersen, Morten Nonboe; Andersen, Rasmus Orum; Wheeler, Kevin; Journal of Machine Learning Research; October 2000; Volume 1, pp. 1-48; In English; Copyright; Avail: CASI; A03, Hardcopy

We implement a 2-time slice dynamic Bayesian network (2T-DBN) framework and make a 1-D state estimation simulation, an extension of the experiment in (v.d. Merwe et al., 2000) and compare different filtering techniques. Furthermore, we demonstrate experimentally that inference in a complex hybrid DBN is possible by simulating fault detection in a watertank system, an extension of the experiment in (Koller & Lerner, 2000) using a hybrid 2T-DBN. In both experiments, we perform approximate inference using standard filtering techniques, Monte Carlo methods and combinations of these. In the watertank simulation, we also demonstrate the use of 'non-strict' Rao-Blackwellisation. We show that the unscented Kalman filter (UKF) and UKF in a particle filtering framework outperform the generic particle filter, the extended Kalman filter (EKF) and EKF in a particle filtering framework with respect to accuracy in terms of estimation RMSE and sensitivity with respect to choice of network structure. Especially we demonstrate the superiority of UKF in a PF framework when our beliefs of how data was generated are wrong. Furthermore, we investigate the influence of data noise in the watertank simulation using UKF and PFUKD and show that the algorithms are more sensitive to changes in the measurement

noise level that the process noise level. Theory and implementation is based on (v.d. Merwe et al., 2000).
Author
Bayes Theorem; Kalman Filters; Noise Intensity; Monte Carlo Method; Acoustic Simulation; Fault Detection

20040071025 Lawrence Livermore National Lab., Livermore, CA
Grid-Search Location Methods for Ground-Truth Collection from Local and Regional Seismic Networks
Rodi, W.; Myers, S.; Schultz, C.; Jul. 2003; In English
Report No.(s): DE2003-15005407; UCRL-JC-154457; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this project is to develop improved seismic event location techniques that can be used to generate more and better quality reference events using data from local and regional seismic networks. Their approach is to extend existing methods of multiple-event location with more general models of the errors affecting seismic arrival time data, including picking errors and errors in model-based travel-times (path corrections). Toward this end, they are integrating a grid-search based algorithm for multiple-event location (GMEL) with a new parameterization of travel-time corrections and new kriging method for estimating the correction parameters from observed travel-time residuals. Like several other multiple-event location algorithms, GMEL currently assumes event-independent path corrections and is thus restricted to small event clusters. The new parameterization assumes that travel-time corrections are a function of both the event and station location, and builds in source-receiver reciprocity and correlation between the corrections from proximate paths as constraints. The new kriging method simultaneously interpolates travel-time residuals from multiple stations and events to estimate the correction parameters as functions of position. They are currently developing the algorithmic extensions to GMEL needed to combine the new parameterization and kriging method with the simultaneous location of events. The result will be a multiple-event location method which is applicable to non-clustered, spatially well-distributed events. They are applying the existing components of the new multiple-event location method to a data set of regional and local arrival times from Nevada Test Site (NTS) explosions with known origin parameters. Preliminary results show the feasibility and potential benefits of combining the location and kriging techniques. They also show some preliminary work on generalizing of the error model used in GMEL with the use of mixture-of-Gaussians probability distributions fit to observed travel-time residuals.
NTIS
Algorithms; Error Analysis; Estimating; Probability Distribution Functions; Seismology

20040071038 General Accounting Office, Washington, DC
Information Security: Information System Controls at the Federal Deposit Insurance Corporation
May 2004; 28 pp.; In English
Report No.(s): PB2004-105522; GAO-04-630; No Copyright; Avail: CASI; A03, Hardcopy

Effective controls over information systems are essential to ensuring the protection of financial and personnel information and the security and reliability of bank examination data maintained by the Federal Deposit Insurance Corporation (FDIC). As part of our calendar year 2003 financial statement audits of three FDIC Funds, GAO assessed the effectiveness of the corporation's general controls on its information systems. Our assessment included follow up on the progress that FDIC has made in correcting or mitigating computer security weaknesses identified in our audits for calendar years 2001 and 2002.
NTIS
Computer Information Security; Protection

20040071044 RAND Corp., Santa Monica, CA, USA
Meta-Regression Approaches: What, Why, When and How. Technical Review No.8
Morton, S. C.; Adams, J. L.; Suttorp, M. J.; Shekelle, P. G.; Mar. 2004; 64 pp.; In English
Report No.(s): PB2004-105071; No Copyright; Avail: CASI; A04, Hardcopy

Dealing with heterogeneity among study treatment effects, or "the situation in which differences in study outcomes are not readily accounted for by sampling variation," is one of the most important challenges facing a meta-analyst. The National Center for Complementary and Alternative Medicine (NCCAM) recognized the importance of heterogeneity in meta-analysis. With the Agency for Healthcare Research and Quality (AHRQ), NCCAM established the objective of this study to compare and contrast several strategies for understanding heterogeneity via meta-regression methods. If heterogeneity is found or suspected to exist, the common approaches used in meta-analysis are to: (1) stratify the studies into homogeneous subgroups and then fit a separate fixed effects estimate, e.g., of the pooled odds ratio, in each strata, (2) construct a random effects estimate across all studies; or (3) fit a meta-regression model that explains the heterogeneity in terms of study-level

covariates. The broad objective of this report is to focus on this strategy of modeling the differences between studies, by comparing and contrasting several meta-regression methods.
NTIS
Heterogeneity; Regression Analysis

20040071047 Lawrence Livermore National Lab., Livermore, CA
Parallelizing a High Accuracy Hardware-Assisted Volume Renderer for Meshes with Arbitrary Polyhedra
Bennett, J.; Cook, R.; Max, N.; May, D.; Williams, P.; Mar. 26, 2001; In English
Report No.(s): DE2004-15005664; UCRL-JC-143127; No Copyright; Avail: National Technical Information Service (NTIS)
This paper discusses the authors efforts to improve the performance of the high-accuracy (HIAC) volume rendering system, based on cell projection, which is used to display unstructured, scientific data sets for analysis. The parallelization of HIAC, using the pthreads and MPI API's, resulted in significant speedup, but interactive frame rates are not yet attainable for very large data sets.
NTIS
Polyhedrons; Hardware; Computational Grids; Accuracy

20040071058 Forest Products Lab., Madison, WI
Estimating the Board Foot to Cubic Foot Ratio
Verrill, S.; Herian, V. L.; Spelter, H.; 2004; 24 pp.; In English
Report No.(s): PB2004-105070; FPL-RP-616; No Copyright; Avail: CASI; A03, Hardcopy
Certain issues in recent soft-wood lumber trade negotiations have centered on the method for converting estimates of timber volumes reported in cubic meters to board feet. Such conversions depend on many factors; three of the most important of these are log length, diameter, and taper. Average log diameters vary by region and have declined in the western USA due to the growing scarcity of large diameter, old-growth trees. Such a systematic reduction in size in the log population affects volume conversions from cubic units to board feet, which makes traditional rule of thumb conversion factors antiquated. In this paper, we present an improved empirical method for performing cubic volume to board foot conversion.
NTIS
Estimates; Populations; Wood

20040071094 Lawrence Livermore National Lab., Livermore, CA
Multivariate Clustering of Large-Scale Scientific Simulation Data
Eliassi-Rad, T.; Critchlow, T.; Jun. 13, 2003; In English
Report No.(s): DE2004-15005754; UCRL-JC-153698; No Copyright; Avail: National Technical Information Service (NTIS)
Simulations of complex scientific phenomena involve the execution of massively parallel computer programs. These simulation programs generate large-scale data sets over the spatio-temporal space. Modeling such massive data sets is an essential step in helping scientists discover new information from their computer simulations. In this paper, we present a simple but effective multivariate clustering algorithm for large-scale scientific simulation data sets. Our algorithm utilizes the cosine similarity measure to cluster the field variables in a data set. Field variables include all variables except the spatial (x, y, z) and temporal (time) variables. The exclusion of the spatial dimensions is important since 'similar' characteristics could be located (spatially) far from each other. To scale our multivariate clustering algorithm for large-scale data sets, we take advantage of the geometrical properties of the cosine similarity measure. This allows us to reduce the modeling time from O(n(sup 2)) to O(n x g(f(u))), where n is the number of data points, f(u) is a function of the user-defined clustering threshold, and g(f(u)) is the number of data points satisfying f(u). We show that on average g(f(u)) is much less than n. Finally, even though spatial variables do not play a role in building clusters, it is desirable to associate each cluster with its correct spatial region. To achieve this, we present a linking algorithm for connecting each cluster to the appropriate nodes of the data set's topology tree (where the spatial information of the data set is stored). Our experimental evaluations on two large-scale simulation data sets illustrate the value of our multivariate clustering and linking algorithms.
NTIS
Algorithms; Data Simulation

20040073487 NASA Langley Research Center, Hampton, VA, USA
Discontinuous Galerkin Finite Element Method for Parabolic Problems
Kaneko, Hideaki; Bey, Kim S.; Hou, Gene J. W.; [2004]; 19 pp.; In English
Contract(s)/Grant(s): NAG1-2300; NAG1-01092; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, we develop a time and its corresponding spatial discretization scheme, based upon the assumption of a certain weak singularity of parallel ut(t) parallel Lz(omega) = parallel ut parallel2, for the discontinuous Galerkin finite element method for one-dimensional parabolic problems. Optimal convergence rates in both time and spatial variables are obtained. A discussion of automatic time-step control method is also included.
Author
Finite Element Method; Galerkin Method; Discontinuity; Parabolic Differential Equations; Mathematical Models; Problem Solving

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20040068174 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
An Approach for Self-Timed Synchronous CMOS Circuit Design
Walker, Alvernon; Lala, Parag K.; May 17, 2001; 5 pp.; In English
Contract(s)/Grant(s): NAG5-7158; No Copyright; Avail: CASI; A01, Hardcopy

In this letter we present a timing and control strategy that can be used to realize synchronous systems with a level of performance that approaches that of asynchronous circuits or systems. This approach is based upon a single-phase synchronous circuit/system architecture with a variable period clock. The handshaking signals required for asynchronous self-timed circuits are not needed. Dynamic power supply current monitoring is used to generate the timing information, that is comparable to the completion signal found in self-timed circuits; this timing information is used to modi@ the circuit clock period. This letter is concluded with an example of the proposed approach applied to a static CMOS ripple-carry adder.
Author
Architecture (Computers); Circuits; Clocks; Time Synchronization; Time

20040068175 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
A Step Response Based Mixed-Signal BIST Approach for Continuous-time Linear Circuits
Walker, Alvernon; Lala, P. K.; May 17, 2001; 7 pp.; In English
Contract(s)/Grant(s): NAG5-7158; No Copyright; Avail: CASI; A02, Hardcopy

A new Mixed-Signal Built-in self-test approach that is based upon the step response of a reconfigurable (or multifunction) analog block is presented in this paper. The technique requires the overlapping step response of the Circuit Under Test (CUT) for two circuit configurations. Each configuration can be realized by changing the topology of the CUT or by sampling two CUT nodes with differing step responses. The technique can effectively detect both soft and hard faults and does not require an analog-to-digital converter (ADC) and/or digital-to-analog converter(DAC). It also does not require any precision voltage sources or comparators. This approach does not require any additional analog circuits to realize the test signal generator and sample circuits. The paper is concluded with the application of the proposed approach to a circuit found in the work of Epstein et al and two ITC 97 analog benchmark circuits.
Author
Analog Circuits; Electronic Equipment Tests; Fault Detection; Reliability Engineering; Self Tests

20040068176 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
A Step Response Based Mixed-Signal BIST Approach
Walker, Alvernon; May 17, 2001; 10 pp.; In English
Contract(s)/Grant(s): NAG5-7158; No Copyright; Avail: CASI; A02, Hardcopy

A new Mixed-Signal Built-in Self-test approach that is based upon the step response of a reconfigurable (or multifunction) analog block is presented in this paper. The technique requires the overlapping step response of the Circuit Under Test (CUT) for two circuit configurations. Each configuration can be realized by changing the topology of the CUT or by sampling two CUT nodes with differing step responses. The technique can effectively detect both soft and hard faults and does not require an analog-to-digital converter (ADC) and/or digital-to-analog converter(DAC). It also does not require any precision voltage sources or comparators. The approach does not require any additional analog circuits to realize the test signal generator and a two input analog multiplexer for CUT test node sampling. The paper is concluded with the application of the proposed

approach to a circuit found in the work of Epstein et a1 and two ITC 97 analog benchmark circuits.
Author
Analog Circuits; Electronic Equipment Tests; Self Tests

20040073510 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Technology Development: Solid-Liquid Interface Characterization Hardware
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 10; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Characterizing the solid-liquid interface during directional solidification is key to understanding and improving material properties. The goal of this Advanced Technology Development (ATD) has been to develop hardware, which will enable real-time characterization of practical materials, such as aluminum (Al) alloys, to unprecedented levels. Required measurements include furnace and sample temperature gradients, undercooling at the growing interface, interface shape, or morphology, and furnace translation and sample growth rates (related). These and other parameters are correlated with each other and time. A major challenge was to design and develop all of the necessary hardware to measure the characteristics, nearly simultaneously, in a smaller integral furnace compatible with existing X-ray Transmission Microscopes, XTMs. Most of the desired goals have been accomplished through three generations of Seebeck furnace brassboards, several varieties of film thermocouple arrays, heaters, thermal modeling of the furnaces, and data acquisition and control (DAC) software. Presentations and publications have resulted from these activities, and proposals to use this hardware for further materials studies have been submitted as sequels to this last year of the ATD.
Author
Data Acquisition; Directional Solidification (Crystals); Aluminum Alloys; Real Time Operation; Temperature Gradients; Supercooling

20040073552 Naval Postgraduate School, Monterey, CA
An Investigation of Wireless Solutions for the "Last Mile"
Varlas, Antonios K.; Mar. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422339; No Copyright; Avail: CASI; A06, Hardcopy

The need for broadband network access is experiencing rapid growth, but what is currently available is not sufficient. Copper-based technologies cannot address the requirements of today's bandwidth-intensive Internet applications. End-users in the "last mile" demand access speeds equivalent to those supported by fiber optics backbone networks, although, the cost and time associated with its installation are prohibitive factors for bringing fiber to every home and business. This results in the well-known "last mile access problem," which prevents the Inteinet from reaching its full potential, and has paved the way for the development of many innovative technologies. Driven by demands for more bandwidth, wireless broadband technologies have been proposed.
DTIC
Local Area Networks; Wireless Communication

20040073608 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
MSSMP: No Place to Hide
Murphy, D. W.; Bott, J. P.; Bryan, W. D.; Coleman, J. L.; Cage, D. W.; Jun. 1997; 11 pp.; In English
Report No.(s): AD-A422478; No Copyright; Avail: CASI; A03, Hardcopy

The Multipurpose Security and Surveillance Mission Platform (MSSMP) system is a distributed network of remote sensors mounted on vertical-takeoff-and-landing (VTOL) mobility platforms plus portable control stations. The system is designed to provide a rapidly deployable extended-range surveillance capability for a wide variety of security operations and other tactical missions. While MSSMP sensor packages can be deployed on many types of mobility platforms, initial system demonstrations have used a Sikorsky Cypher VTOL unmanned aircraft as well as a portable sensor unit In January 1997 the MSSMP system was demonstrated at the Military Operations in Urban Terrain facility at Ft. Benning GA flying down city streets looking through lower- and upper-story windows ahead of advancing troops and performing observations after landing on the roof of a two story building. The MSSMP system makes maximum use of commercial off-the-shelf (COTS) subsystem-level components for sensing processing and communications and of both established and emerging standard communications networking protocols and system integration techniques. This paper will (1) discuss the technical issues involved in focusing these elements to produce a system architecture that can flexibly support the range of configurations needed to address a wide

variety of applications while facilitating the ongoing integration of new technology COTS components and (2) present the results of recent user evaluations.
DTIC
Architecture (Computers)

20040073619 Space and Naval Warfare Systems Center, San Diego, CA
Early User Appraisal of the MDARS Interior Robot
Laird, R. T.; Everett, H. R.; Gilbreath, G. A.; Inderieden, R. S.; Apr. 1999; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422496; No Copyright; Avail: CASI; A03, Hardcopy

The Mobile Detection Assessment Response System (MDARS) is a joint Army-Navy effort to field interior and exterior autonomous platforms for security and inventory assessment functions at DoD warehouses and storage sites. The MDARS operator interface (host console) is based upon the Multiple Resource Host Architecture (MRHA), a distributed processing system that allows coordinated control of multiple autonomous resources. The current configuration provides control for up to 32 interior and/or exterior robotic vehicles, with provision for near-term integration of remote fixed sensors or sensor pods. The MDARS-Interior (MDARS-I) effort, initiated in 1989 to improve the effectiveness of a shrinking guard force, was quickly expanded to address the intensive manpower requirements associated with accounting for high- dollar and critical assets. An integral component of the MRHA is the Product Assessment System, which extends the capabilities of MDARS into automated inventory management. The robotic platforms are equipped with an RF interrogator for reading interactive transponder tags attached to high-value or critical inventory items. Upon interrogation by the robot, individual tags respond with the stock number and any other relevant information concerning the product. The data collected is stored in a database for comparison with expected conditions, and any discrepancies subsequently flagged by geographic location for investigation. In 1995, a Broad Agency Announcement (BAA) contract was awarded to Cybermotion, Inc., of Roanoke, VA, to expand upon the government-developed interior prototype by adding improved navigation, extended intrusion detection, and RF interrogation of inventory. The upgraded platform passed formal Technical Feasibility Testing with flying colors in February 1997. This paper provides an overview of the MDARS-I robotic security system, some insights into the problems associated with installation, and a first assessment of lessons learned.
DTIC
Detection; Robotics; Robots; Warning Systems

20040073806 Massachusetts Inst. of Tech., Lexington, MA
Polymorphous Computing Architecture (PCA) Application Benchmark 1: Three-Dimensional Radar Data Processing
Lebak, J. M.; McMahon, J. S.; Arakawa, M.; Nov. 19, 2001; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A422824; ESC-TR-2003-075; DARPA-ESC-TR-2003-075; No Copyright; Avail: CASI; A03, Hardcopy

The DARPA Polymorphous Computing Architecture (PCA) program is building advanced computer architectures that can reorganize their computation and communication structures to achieve better overall application performance. As part of the PCA program, MIT Lincoln Laboratory has been asked to provide examples of defense-oriented applications that will challenge the candidate architectures. This report describes an example airborne radar data processing application. Several example application parameter sets are given that reflect the range of requirements spanned by current systems.
DTIC
Architecture (Computers); Data Processing; Polymorphism; Radar Data

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040068178 QSS Group, Inc., Moffett Field, CA, USA
A Generic Software Safety Document Generator
Denney, Ewen; Venkatesan, Ram Prasad; 2004; 15 pp.; In English; 10th International Conference on Algebraic Methodology And Software Technology (AMAST) 2004, 12-16 Jul. 2004, Sterling, UK; No Copyright; Avail: CASI; A03, Hardcopy

Formal certification is based on the idea that a mathematical proof of some property of a piece of software can be regarded

as a certificate of correctness which, in principle, can be subjected to external scrutiny. In practice, however, proofs themselves are unlikely to be of much interest to engineers. Nevertheless, it is possible to use the information obtained from a mathematical analysis of software to produce a detailed textual justification of correctness. In this paper, we describe an approach to generating textual explanations from automatically generated proofs of program safety, where the proofs are of compliance with an explicit safety policy that can be varied. Key to this is tracing proof obligations back to the program, and we describe a tool which implements this to certify code auto-generated by AutoBayes and AutoFilter, program synthesis systems under development at the NASA Ames Research Center. Our approach is a step towards combining formal certification with traditional certification methods.
Author
Computer Programs; Theorem Proving

20040068183 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
3D Surface Reconstruction and Automatic Camera Calibration
Jalobeanu, Andre; 2004; 23 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Illustrations in this view-graph presentation are presented on a Bayesian approach to 3D surface reconstruction and camera calibration.Existing methods, surface analysis and modeling,preliminary surface reconstruction results, and potential applications are addressed.
Derived from text
Three Dimensional Models; Topography

20040068289 NASA Ames Research Center, Moffett Field, CA, USA, Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Assume-Guarantee Verification of Source Code with Design-Level Assumptions
Giannakopoulou, Dimitra; Pasareanu, Corina S.; Cobleigh, Jamieson M.; [2004]; 10 pp.; In English; 26th International Conference on Software Engineering, May 2004, Scotland, UK; Copyright; Avail: CASI; A02, Hardcopy

Model checking is an automated technique that can be used to determine whether a system satisfies certain required properties. To address the 'state explosion' problem associated with this technique, we propose to integrate assume-guarantee verification at different phases of system development. During design, developers build abstract behavioral models of the system components and use them to establish key properties of the system. To increase the scalability of model checking at this level, we have developed techniques that automatically decompose the verification task by generating component assumptions for the properties to hold. The design-level artifacts are subsequently used to guide the implementation of the system, but also to enable more efficient reasoning at the source code-level. In particular we propose to use design-level assumptions to similarly decompose the verification of the actual system implementation. We demonstrate our approach on a significant NASA application, where design-level models were used to identify; and correct a safety property violation, and design-level assumptions allowed us to check successfully that the property was presented by the implementation.
Author
Program Verification (Computers); Source Programs

20040070712 NASA Ames Research Center, Moffett Field, CA, USA
Role of HPC in Advancing Computational Aeroelasticity
Guruswamy, Guru P.; February 17, 2004; 21 pp.; In English; HPCMP Users Group Meeting, Jun. 2004, Williamsburg, VA, USA; No Copyright; Avail: CASI; A03, Hardcopy

On behalf of the High Performance Computing and Modernization Program (HPCMP) and NASA Advanced Supercomputing Division (NAS) a study is conducted to assess the role of supercomputers on computational aeroelasticity of aerospace vehicles. The study is mostly based on the responses to a web based questionnaire that was designed to capture the nuances of high performance computational aeroelasticity, particularly on parallel computers. A procedure is presented to assign a fidelity-complexity index to each application. Case studies based on major applications using HPCMP resources are presented.
Author
Aeroelasticity; Parallel Computers; Supercomputers

20040070714 NASA Ames Research Center, Moffett Field, CA, USA

Debris Dispersion Model Using Java 3D

Thirumalainambi, Rajkumar; Bardina, Jorge; 2004; 6 pp.; In English; ESM 2004, 18th European Simulation Multi-Conference, 2004, Magdeburg, Germany; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes web based simulation of Shuttle launch operations and debris dispersion. Java 3D graphics provides geometric and visual content with suitable mathematical model and behaviors of Shuttle launch. Because the model is so heterogeneous and interrelated with various factors, 3D graphics combined with physical models provides mechanisms to understand the complexity of launch and range operations. The main focus in the modeling and simulation covers orbital dynamics and range safety. Range safety areas include destruct limit lines, telemetry and tracking and population risk near range. If there is an explosion of Shuttle during launch, debris dispersion is explained. The shuttle launch and range operations in this paper are discussed based on the operations from Kennedy Space Center, Florida, USA.

Author

Computerized Simulation; Spacecraft Launching; Mathematical Models; Debris

20040070754 PixSell, Inc., USA

Software for Viewing Landsat Mosaic Images

Watts, Jack; Farve, Catherine L.; Harvey, Craig; [2002]; 1 pp.; In English

Report No.(s): NASA/NP-2002-04-00015-SSC; SSC-00148; No Copyright; Avail: CASI; A01, Hardcopy

A Windows-based computer program has been written to enable novice users (especially educators and students) to view images of large areas of the Earth (e.g., the continental USA) generated from image data acquired in the Landsat observations performed circa the year 1990. The large-area images are constructed as mosaics from the original Landsat images, which were acquired in several wavelength bands and each of which spans an area (in effect, one tile of a mosaic) of 5 in latitude by approximately equal to 6 degrees in longitude. Whereas the original Landsat data are registered on a universal transverse Mercator (UTM) grid, the program converts the UTM coordinates of a mouse pointer in the image to latitude and longitude, which are continuously updated and displayed as the pointer is moved. The mosaic image currently on display can be exported as a Windows bit-map file. Other images (e.g., of state boundaries or interstate highways) can be overlaid on Landsat mosaics. The program interacts with the user via standard toolbar, keyboard, and mouse user interfaces. The program is supplied on a compact disk along with tutorial and educational information.

Author

Landsat Satellites; Mosaics; Computer Programs; Images

20040070755 Lockheed Martin Corp., USA, ABPI, USA

Software for Improved Extraction of Data From Tape Storage

Cheng, Chiu-Fu; May 10, 2002; 1 pp.; In English

Report No.(s): NASA/NP-2002-12-00042-SSC; SSC-00156; No Copyright; Avail: CASI; A01, Hardcopy

A computer program has been written to replace the original software of Racal Storeplex Delta tape recorders, which are still used at Stennis Space Center but have been discontinued by the manufacturer. Whereas the original software could be activated by a command-line interface only, the present software offers the option of a command-line or graphical user interface. The present software also offers the option of batch-file operation (activation by a file that contains command lines for operations performed consecutively). The present software is also more reliable than was the original software: The original software was plagued by several deficiencies that made it difficult to execute, modify, and test. In addition, when using the original software to extract data that had been recorded within specified intervals of time, the resolution with which one could control starting and stopping times was no finer than about a second (or, in some cases, several seconds). In contrast, the present software is capable of controlling playback times to within 1/100 second of times specified by the user, assuming that the tape-recorder clock is accurate to within 1/100 second.

Derived from text

Computer Programs; Data Storage; Extraction

20040070769 Associated Business Publications International, USA

Software for Simulating Remote Sensing Systems

Zanoni, Vicki; Ryan, Robert; Blonski, Slawomir; Russell, Jeffrey; Gasser, Gerald; Greer, Randall; April 08, 2003; 1 pp.; In English

Report No.(s): NASA/NP-2003-08-00033-SSC; SSC-00181-SM; No Copyright; Avail: CASI; A01, Hardcopy

The Application Research Toolbox (ART) is a collection of computer programs that implement algorithms and mathematical models for simulating remote sensing systems. The ART is intended to be especially useful for performing design-tradeoff studies and statistical analyses to support the rational development of design requirements for multispectral imaging systems. Among other things, the ART affords a capability to synthesize coarser-spatial-resolution image-data sets from finer-spatial-resolution data sets and multispectral-image-data products from hyperspectral-image-data products. The ART also provides for synthesis of image-degradation effects, including point-spread functions, misregistration of spectral images, and noise. The ART can utilize real or synthetic data sets, along with sensor specifications, to create simulated data sets. In one example of a typical application, simulated data pertaining to an existing multispectral sensor system are used to verify the data collected by the system in operation. In the case of a proposed sensor system, the simulated data can be used to conduct trade studies and statistical analyses to ensure that the sensor system will satisfy the requirements of potential scientific, academic, and commercial user communities.
Author
Computer Programs; Remote Sensing; Simulation; White Noise; Statistical Analysis; Imaging Techniques

20040070774 Computational Physics, Inc., Springfield, VA, USA
Enhancements to and Applications with the "Unified" Long-Term PSC Database
Fromm, Michael; Alfred, Jerome; [2004]; 9 pp.; In English
Contract(s)/Grant(s): NNH04C13C
Report No.(s): Quarterly-Report-1; No Copyright; Avail: CASI; A02, Hardcopy
This report summaries the project team's activity during the period 1 January - 31 March 2004. It consists of a project plan, which was completed during this period and an indication of the completion status of each phase of the project. The intention of the investigative team is to closely follow the statement of work documented in our proposal. For this reason, the proposal may be referenced in this and upcoming status reports. This project got underway in this quarter. Our activity was to formulate a project plan and to engage in planning meetings with collaborators.
Author
Data Bases; Project Planning; Aerosols

20040070777 NASA Langley Research Center, Hampton, VA, USA
WAMI: A Menu-Driven Computer Program for the Estimation of Weight and Moments of Inertia of Earth-to-Orbit Transports
MacConochie, Ian O.; White, Nancy H.; Mills, Janelle C.; [2004]; 9 pp.; In English; 63rd Annual Conference of Society of Allied Weight Engineers, Inc., 17-19 May 2004, Newport Beach, CA, USA
Report No.(s): SAWE Paper-3329; Copyright; Avail: CASI; A02, Hardcopy
A program, entitled Weights, Areas, and Mass Properties (or WAMI) is centered around an array of menus that contain constants that can be used in various mass estimating relationships for the ultimate purpose of obtaining the mass properties of Earth-to-Orbit Transports. The current Shuttle mass property data was relied upon heavily for baseline equation constant values from which other options were derived.
Author
Computer Programs; Weight (Mass); Data Bases

20040070897 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Software Manages Documentation in a Large Test Facility
Gurneck, Joseph M.; June 21, 2001; 1 pp.; In English
Report No.(s): SE-SSC-00122-SM; SE-2001-07-00034-SSC; No Copyright; Avail: CASI; A01, Hardcopy
The 3MCS computer program assists and instrumentation engineer in performing the 3 essential functions of design, documentation, and configuration management of measurement and control systems in a large test facility. Services provided by 3MCS are acceptance of input from multiple engineers and technicians working at multiple locations;standardization of drawings;automated cross-referencing; identification of errors;listing of components and resources; downloading of test settings; and provision of information to customers.
Author
Computer Programs; Propulsion

20040070937 NASA Langley Research Center, Hampton, VA, USA
Future Air Traffic Growth and Schedule Model User's Guide
Kimmel, William M., Technical Monitor; Smith, Jeremy C.; Dollyhigh, Samuel M.; May 2004; 26 pp.; In English
Contract(s)/Grant(s): NAS1-00135; WU 23-762-45-E2
Report No.(s): NASA/CR-2004-213027; No Copyright; Avail: CASI; A03, Hardcopy

The Future Air Traffic Growth and Schedule Model was developed as an implementation of the Fratar algorithm to project future traffic flow between airports in a system and of then scheduling the additional flights to reflect current passenger time-of-travel preferences. The methodology produces an unconstrained future schedule from a current (or baseline) schedule and the airport operations growth rates. As an example of the use of the model, future schedules are projected for 2010 and 2022 for all flights arriving at, departing from, or flying between all continental USA airports that had commercial scheduled service for May 17, 2002. Inter-continental US traffic and airports are included and the traffic is also grown with the Fratar methodology to account for their arrivals and departures to the continental US airports. Input data sets derived from the Official Airline Guide (OAG) data and FAA Terminal Area Forecast (TAF) are included in the examples of the computer code execution.
Author
Air Traffic; Airline Operations; Algorithms; Computer Programs

20040071074 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Software for Estimating Costs of Testing Rocket Engines
Hines, Merlon M.; January 2004; 1 pp.; In English
Report No.(s): NASA/NP-2002-06-00024; SSC-00154; No Copyright; Avail: CASI; A01, Hardcopy

A high-level parametric mathematical model for estimating the costs of testing rocket engines and components at Stennis Space Center has been implemented as a Microsoft Excel program that generates multiple spreadsheets. The model and the program are both denoted, simply, the Cost Estimating Model (CEM). The inputs to the CEM are the parameters that describe particular tests, including test types (component or engine test), numbers and duration of tests, thrust levels, and other parameters. The CEM estimates anticipated total project costs for a specific test. Estimates are broken down into testing categories based on a work-breakdown structure and a cost-element structure. A notable historical assumption incorporated into the CEM is that total labor times depend mainly on thrust levels. As a result of a recent modification of the CEM to increase the accuracy of predicted labor times, the dependence of labor time on thrust level is now embodied in third- and fourth-order polynomials.
Author
Mathematical Models; Program Verification (Computers); Computer Programs; Cost Estimates; Engine Tests

20040071079 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Corp., Bay Saint Louis, MS, USA
Software Assists in Extensive Environmental Auditing
Callac, Christopher; Matherne, Charlie; Selinsky, T.; September 26, 2002; 1 pp.; In English
Report No.(s): NASA/NP-2002-10-00039; SSC-00180; No Copyright; Avail: CASI; A01, Hardcopy

The Base Environmental Management System (BEMS) is a Web-based application program for managing and tracking audits by the Environmental Office of Stennis Space Center in conformity with standard 14001 of the International Organization for Standardization (ISO 14001). (This standard specifies requirements for an environmental-management system.) BEMS saves time by partly automating what were previously manual processes for creating audit checklists; recording and tracking audit results; issuing, tracking, and implementing corrective-action requests (CARs); tracking continuous improvements (CIs); and tracking audit results and statistics. BEMS consists of an administration module and an auditor module. As its name suggests, the administration module is used to administer the audit. It helps administrators to edit the list of audit questions; edit the list of audit locations; assign mandatory questions to locations; track, approve, and edit CARs; and edit completed audits. The auditor module is used by auditors to perform audits and record audit results: it helps the auditors to create audit checklists, complete audits, view completed audits, create CARs, record and acknowledge CIs, and generate reports from audit results.
Author
Environment Management; Management Systems; Computer Programs

20040071080 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Software for Partly Automated Recognition of Targets
Opitz, David; Blundell, Stuart; Bain, William; Morris, Matthew; Carlson, Ian; Mangrich, Mark; Selinsky, T.; Aug. 7, 2002; 2 pp.; In English
Report No.(s): NASA/NP-2003-01-00045; SSC-00166; No Copyright; Avail: CASI; A01, Hardcopy

The Feature Analyst is a computer program for assisted (partially automated) recognition of targets in images. This program was developed to accelerate the processing of high-resolution satellite image data for incorporation into geographic information systems (GIS). This program creates an advanced user interface that embeds proprietary machine-learning algorithms in commercial image-processing and GIS software. A human analyst provides samples of target features from multiple sets of data, then the software develops a data-fusion model that automatically extracts the remaining features from selected sets of data. The program thus leverages the natural ability of humans to recognize objects in complex scenes, without requiring the user to explain the human visual recognition process by means of lengthy software. Two major subprograms are the reactive agent and the thinking agent. The reactive agent strives to quickly learn the user's tendencies while the user is selecting targets and to increase the user's productivity by immediately suggesting the next set of pixels that the user may wish to select. The thinking agent utilizes all available resources, taking as much time as needed, to produce the most accurate autonomous feature-extraction model possible.
Author
Computer Programs; Target Recognition; Pattern Recognition

20040071096 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Spectral Sciences, Inc., Burlington, MA, USA
Software for Simulation of Hyperspectral Images
Richtsmeier, Steven C.; Singer-Berk, Alexander; Bernstein, Lawrence S.; [2003]; 1 pp.; In English
Report No.(s): NASA/NP-2003-09-00039-SSC; SSC-00183; No Copyright; Avail: Other Sources; Abstract Only

A package of software generates simulated hyperspectral images for use in validating algorithms that generate estimates of Earth-surface spectral reflectance from hyperspectral images acquired by airborne and spaceborne instruments. This software is based on a direct simulation Monte Carlo approach for modeling three-dimensional atmospheric radiative transport as well as surfaces characterized by spatially inhomogeneous bidirectional reflectance distribution functions. In this approach, "ground truth" is accurately known through input specification of surface and atmospheric properties, and it is practical to consider wide variations of these properties. The software can treat both land and ocean surfaces and the effects of finite clouds with surface shadowing. The spectral/spatial data cubes computed by use of this software can serve both as a substitute for and a supplement to field validation data.
Author
Computerized Simulation; Spectral Reflectance; Surface Properties; Meteorological Parameters; Emission Spectra

20040071110 Pennsylvania State Univ., University Park, PA, USA
Optimal Discrete Event Supervisory Control of Aircraft Gas Turbine Engines
Litt, Jonathan, Technical Monitor; Ray, Asok; [2004]; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-01-10646; NAG3-2448; NNC04GA49G; No Copyright; Avail: CASI; A02, Hardcopy

This report presents an application of the recently developed theory of optimal Discrete Event Supervisory (DES) control that is based on a signed real measure of regular languages. The DES control techniques are validated on an aircraft gas turbine engine simulation test bed. The test bed is implemented on a networked computer system in which two computers operate in the client-server mode. Several DES controllers have been tested for engine performance and reliability.
Author
Optimal Control; Gas Turbine Engines; Control Systems Design; Computer Programs

20040073483 NASA Glenn Research Center, Cleveland, OH, USA
Development of a Solid-Oxide Fuel Cell/Gas Turbine Hybrid System Model for Aerospace Applications
Freeh, Joshua E.; Pratt, Joseph W.; Brouwer, Jacob; May 2004; 16 pp.; In English; Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria
Report No.(s): NASA/TM-2004-213054; GT2004-53616; E-14490; No Copyright; Avail: CASI; A03, Hardcopy

Recent interest in fuel cell-gas turbine hybrid applications for the aerospace industry has led to the need for accurate computer simulation models to aid in system design and performance evaluation. To meet this requirement, solid oxide fuel cell (SOFC) and fuel processor models have been developed and incorporated into the Numerical Propulsion Systems

Simulation (NPSS) software package. The SOFC and reformer models solve systems of equations governing steady-state performance using common theoretical and semi-empirical terms. An example hybrid configuration is presented that demonstrates the new capability as well as the interaction with pre-existing gas turbine and heat exchanger models. Finally, a comparison of calculated SOFC performance with experimental data is presented to demonstrate model validity. Keywords: Solid Oxide Fuel Cell, Reformer, System Model, Aerospace, Hybrid System, NPSS
Author
Solid Oxide Fuel Cells; Systems Engineering; Models; Hybrid Structures; Gas Turbines; Applications Programs (Computers); Aircraft Fuels

20040073530 Survivability/Vulnerability Information Analysis Center, Wright-Patterson AFB, OH
JLF Standard Characterization of Foreign Ammunition (SCOFA)
Yee, Alfred; Kennedy, Kelly; Sep. 18, 2002; 4 pp.; In English
Contract(s)/Grant(s): SPO700-96-D-4000; Proj-TAT-01-10
Report No.(s): AD-A412985; No Copyright; Avail: CASI; A01, Hardcopy

SCOFA developed as a result of the information needs of organizations involved in using ammunition characterization data as critical input for planning and preparing JLF/LFT&E testing as well as for vulnerability/lethality modeling in support of LFT&E and design. SCOFA has evolved to include documentation on blue, gray, and red projectile characterization data in a format acceptable for use in vulnerability/lethality analysis codes and characterization data resulting from target testing to better understand behavior for subsequent asset testing.
DTIC
Ammunition; Data Processing

20040073541 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven
Design and Evaluation of a Multi-Robot Control Interface
Trouvain, B.; Wolf, H. L.; Oct. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422306; No Copyright; Avail: CASI; A03, Hardcopy

Designing a human-machine interface for a semi- autonomous, mobile, multi-robot system is a challenging task. The requirements include operating in a real-time environment, facilitating asynchronous command execution, and supporting the operator in dividing his or her monitoring and control resources among multiple robots. This paper presents the results of two simulation-based, multi-robot experiments that were conducted to guide and support the development of a multi- robot control interface. The experiments were designed around a simple mission-independent task of navigating robots towards goal points. While working with an identical setup, the two experiments differed in the level of autonomy provided by the robots. In the first experiment, the robots' navigational capabilities were realized by a simple line-of-sight algorithm requiring the operator to explicitly specify a path. In the second experiment, a more elaborate path generation algorithm was used, reducing the operator's activity to the selection of a goal point. In separate trials, operators had to manage 2, 4, and 8 robots in the two different environments. Robot autonomy represents a requirement for a multi-robot system managed by a single operator. Understanding the impact of varying levels of robot autonomy on operator performance is important for the interface design process. (9 figures, 15 refs.)
DTIC
Human Performance; Human-Computer Interface; Man Machine Systems; Operators (Personnel); Robot Control; Robots

20040073550 Naval Postgraduate School, Monterey, CA
Speech Recognition Software; An Alternative to Reduce Ship Control Manning
Kuffel, Robert F.; Mar. 2004; 62 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422331; No Copyright; Avail: CASI; A04, Hardcopy

This study identifies factors affecting the performance of commercial-off-the-shelf speech recognition software (SRS) when used for ship control purposes. After a review of research in the feasibility and acceptability of SRS- based ship control, the paper examines the effects of: * A restricted vocabulary versus a large vocabulary, * Low experience level conning officers versus high experience level conning officers, * Male versus female voices, * Pre-test training on specific words versus no pre-test training. Controlled experimentation finds that: * The experience level of a conning officer has no significant impact on SRS performance. * Female participants experienced more SRS errors than did their male counterparts. However, in this experiment, only a limited number of trials were available to assess a difference. * SRS with restricted vocabulary performs no better than SRS with large vocabularies. * Using the software "correct as you go" feature may impact software

performance. Following the user profile establishment, individual user training on two specific words reduces error rates significantly.
DTIC
Computer Programs; Ships; Speech Recognition

20040073551 Naval Postgraduate School, Monterey, CA
Reed-Muller Codes in Error Correction in Wireless Adhoc Networks
Tezeren, Serdar U.; Mar. 2004; 153 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422336; No Copyright; Avail: CASI; A08, Hardcopy

The IEEE 802,11a standard uses a coded orthogonal frequency division multi-plexing (COFDM) scheme in the 5-GHz band to support data rates up to 54 Mbps The COFDM was chosen because of its robustness to multipath fading affects, In the standard, convolutional codes are used for error connection, This thesis examines the performance of the COFDM system with variable rate Reed-Muller (RM) error correction codes with a goal to reduce the peak-to-average power ratio (PAPR), Contrary to the expectations, RM codes did not provide expected improvement in PAPR reduction, Peak clipping and Hanning windowing techniques were investigated in order to reduce the PAPR, The results indicate that a tradeoff exists between the PAPR and the bit-error rate (PER) performance. Although peak clipping yielded considerable reduction in PAPR, it required high signal-to-noise ratios, On the other hand, Hanning windowing provided only a small reduction in PAPR with reasonable PER performance.
DTIC
Error Analysis; Error Correcting Codes; Multipath Transmission; Signal to Noise Ratios

20040073557 Naval Postgraduate School, Monterey, CA
Performance Analysis of the Effect of Pulsed-Noise Interference on WLAN signals Transmitted Over a Nakagami Fading Channel
Tsoumanis, Andreas; Mar. 2004; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422351; No Copyright; Avail: CASI; A05, Hardcopy

This thesis examines the performance of wireless local area network (WLAN) signals, specifically, the signal of IEEE 802,1 la standard, The signal is subject to pulsed noise jamming, when either the desired signal alone or the desired signal and the jamming signal are subject to Nakagami fading, As expected, the implementation of forward error correction (FEC) coding with soft decision decoding (SDD) and maximum- likelihood detection improves performance as compared to uncoded signals, In addition, the combination of maximum- likelihood detection and error connection coding renders pulsed-noise jamming ineffective as compared to bandage noise jamming, When the jamming signal encounters fading as well, we assume that the average jamming power is much greater than the AWGN power, For uncoded signals, a jamming signal that experiences fading actually improves performance when the parameter of the information signal m(s) is less than or equal to one, Surprisingly, for larger values of m(s) a jamming signal that experiences fading works in favor of the information signal only for small signal-to- interference ratio (SIR), When SIR is large, performance when the jamming signal experiences fading is worse relative to performance when the jamming signal does not experience fading, For error correction coding with SDD, we investigate only continuous jamming since it is by far the worst-case, Moreover, while we consider a range of fading conditions for the jamming signal, we examine only Rayleigh fading of the information signal, The coded signal, when the jamming signal experiences severe fading, performs better relative to the case when the jamming signal does not experience fading,
DTIC
Electromagnetic Radiation; Error Correcting Codes; Fading; Jamming; Reliability Analysis; Signal to Noise Ratios; Transmitters

20040073566 Naval Postgraduate School, Monterey, CA
Using Agent-Based Modeling to Examine the Logistical Chain of the Seabase
Milton, Rebecca M.; Mar. 2004; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422379; No Copyright; Avail: CASI; A05, Hardcopy

This thesis examines a 2015 Marine Expeditionary Brigade scheme of maneuver as the baseline scenario for a commercial logistics support software program called SEAWAY, Modifications to this scenario are conducted using a designed experiment in order to explore how the plan characteristics relate to eleven specified input factors, Multiple regression analysis is used to fit models to the resulting data for three different measures of performance: Total Aircraft Sorties, Total Aircraft Sortie Time

and Total Aircraft Tons, The results suggest the plan performance is predicted well by a small subset of the factors and their interactions, One implication of this work is a better understanding of which factors are key determinants of the plan characteristics for variations on this specific base scenario, By using these fitted models, the number of SEAWAY runs needed to identify acceptable plans should decrease dramatically, The approach in this thesis provides a blueprint for similar analyses of other scenarios by demonstrating how information gained from models fit during an exploration phase might allow the logistician to quickly determine factor settings that yield an acceptable plan once details of an operation become available, Finally, working with the SEAWAY developers provided them with some new insights,
DTIC
Computer Programs; Logistics

20040073568 Naval Postgraduate School, Monterey, CA
Predicting Catastrophic BGP Routing Instabilities
Nguyen, Lien K.; Mar. 2004; 171 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422383; No Copyright; Avail: CASI; A08, Hardcopy

Inter-domain routing connects individual pieces of Internet topology, creating an integral, global data delivery infrastructure. Currently, this critical function is performed by the Border Gateway Protocol (BGP) version 4 RF01771. Like all routing protocols, BGP is vulnerable to instabilities that reduce its effectiveness. Among the causes of these instabilities are those which are maliciously induced. Although there are other causes, e.g., natural events and network anomalies, this thesis will focus exclusively on maliciously induced instabilities. Most current models that attempt to predict a BGP routing instability confine their focus to either macro- or micro-level metrics, but not to both. The inherent limitations of each of these forms of metric gives rise to an excessive rate of spurious alerts, both false positives and false negatives. It is the original intent of this thesis to develop an improved BGP instability prediction model by statistically combining BGP instability metrics with user level performance metrics. The motivation for such a model is twofold. 1) To provide sufficient prior warning of impending failure to facilitate proactive protection measures. 2) To improve warning reliability beyond existing models, by demonstrably reducing both false positives and false negatives. However, our analysis of actual network trace data shows that a widely used BGP instability metric, the total number of update messages received in a time period, is not a good indicator of future user level performance.
DTIC
Computer Networks; Internets; Predictions; Protocol (Computers); Stability

20040073577 Naval Postgraduate School, Monterey, CA
Denial of Service Attacks on 802.1X Security Protocol
Ozan, Orhan; Mar. 2004; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422412; No Copyright; Avail: CASI; A07, Hardcopy

Wireless Local Area Networks (WLANs) are quickly becoming popular in daily life. Users are adopting the latest technology to save time and costs. In addition, WLANs are providing high-speed network access to the users. There are security concerns with WLANs that must be considered when deploying them over critical infrastructure, such as military and administrative government LANs. The IEEE 802.11 wireless standard specifies both an authentication service and encryption protocol, but research has demonstrated that these protocols are severely flawed. The IEEE has established a new work group, the IEEE 802. 11i, to address all the security vulnerabilities of the 802.11 security protocol. The work group proposed using the IEEE 802. 1X Port-Based Network Access Control Standard as an interim measure to meet the security requirements of the WLANs and to maintain the confidentiality, authenticity, and availability of the data until the work group is finished with the new specifications. Using an open-source test-bed for evaluating DoS attacks on WLANs, this research demonstrates four different DoS attacks that verify the weaknesses of the IEEE 802. 1X protocol. Solutions are provided to mitigate the effects of such DoS attacks.
DTIC
Computer Information Security; Local Area Networks; Protocol (Computers); Security

20040073578 Naval Postgraduate School, Monterey, CA
Autonomous Agent-Based Simulation of a Model Simulating the Human Air-Threat Assessment Process
Ozkan, Baris E.; Mar. 2004; 120 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422415; No Copyright; Avail: CASI; A06, Hardcopy

The Air Defense Laboratory (ADL) Simulation is a software program that models the way an air-defense officer thinks

in the threat assessment process. The model uses multi- agent system (MAS) technology and is implemented in Java programming language. This research is a portion of Red Intent Project whose goal is to ultimately implement a model to predict the intent of any given track in the environment. For any air track in the simulation, two sets of agents are created, one for controlling track actions and one for predicting its identity and intent based on information received from track, the geopolitical situation and intelligence. The simulation is also capable of identifying coordinated actions between air tracks. We used three kinds of aircraft behavior in the simulation: civilian, friendly and enemy. Predictor agents are constructed in a layered structure and use "conceptual blending" in their decision-making processes using mental spaces and integration networks. Mental spaces are connected to each other via connectors and connecters trigger tickets. Connectors and Tickets were implemented using the Connector-based Multi Agent System (CMAS) library. This simulation is one of the first applications to use cognitive blending theory for a military application. We demonstrated that agents can create an "integration network" composed of mental spaces" and retrieve any mental space data inside the network immediately without traversing the entire network by using the CMAS library. The results of the tests of the simulation showed that the ADL Simulation can be used as assistant to human air-defense personnel to increase accuracy and decrease reaction time in naval air-threat assessment.
DTIC
Air Defense; Autonomy; Computer Programs; Simulation; Threat Evaluation

20040073579 Naval Postgraduate School, Monterey, CA
Integrating XML and RDF Concepts to Achieve Automation Within a Tactical Knowledge Management Environment
McCarty, George E., Jr; Mar. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422416; No Copyright; Avail: CASI; A06, Hardcopy

Since the advent of Naval Warfare, Tactical Knowledge Management (KM) has been critical to the success of the On Scene Commander. Today's Tactical Knowledge Manager typically operates in a high stressed environment with a multitude of knowledge sources including detailed sensor deployment plans, rules of engagement contingencies, and weapon delivery assignments. However the warfighter has placed a heavy reliance on delivering this data with traditional messaging processes while focusing on information organization vice knowledge management. This information oriented paradigm results in a continuation of data overload due to the manual intervention of human resources. Focusing on the data archiving aspect of information management overlooks the advantages of computational processing while delaying the empowerment of the processor as an automated decision making tool.
DTIC
Knowledge Based Systems; Programming Languages

20040073601 Naval Ocean Systems Center, San Diego, CA
Security Considerations for Autonomous Robots
Gage, Douglas W.; Jan. 1990; 6 pp.; In English
Report No.(s): AD-A422454; No Copyright; Avail: CASI; A02, Hardcopy

The security aspects of autonomous robots are analyzed by modeling a robot as a set of sensors, effectors, optional communications resources, and processing elements whose behavior is tightly coupled to be sensed characteristics of its environment. A simple taxonomy of potential generic threat types is presented, comprising both the possible direct external threat paths and the derived consequent internal threat states. Several generic countermeasure strategies are proposed.
DTIC
Autonomous Navigation; Autonomy; Robots; Security

20040073605 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Underwater Telerobotics and Virtual Reality: A New Technology Partnership
Murray, Steve; Murphy, Doug; Jun. 1986; 11 pp.; In English
Report No.(s): AD-A422460; No Copyright; Avail: CASI; A03, Hardcopy

Despite major advances in autonomous vehicle technologies, human-control led ROVs (remotely-operated vehicles) continue to fill an important role in underwater work. To perform effectively, however, the human operator requires meaningful cues for spatial orientation, good workspace visibility, and tight feedback about manipulator behavior. These needs can be hard to support in actual undersea operations. Telerobot designers for space missions have addressed these challenges by presenting a graphic, virtual reality model of the workspace to the operator, who then performs tasks on this representation of the actual work site. Real-time graphic modeling can (1) maintain a continuous, clear depiction of the workspace that is largely

independent of communications bandwidth, (2) allow arbitrary shading and perspective of the workspace, (3) provide integrated navigation and orienting cues, and (4) support a rich, multi- sensory feedback environment. The use of virtual reality technologies for operator interface design is being investigated at NCCOSC for undersea ROV applications. A general-purpose virtual reality testbed is described which involves a dedicated virtual reality system for underwater applications, together with a manipulator system and supporting software. The objectives of the testbed are to examine fundamental human performance and engineering issues connected with operating on a virtual workspace for real telerobotic tasks, and to benchmark emerging telerobotic technologies in a standardized test environment.
DTIC
Remotely Piloted Vehicles; Telerobotics

20040073614 Naval Postgraduate School, Monterey, CA
Design and Implementation of NFS for a Multilevel Secure System
Phan, Kandy Q.; Mar. 2004; 96 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422487; No Copyright; Avail: CASI; A05, Hardcopy

Popular software for high assurance systems is not readily available. Developers do not want to develop or port applications for secure systems because of the perception that high assurance development is too time consuming, in some cases impossible, and that performance is inadequate. This trend must be stopped by showing that if an intelligent approach to porting software is used, then the development costs will be acceptable. The network file system (NFS) service, which is a rather complex module that provides widely used functionality for file sharing, has been ported to the XTS-400 to show that a port can be completed in a timely manner and to assess the challenges of development for a multilevel system. Porting starts by analyzing the major requirements of the software and of the target system, and then proceeds to developing an approach for tackling the port. The hardest part of porting is the learning curve required to understand the target system and the software to be ported. Once this is accomplished, then porting becomes straightforward. Tests demonstrated that remote clients were able to access shared files on the NFS server. The XTS-400 now has the capability to share files through the popular NFS protocol.
DTIC
Computer Information Security; Computer Programming; Software Engineering

20040073623 Space and Naval Warfare Systems Center, San Diego, CA
Network Protocols for Mobile Robot Systems
Gage, Douglas W.; Oct. 1997; 13 pp.; In English
Report No.(s): AD-A422500; No Copyright; Avail: CASI; A03, Hardcopy

Communications and communications protocols will play an important role in mobile robot systems able to address real world applications. A poorly integrated "stack" of communications protocols, or protocols which are poorly matched to the functional and performance characteristics of the underlying physical communications links, can greatly reduce the effectiveness of an otherwise well implemented robotic or networked sensor system. The proliferation of Internet-like networks in military as well as civilian domains has motivated research to address some of the performance limitations TCP suffers when using FF and other media with long bandwidth-delay, dynamic connectivity and error-prone links. Beyond these performance issues, however, TCP is poorly matched to the requirements of mobile robot and other quasi- autonomous systems: it is oriented to providing a continuous data stream, rather than discrete messages, and the canonical "socket" interface conceals short losses of communications connectivity, but simply gives up and forces the Application layer software to deal with longer losses. For the Multipurpose Security and Surveillance Mission Platform (MSSMP) project, a software applique is being developed that will run on top of User Datagram Protocol (UDP) to provide a reliable message-based Transport service. In addition, a Session layer protocol is planned to support the effective transfer of control of multiple platforms among multiple control stations.
DTIC
Protocol (Computers); Robots

20040073631 Space and Naval Warfare Systems Center, San Diego, CA
Motion Based Target Acquisition and Evaluation in an Adaptive Machine Vision System
BLACKBURN, Michael R.; May 1995; 25 pp.; In English
Report No.(s): AD-A422512; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Computer Vision; Target Acquisition

20040073635 Engineering Research and Consulting, Inc., Edwards AFB, CA
Monitoring Micro-Structural Evolution and Crack Formation in a Solid Propellant Under Incremental Strain Condition-Using Digital Radiograph X-Ray Techniques
Liu, C. T.; Kylnn, Lee M.; Thompson, Jay D.; Mar. 2004; 11 pp.; In English
Contract(s)/Grant(s): F-4611-99-C-0025; Proj-2302
Report No.(s): AD-A422518; AFRL-PR-ED-VG-2004-049; No Copyright; Avail: CASI; A03, Hardcopy
Monitor Micro-Structure Evolution, Damage process, and Crack Formation in a Solid Propellant.
DTIC
Crack Initiation; Cracks; Digital Cameras; Digital Techniques; Microstructure; Radiography; Solid Propellants; X Rays

20040073662 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Low-Cost Miniature Interface and Control Systems for Smart Sensors, Tactical Radios, and Computer Networks
Martin, Brett; Bryan, Dale; Nov. 1995; 6 pp.; In English
Report No.(s): AD-A422547; No Copyright; Avail: CASI; A02, Hardcopy
Low-cost Commercial-Off-the-Shelf (COTS) hardware and software products can be used to build small control, processor and interface devices suitable for current and future tactical radio systems. For example, the input from video cameras, infrared imagers, acoustic transducers, proximity detectors, laser range finders, and other sensor input can be digitized, compressed, processed and transmitted via SINCGARS radios when a soldier presses a button. Tactical radios could also be connected to ethernet or telephone lines, and a radio could become a field-accessible email address, file server, or message bulletin board. These capabilities can be developed and fielded quickly for a very modest cost.
DTIC
Command and Control; Computer Networks; Intrusion; Low Cost; Miniaturization; Radio Equipment

20040073692 Secure Software Solutions, Fairfax, VA
Static Security Analysis for Open Source Software
Viega, John; Apr. 2004; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-C-0161; Proj-CHAT
Report No.(s): AD-A422592; AFRL-IF-RS-TR-2004-94; No Copyright; Avail: CASI; A03, Hardcopy
The goal of the project, Static Security Analysis for Open Source Software", was to explore technologies to improve the security of software by helping to automate security analysis. The project successfully improved upon the best published analysis techniques and made several releases publicly available as open source software. The analysis techniques developed under this effort reduce both false positives and false negatives compared to previous techniques. Additionally, the tools developed are highly scalable and extensible. Some of these tools were adopted by other projects within the DARPA Composable High Assurance Trusted Software Program.
DTIC
Computer Information Security; Security; Systems Analysis

20040073700 Honeywell ASC Labs., Minneapolis, MN
Skeptical Systems
Geib, Christopher W.; Mar. 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-02-C-0116; Proj-N124
Report No.(s): AD-A422601; AFRL-IF-RS-TR-2004-91; No Copyright; Avail: CASI; A03, Hardcopy
This report describes the technical components developed for hostile intent recognition, and documents specific experiments to evaluate a demonstration skeptical system in a cyber security domain. Current systems execute any command issued by an authenticated user so long as they fall within the privileges granted. By contrast, a skeptical system entertains doubts about the tasks that it is asked to perform. It questions the authenticity, integrity, and intent of the requester and acts with due consideration of its doubts. The report is broken down into three major sections. The first section discusses the system architecture overview and the technologies behind the demonstration system. The next section discusses a number of demonstration scenarios and the system's performance on them. The third section discusses scalability experiments done on the intent recognition algorithm (one of the central components of the system). The report closes with general conclusions about the system and makes some suggestions for areas for future work.
DTIC
Intrusion Detection (Computers)

20040073701 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Development Approaches Coupled with Verification and Validation Methodologies for Agent-Based Mission-Level Analytical Combat Simulations

Champagne, Lance E.; Mar. 2004; 296 pp.; In English

Report No.(s): AD-A422602; AFIT/DS/ENS/03-02; No Copyright; Avail: CASI; A13, Hardcopy

This research investigated the applicability of agent-based combat simulations to real-world combat operations. An agent-based simulation of the Allied offensive search for German U-Boats in the Bay of Biscay during World War II was constructed, extending the state-of-the-art in agent-based combat simulations, bridging the gap between the current level of agent-like combat simulations and the concept of agent- based simulations found in the broader literature. The proposed simulation advances agent-based combat simulations to validateable" mission-level military operations.

DTIC

Combat; Military Operations; Simulation

20040073704 Texas Univ., Arlington, TX

Facilitating Intelligent Sharing of Information for Decision Making over Distributed Heterogeneous Network- Centric Environments

Chakravarthy, S.; Varakala, S.; Apr. 2004; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-02-2-0134; Proj-R427

Report No.(s): AD-A422606; AFRL-IF-RS-TR-2004-98; No Copyright; Avail: CASI; A03, Hardcopy

This report provides a novel approach for supporting the creation of rules and events dynamically at run time, which is critical for several classes of monitoring applications. The proposed approach avoids recompilation and restarts which are not appropriate in many environments that require fine-tuning of rules on the fly. The dynamic programming environment (DPE) presented in this report provides a generic set of classes that are designed to handle the creation, management, and execution of rules. This set of generic classes is application-independent making the system a general-purpose tool. The user application provides necessary class and event information to the DPE. The DPE uses this information to create, modify and manage the rules. The DPE supports the creation of new composite and temporal events. The system also provides information about rules and events in XML format. A user-friendly interface is provided to perform these tasks.

DTIC

Computer Networks; Computer Programming; Decision Making; Dynamic Programming; Heterogeneity; Software Engineering

20040073737 Naval Research Lab., Bay Saint Louis, MS

Moving-Map Composers System Version 3.4P Installation Guide and Training Manual

Trenchard, Michael E.; Myrick, Stephanie A.; Lohrenz, Maura C.; Gendron, Marlin L.; Watkins, Jessica L.; Apr. 8, 2004; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422654; NRL/FR/7440--04-10031; No Copyright; Avail: CASI; A03, Hardcopy

This report provided an installation guide and training manual for the Naval Research Laboratory (NRL) Moving Map Composer (MMC) Version 3.4P software system, which was developed for the Finland Air Force (FiAF). Installation and training will be performed later this year in Finland on an FiAF-owned Digital Alpha computer.

DTIC

Computer Programs; Education; Installation Manuals

20040073739 Single Integrated Air Picture System Engineering Task Force, Arlington, VA

Roving Sands 2003 Event Test Plan

May 2003; 63 pp.; In English

Report No.(s): AD-A422657; No Copyright; Avail: CASI; A04, Hardcopy

ISSUES Integrated Air Defense System (IADS) performance must be conducted to determine what programs need improvements. The modeling and simulation activities conducted at ROVING SANDS 2003 (RS03) event will allow the Single Integrated Air Picture System Engineering Task Force (SIAP SE TF) to investigate a set of SIAP-related issues, including TBM and translation/forwarding performance and assess the capability of the simulation units for applicability to other SIAP analysis venues. BACKGROUND Past Roving Sands events offered SlAP SE TF the opportunity to conduct live fly lADS performance assessments. Given that the 2003 Roving Sands event was scaled back, however, SlAP has refocused its objectives and is conducting a set of assessments using the hardware-in-the-loop (HWIL)/simulation assets available.

SCOPE This document includes details for both the on-site (HWlL/simulation) activity and the post-event assessment efforts. It includes location of activities, who is participating in the activities, what the activities will accomplish, post-event analysis and reporting, and lessons learned processing.
DTIC
Air Defense; Data Processing; Sands; Simulation; Systems Integration

20040073762 Air Force Research Lab., Brooks AFB, TX
Team Communication and Performance During Sustained Command and Control Operations: Preliminary Results
Harville, Donald; Barnes, Christipher; Elliott, Linda; Apr. 2004; 17 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A422693; AFRL-HE-BR-TR-2004-0018; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the approach and initial results of an investigation of individual and team Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) communication and performance in complex time-critical targeting sustained operations (SUSOPS) scenarios. There have been few experimental studies on the effects of fatigue on complex decision making. Therefore, we have initiated a program of research that extends this effort by (a) utilization of a complex command and control simulation based on demanding and time-critical USAF operational tasks, and (b) utilization of operational USAF military personnel as research participants. We describe our initial baseline study, and preliminary findings regarding effects on communication processes. As expected in overnight sessions, the subjects significantly changed their communications that they were fatigued. Their fatigue was also potentially reflected in the subjects significantly changing two other types of communications: 1) requesting information on assets; and 2) strategy (information regarding the movement of assets or the sequencing of actions among team members). Future studies will extend this baseline investigation and assess potential countermeasures for acute and chronic fatigue effects in sustained operations.
DTIC
Command and Control; Human Performance; Interprocessor Communication; Teams; Telecommunication

20040073799 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
Instructional Characteristics and Motivational Features of a PC-based Game
Belanich, James; Sibley, Daragh E.; Orvis, Kara L.; Apr. 2004; 45 pp.; In English
Report No.(s): AD-A422808; ARI-RR-1822; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of the research was to identify and assess instructional and motivational features of a first- person-perspective game environment. The game used was "America's Army", a popular PC-based game developed by the U.S. Army to inform "recruiting age" individuals about the Army. Twenty-one participants first completed a pre-game questionnaire that assessed prior knowledge of information presented in the game, after which they played the "basic training" sections of the game. Then, participants answered questions regarding information presented during the game and about motivational aspects of the game. Participants recalled procedures better than facts. Information relevant to the progression of the game was recalled better than information that was not. Graphic images and spoken text were recalled more accurately than printed text. Realism, challenge, exploration, and control were factors that influenced motivation. The findings of the current research were specific to a single PC-based first-person-perspective game, but were in agreement with a broad range of research using other types of games and instructional media. 1% SLiR.IFflTTPPM. %
DTIC
Computer Programs; Motivation

20040073811 Naval Postgraduate School, Monterey, CA
NPS AUV Workbench: Collaborative Environment for Autonomous Underwater Vehicles (AUV) Mission Planning and 3D Visualization
Lee, Chim S.; Mar. 2004; 219 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422838; No Copyright; Avail: CASI; A10, Hardcopy

The absence of common software platforms for Autonomous Underwater Vehicle (AUV) mission planning and analysis is an ongoing impediment to collaborative work between research institutions, their partners, and end users, This thesis details the design and implementation of a distributable application to facilitate AUV mission planning and analysis. Java-based open-source libraries and a component- based framework provide diverse functionalities. The extensible Markup Language (XML) is used for data storage and message exchange, Extensible 3D (X3D) Graphics for visualization and XML Schema-based Binary Compression (XSBC) for data compression. The AUV Workbench provides an intuitive cross-platform-

capable tool with extensibility to provide for future enhancements such as agent-based control, asynchronous reporting and communication, loss-free message compression and built-in support for mission data archiving. This thesis also investigates the Jabber instant messaging protocol, showing its suitability for text and file messaging in a tactical environment. Exemplars show that the XML backbone of this open- source technology can be leveraged to enable both human and agent messaging with improvements over current systems. Integrated Jabber instant messaging support makes the NPS AUV Workbench the first custom application supporting XML Tactical Chat (XTC).
DTIC
Autonomy; Computer Programs; Message Processing; Mission Planning; Underwater Vehicles

20040074139 National Defense Univ., Washington, DC
Defense Horizons. Number 17, August 2002. Computer Simulation and the Comprehensive Test Ban Treaty
Zimmerman, Peter D.; Dorn, David W.; Aug. 2002; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422469; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Computerized Simulation; Horizon; Nuclear Explosions

20040074141 National Defense Univ., Washington, DC
Defense Horizons. Number 11, April 2002. Computer Games and the Military: Two Views
Herz, J. C.; Macedonia, Michael R.; Apr. 2002; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422472; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Computerized Simulation; Games; Horizon; Training Devices

20040074180 Ohio Aerospace Inst., Cleveland, OH, USA
Lapin Data Interchange Among Database, Analysis and Display Programs Using XML-Based Text Files
[2004]; 6 pp.; In English
Contract(s)/Grant(s): NCC3-751; No Copyright; Avail: CASI; A02, Hardcopy
The purpose was to investigate and evaluate the interchange of application- specific data among multiple programs each carrying out part of the analysis and design task. This has been carried out previously by creating a custom program to read data produced by one application and then write that data to a file whose format is specific to the second application that needs all or part of that data. In this investigation, data of interest is described using the XML markup language that allows the data to be stored in a text-string. Software to transform output data of a task into an XML-string and software to read an XML string and extract all or a portion of the data needed for another application is used to link two independent applications together as part of an overall design effort. This approach was initially used with a standard analysis program, Lapin, along with standard applications a standard spreadsheet program, a relational database program, and a conventional dialog and display program to demonstrate the successful sharing of data among independent programs. See Engineering Analysis Using a Web-Based Protocol by J.D. Schoeffler and R.W. Claus, NASA TM-2002-211981, October 2002. Most of the effort beyond that demonstration has been concentrated on the inclusion of more complex display programs. Specifically, a custom-written windowing program organized around dialogs to control the interactions have been combined with an independent CAD program (Open Cascade) that supports sophisticated display of CAD elements such as lines, spline curves, and surfaces and turbine-blade data produced by an independent blade design program (UD0300).
Derived from text
Data Bases; Document Markup Languages; Applications Programs (Computers); Computer Techniques

20040074295 NASA, Washington, DC, USA
The Lunar L1 Gateway Concept: Supporting Future Major Space Science Facilities
Thronson, H.; Geffre, J.; Prusha, S.; Caroff, L.; Weisbin, C., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 259-263; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy
We report here on a series of ongoing studies to evaluate alternative architectures for future space science facilities and how robots, humans, and autonomous systems might be optimally used to support them. This presentation outlines one scenario -- a "Gateway" at the Earth-Moon L1 point for supporting multiple options beyond Low Earth Orbit --

plus our process for evaluating human/robotic activities to construct telescopes.
Derived from text
Evaluation; Architecture (Computers); Support Systems

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040068167 Computer Sciences Corp., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
An Execution Service for Grid Computing
Smith, Warren; Hu, Chaumin; 2004; 8 pp.; In English
Contract(s)/Grant(s): RTOP 725-10-31; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the design and implementation of the IPG Execution Service that reliably executes complex jobs on a computational grid. Our Execution Service is part of the IPG service architecture whose goal is to support location-independent computing. In such an environment, once n user ports an npplicntion to one or more hardware/software platfrms, the user can describe this environment to the grid the grid can locate instances of this platfrm, configure the platfrm as required for the application, and then execute the application. Our Execution Service runs jobs that set up such environments for applications and executes them. These jobs consist of a set of tasks for executing applications and managing data. The tasks have user-defined starting conditions that allow users to specih complex dependencies including task to execute when tasks fail, afiequent occurrence in a large distributed system, or are cancelled. The execution task provided by our service also configures the application environment exactly as specified by the user and captures the exit code of the application, features that many grid execution services do not support due to dficulties interfacing to local scheduling systems.
Author
Grid Computing (Computer Networks); Complex Systems; Architecture (Computers); Operating Systems (Computers)

20040068171 NASA Ames Research Center, Moffett Field, CA, USA
AveBoost2: Boosting for Noisy Data
Oza, Nikunj C.; [2004]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

AdaBoost is a well-known ensemble learning algorithm that constructs its constituent or base models in sequence. A key step in AdaBoost is constructing a distribution over the training examples to create each base model. This distribution, represented as a vector, is constructed to be orthogonal to the vector of mistakes made by the pre- vious base model in the sequence. The idea is to make the next base model's errors uncorrelated with those of the previous model. In previous work, we developed an algorithm, AveBoost, that constructed distributions orthogonal to the mistake vectors of all the previous models, and then averaged them to create the next base model s distribution. Our experiments demonstrated the superior accuracy of our approach. In this paper, we slightly revise our algorithm to allow us to obtain non-trivial theoretical results: bounds on the training error and generalization error (difference between training and test error). Our averaging process has a regularizing effect which, as expected, leads us to a worse training error bound for our algorithm than for AdaBoost but a superior generalization error bound. For this paper, we experimented with the data that we used in both as originally supplied and with added label noise-a small fraction of the data has its original label changed. Noisy data are notoriously difficult for AdaBoost to learn. Our algorithm's performance improvement over AdaBoost is even greater on the noisy data than the original data.
Author
Algorithms; Machine Learning; Mathematical Models; Noise; Computer Programs

20040070853 ITT Telecommunications, Raleigh, NC, USA
The Road from Babel: Prospects for Integrated Office Systems
Pfeiffer, William G.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 195-201; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Good afternoon...and thank you for this opportunity to share some thoughts on a subject that's of vital interest to all of us who are concerned with quality and productivity. Let me begin by summarizing my presentation in a format that's fairly popular nowadays - the fantasy epic. A long, long time ago, in a galaxy far, far away, there was a very advanced civilization - so advanced, in fact, that most of its people worked not with their bodies at all, but with their brains. But as time went by,

their work became extraordinarily tedious and complicated. Too much effort was expended; far too little was getting done. Thus it was, that a secret cadre of brilliant sorcerers decided to create a collection of marvelous and powerful machines...machines that held out the promise of great benefit for the people. But as is so often the case in this kind of story, there was a catch: the full power of these ingenious devices could be unleased only if they could connect and communicate with each other. Unfortunately, the sourcerers had worked separately. They had built their machines so that communication was difficult or impossible. Seeing this predicament, the three Wizards of Ultimate Magic began to turn their enormous talents to the search for a solution. And that's where my tale leaves off. The ending has yet to be written. So let me now go back and talk in terms of 20th-century reality. The 'office of the future' - as typically conceived of and confidently promised by the office automation press - has, alas, not yet arrived. But the good news is that the technologies necessary to create it have been around for about ten years. What's missing is the 'glue' - in electronic terms, the system architecture that allows equipment from different vendors to work together, and the acceptance of procedural and organizational changes to accommodate the technologies. In other words, we have a hodgepodge of technology - an electronic Tower of Babel, if you will. We've been working our way out of it, gradually and not very elegantly, with ad hoc solutions of hardware and software.
Author
Office Automation; Systems Integration; Computer Networks; Communication Networks

20040073537 Space and Naval Warfare Systems Center, San Diego, CA
NERD (Network Enabled Resource Device)
Denewiler, Thomas; Laird, Robin T.; Jul. 2002; 15 pp.; In English
Report No.(s): AD-A422284; No Copyright; Avail: CASI; A03, Hardcopy

Network Enabled Resource Devices (NERDs) combine the most common electronic components used in robotic applications into a standard electronics box with "plug-n- play" capabilities. Risk reduction efforts, systems testing and integration, and modifying the functionality of evolving systems becomes greatly simplified by standardizing core hardware and software components; in many cases, minimal software modifications are required to adapt an existing NERD for an emergent application. Internal components include an integral DC-DC converter, a wireless bridge and hub allowing point-to-multipoint communications, an audio/video hardware CODEC, a RISC-based processor with FPGA-based I/O, and a GPS receiver. NERDs can accept 12- 36VDC to power all components and are compatible with standard military batteries. Two 8-pin input/ output data ports connected directly to the embedded processor allow for a wide range of control flexibility in a variety of applications. Implementations to date include controlling a non-lethal weapons pod on the MDARS-Exterior robot, an intelligent garage-door opener for the exterior robot refueling area, a communications/GPS module for a security team response vehicle, and an embedded controller for intruder detection systems.
DTIC
Communication Networks

20040073624 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Human-Machine Interaction With Multiple Autonomous Sensors
Murray, Steven A.; Jun. 1995; 9 pp.; In English
Contract(s)/Grant(s): N0001493WX24310AA
Report No.(s): AD-A422501; No Copyright; Avail: CASI; A02, Hardcopy

Security and inspection systems are becoming increasingly automated. Many such systems include mobile platforms capable of autonomous sensing and analysis of the environment from a multitude of perspectives. This increased automation shifts the responsibilities of humans from active patrolling and inspection to passive monitoring of remote sensor information. The operator brings perceptual and cognitive characteristics to this task which need to be addressed in both system architecture and interface design if desired performance reliability is to be achieved. A study is reported which examines the impact of these characteristics on system performance.
DTIC
Autonomy; Man Machine Systems

20040073637 Kansas Univ., Lawrence, KS
Innovative Active Networking Services
Minder, Gary J.; Evans, Joseph B.; Komp, Ed; Shankar, Ravi; Zinjuvadia, Vishal; Mar. 2004; 142 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-2-0516; Proj-H494
Report No.(s): AD-A422520; AFRL-IF-RS-TR-2004-59; No Copyright; Avail: CASI; A07, Hardcopy

Traditional networking implementations follow a layered protocol model that implements a well-defined protocol stack. Major functionality is built into the software and hardware of end-point hosts and the network switches and routers. The entire complex of end-point host system software, network switch software, and networking services evolves slowly due to the need to reach consensus prior to widespread changes and improvements in the protocols. Active Network was developed to bring robust, rapid flexibility to developing and deploying new network services and protocols. Our research project covered three areas: 1) Create an architecture and implementation for Innovative Active Networking Services based on Composite Protocols; 2) Established criteria and evaluation measures for Active Network performance; and 3) Implement Active Networking services on end-point host systems based on the Windows NT and Linux operating systems.
DTIC
Computer Networks; Protocol (Computers)

20040073660 Naval Ocean Systems Center, San Diego, CA
Security Considerations for Autonomous Robots
Gage, Douglas W.; Apr. 1988; 6 pp.; In English
Report No.(s): AD-A422545; No Copyright; Avail: CASI; A02, Hardcopy

The security aspects of autonomous robots are analyzed by modeling a robot as a set of sensors, effectors, optional communications resources, and processing elements whose behavior is tightly coupled to the sensed characteristics of its environment. A simple taxonomy of potential generic threat types is presented, comprising both the possible direct external threat paths and the derived consequent internal threat states. Several generic countermeasure strategies are proposed.
DTIC
Autonomy; Robots; Security

20040073669 Army Tank-Automotive Research and Development Command, Warren, MI
Lab Test of a Prototype HMMWV Air Filter Element Constructed With Microstructured Oriented Fiber (MOF) Filter Media
Goryca, Mary; Richard, Michael; Feb. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE07-03-C-L066
Report No.(s): AD-A422560; TARDEC-TR-13976; No Copyright; Avail: CASI; A03, Hardcopy

Two prototype Microstructured Oriented Fiber (MOF) air filter elements were designed and built to fit a HMMWV (M998 Utility Truck) multi-stage housing by MicroEnergy Technologies Inc. under contract DAAE07-03-C-L066. During April and May of 2003, the MOF filters underwent dust capacity and efficiency performance testing at the U.S.Army Tank Automotive Research, Development and Engineering Center (TARDEC). The MOF filter did not meet the efficiency or dust capacity performance requirements. The MOF filter attained an efficiency of 66.78%, which is far lower than the required 99. 5%. The MOF filter achieved a dust capacity of 40 minutes, which is considerably less than the required 20 hours. During the efficiency and dust capacity testing, the pressure drop across the master (absolute) filter increased rapidly which indicated the MOF filter was allowing a significant amount of dust to pass through resulting in low performance. The MOF filter is not recommended for the M988 since the dust capacity and initial efficency did net meet the performance requirements.
DTIC
Air Filters; Prototypes

20040073686 Naval Postgraduate School, Monterey, CA
Analysis of Network Management Protocols in Optical Networks
Lim, Kok S.; Mar. 2004; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422585; No Copyright; Avail: CASI; A05, Hardcopy

In this thesis the scalability issues of Simple Network Management Protocol (SNMP) in optical network management are explored. It is important to understand the effect of varying the number of nodes the request inter- arrival times and the polling interval on the performance of SNMP and the number of nodes that can be effectively managed. The current study explored the effect of varying these parameters in a controlled test environment using the OPNET simulation package. In addition, traffic analysis was performed on measured SNMP traffic and statistics were developed from the traffic analysis. With this understanding of SNMP traffic an SNMPv1 model was defined and integrated into an OPNET network model to study the performance of SNMP.
DTIC
Network Analysis; Optical Properties; Protocol (Computers)

20040074124 Naval Postgraduate School, Monterey, CA

An Introduction to Legal Aspects of Operations in Cyberspace

Wingfield, Thomas C.; Michael, James B.; Apr. 28, 2004; 20 pp.; In English

Report No.(s): AD-A422696; NPS-CS-04-005; No Copyright; Avail: CASI; A03, Hardcopy

This report consists of a learning module on the legal aspects of operations in cyberspace. The learning module was developed specifically for use in the Naval Postgraduate School Homeland Security Leadership Development, Program's curriculum for the Homeland Defense specialization of the Master of Arts degree in National Security Affairs. Given the complexity of the law governing cyber operations, it is vitally important that policymakers and their legal advisers share a common intellectual framework for evaluating and responding to attacks in cyberspace. This learning module provides the student with an introduction three overlapping legal regimes within which to conduct cyber operations: law enforcement, intelligence collection, and military operations.

DTIC

Communication Networks; Computer Networks; Virtual Reality

20040074125 Naval Postgraduate School, Monterey, CA

Intelligent Software Decoys: Intelligent Software Decoy Tools for Cyber Counterintelligence and Security Countermeasures

Michael, James B.; Rowe, Neil C.; Auguston, Mikhail; Drusinsky, Doran; Rothstein, Hy S.; Apr. 28, 2004; 20 pp.; In English

Report No.(s): AD-A422700; NPS-CS-04-001; No Copyright; Avail: CASI; A03, Hardcopy

This report documents our accomplishments during Phase II of the Intelligent Software Decoys Project, including the development of a theory of cyber deception, tools for conduction cyber-based deception, and issues pertaining to the acceptable use of cyber deception within the context of homeland security and homeland defense.

DTIC

Computer Networks; Countermeasures; Decoys; Security

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*.

20040068136 Kestrel Technology, LLC, Moffett Field, CA, USA

Verification of Java Programs using Symbolic Execution and Invariant Generation

Pasareanu, Corina; Visser, Willem; 2004; 18 pp.; In English; 11th International Spin Workshop on Model Checking of Software, 1-3 Apr. 2004, Barcelona, Spain; No Copyright; Avail: CASI; A03, Hardcopy

Software verification is recognized as an important and difficult problem. We present a norel framework, based on symbolic execution, for the automated verification of software. The framework uses annotations in the form of method specifications an3 loop invariants. We present a novel iterative technique that uses invariant strengthening and approximation for discovering these loop invariants automatically. The technique handles different types of data (e.g. boolean and numeric constraints, dynamically allocated structures and arrays) and it allows for checking universally quantified formulas. Our framework is built on top of the Java PathFinder model checking toolset and it was used for the verification of several non-trivial Java programs.

Author

Java (Programming Language); Program Verification (Computers); Automatic Control; Approximation

20040068152 NASA Ames Research Center, Moffett Field, CA, USA

Time-Extended Policies in Mult-Agent Reinforcement Learning

Tumer, Kagan; Agogino, Adrian K.; 2004; 8 pp.; In English; International Conference on autonomous Agents and Multi-Agent Systems, 19-23 Jul. 2004, New York, NY, USA; No Copyright; Avail: CASI; A02, Hardcopy

Reinforcement learning methods perform well in many domains where a single agent needs to take a sequence of actions to perform a task. These methods use sequences of single-time-step rewards to create a policy that tries to maximize a time-extended utility, which is a (possibly discounted) sum of these rewards. In this paper we build on our previous work showing how these methods can be extended to a multi-agent environment where each agent creates its own policy that works towards maximizing a time-extended global utility over all agents actions. We show improved methods for creating

time-extended utilities for the agents that are both "aligned" with the global utility and "learnable." We then show how to crate single-time-step rewards while avoiding the pi fall of having rewards aligned with the global reward leading to utilities not aligned with the global utility. Finally, we apply these reward functions to the multi-agent Gridworld problem. We explicitly quantify a utility's learnability and alignment, and show that reinforcement learning agents using the prescribed reward functions successfully tradeoff learnability and alignment. As a result they outperform both global (e.g., team games) and local (e.g., "perfectly learnable") reinforcement learning solutions by as much as an order of magnitude.
Author
Computer Programs; Knowledge Based Systems; Artificial Intelligence; Automata Theory

20040068177 NASA Ames Research Center, Moffett Field, CA, USA, QSS Group, Inc., Moffett Field, CA, USA
Using Automated Theorem Provers to Certify Auto-Generated Aerospace Software
Denney, Ewen; Fischer, Bernd; Schumann, Johann; 2004; 13 pp.; In English; Second International Joint Conference on Automated Reasoning (IJCAR) 2004, 4-17 Jul. 2004, Cork, Ireland; No Copyright; Avail: CASI; A03, Hardcopy

We describe a system for the automated certification of safety properties of NASA software. The system uses Hoare-style program verification technology to generate proof obligations which are then processed by an automated first-order theorem prover (ATP). For full automation, however, the obligations must be aggressively preprocessed and simplified We describe the unique requirements this places on the ATP and demonstrate how the individual simplification stages, which are implemented by rewriting, influence the ability of the ATP to solve the proof tasks. Experiments on more than 25,000 tasks were carried out using Vampire, Spass, and e-setheo.
Author
Automatic Control; Theorem Proving; Aerospace Engineering; Computer Systems Programs

20040068184 NASA Ames Research Center, Moffett Field, CA, USA
Efficient Evaluation Functions for Multi-Rover Systems
Agogino, Adrian; Tumer, Kagan; 2004; 12 pp.; In English; Genetic and Evolutionary Computation Conference, 26-30 Jun. 2004, Seattle, WA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Evolutionary computation can be a powerful tool in cresting a control policy for a single agent receiving local continuous input. This paper extends single-agent evolutionary computation to multi-agent systems, where a collection of agents strives to maximize a global fitness evaluation function that rates the performance of the entire system. This problem is solved in a distributed manner, where each agent evolves its own population of neural networks that are used as the control policies for the agent. Each agent evolves its population using its own agent-specific fitness evaluation function. We propose to create these agent-specific evaluation functions using the theory of collectives to avoid the coordination problem where each agent evolves a population that maximizes its own fitness function, yet the system has a whole achieves low values of the global fitness function. Instead we will ensure that each fitness evaluation function is both "aligned" with the global evaluation function and is "learnable," i.e., the agents can readily see how their behavior affects their evaluation function. We then show how these agent-specific evaluation functions outperform global evaluation methods by up to 600% in a domain where a set of rovers attempt to maximize the amount of information observed while navigating through a simulated environment.
Author
Neural Nets; Roving Vehicles; Complex Systems; Algorithms; Functions (Mathematics)

20040073565 Space and Naval Warfare Systems Center, San Diego, CA
An Evolutionary Strategy For Achieving Autonomous Navigation
Gage, Douglas W.; Nov. 1998; 10 pp.; In English
Report No.(s): AD-A422374; No Copyright; Avail: CASI; A02, Hardcopy

An approach is presented for the evolutionary development of supervised autonomous navigation capabilities for small "backpackable" ground robots, in the context of a DARPA-sponsored program to provide robotic support to small units of dismounted warfighters. This development approach relies on the implementation of a baseline visual servoing navigation capability, including tools to support operator oversight and override, which is then enhanced with semantically referenced commands and a mission scripting structure. As current and future machine perception techniques are able to automatically designate visual servoing goal points, this approach should provide a natural evolutionary pathway to higher

levels of autonomous operation and reduced requirements for operator intervention.
DTIC
Autonomous Navigation; Robots

20040073618 Naval Ocean Systems Center, San Diego, CA
Protocols for Robot Communications: Transport and Content Layers
Harmon, Scott Y.; Gage, Douglas W.; Oct. 8, 1980; 11 pp.; In English
Report No.(s): AD-A422494; No Copyright; Avail: CASI; A03, Hardcopy

Communications between cooperating robots can be facilitated by using suitable communications protocols. This paper discusses many of the considerations that impact the form of such protocols, beginning with a primitive model of cooperating robots and their interactions with each other and the external environment. Consideration is paid to the role of the robot's internal model of its world, to the different functions of communications between cooperating robots, and to relevant characteristics of the communications environment. A layered protocol structure is presented, consisting of data transport layers borrowed from computer networking technology and task independent and task dependent content layers. Finally, the effects of the communications environment on this structure are discussed.
DTIC
Protocol (Computers); Robots; Telecommunication

20040073622 Space and Naval Warfare Systems Center, San Diego, CA
Internetting Tactical Security Sensor Systems
Gage, Douglas W.; Bryan, W D.; Nguyen, Hoa G.; Apr. 1998; 12 pp.; In English
Report No.(s): AD-A422499; No Copyright; Avail: CASI; A03, Hardcopy

The Multipurpose Surveillance and Security Mission Platform (MSSMP) is a distributed network of remote sensing packages and control stations, designed to provide a rapidly deployable, extended-range surveillance capability for a wide variety of military security operations and other tactical missions. The baseline MSSMP sensor suite consists of a pan/tilt unit with video and FLIR cameras and laser imageflnder. With an additional radio transceiver, MSSMP can also function as a gateway between existing security/surveillance sensor systems such as TASS, TRSS, and IREMBASS, and IP-based networks, to support the timely distribution of both threat detection and threat assessment information. The MSSMP system makes maximum use of Commercial Off The Shelf (COTS) components for sensing, processing, and communications, and of both established and emerging standard communications networking protocols and system integration techniques. Its use of IP-based protocols allows it to freely interoperate with the Internet- providing geographic transparency, facilitating development, and allowing fully distributed demonstration capability - and prepares it for integration with the IP-based tactical radio networks that will evolve in the next decade. Unfortunately, the Internet's standard Transport layer protocol, TCP, is poorly matched to the requirements of security sensors and other quasi- autonomous systems in being oriented to conveying a continuous data stream, rather than discrete messages. Also, its canonical "socket" interface both conceals short losses of communications connectivity and simply gives up and forces the Application layer software to deal with longer losses. For MSSMP, a software applique is being developed that will run on top of User Datagram Protocol (UDP) to provide a reliable message-based Transport service.
DTIC
Security; Warfare; Warning Systems

20040073625 Space and Naval Warfare Systems Center, San Diego, CA
Minimum-Resource Distributed Navigation and Mapping
Gage, Douglas W.; Nov. 2000; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422502; No Copyright; Avail: CASI; A02, Hardcopy

This paper proposes a conceptual design for a distributed system of very simple robots capable of performing a useful real-world mission, such as mapping the interior of a building overnight with a swarm of hundreds of cockroach-sized robots. Presentation of this concept follows a discussion of strategies for developing distributed robotic systems. Success is dependent on making good decisions in selecting appropriate applications, in system design, and in executing the system development process. Each robot includes basic mobility, crude odometry, contact or near-contact object/obstacle detection sensors, an omnidirectional beacon (probably IR), and a beacon detection sensor that can simultaneously detect multiple beacons on other robots and measure the bearing of each to less than one degree. Beacon triangulation (combined with knowledge of some baseline distance) allows the determination of the position of any robot relative to the others. Occlusion of a robot's beacon

indicates the presence of an intervening object, while lack of occlusion identifies a "ray" of free space. Clever deployment of large numbers of robots will permit mapping of walls and objects and can also support the detection and localization of intruders moving within the space. The object sensor can be very short range, simple, and cheap, perhaps implemented as an array of whiskers. The beacon sensor is more complex, but it can be completely tuned to the detection of the cooperating beacon. Thus, the robots need tackle no perception tasks whatsoever. System development begins with the implementation of an initial baseline system in which each robot is controlled by a central coordinating element via a high bandwidth communications link. The paper discusses the use of a swarm of robots in tactical operations inside buildings (i.e., building clearance and covert reconnaissance), and presents a conceptual design for a system capable of navigating and mapping one floor of a building. (14 refs.)7
DTIC
Autonomous Navigation; Detection; Military Technology; Navigation; Optical Measurement; Robots

20040073649 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Autonomous Visual Control of a Mobile Robot
Blackburn, Michael R.; Nguyen, Hoa G.; Nov. 1994; 9 pp.; In English
Report No.(s): AD-A422533; No Copyright; Avail: CASI; A02, Hardcopy

An autonomous mobile robot with a vision based target acquisition system must be able to find and maintain fixation on a moving target while the system itself is in motion. This capability is achieved by most animate systems, in addition to man, but has proven to be difficult for artificial systems. We propose that efficient and extensible solutions to the target acquisition and maintenance problem may be found when the machine sensor-effector control algorithms emulate the mechanisms employed by biological systems. In nature, motion provides the foundation for visual target detection, acquisition, tracking and trailing, or pursuit. We present in this paper a summary of some simple and robust visual motion based mechanisms we have developed to solve these problems, and describe their implementation in an autonomous visually controlled mobile robot.
DTIC
Automatic Control; Autonomy; Robots; Visual Control; Visual Perception

20040073650 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Controlling Multiple Security Robots in a Warehouse Environment
Everett, H. R.; Gilbreath, G. A.; Heath-Pastore, T. A.; Laird, R. T.; Mar. 1994; 11 pp.; In English
Report No.(s): AD-A422534; No Copyright; Avail: CASI; A03, Hardcopy

The Naval Command Control and Ocean Surveillance Center (NCCOSC) has developed an architecture to provide coordinated control of multiple autonomous vehicles from a single host console. The Multiple Robot Host Architecture (MRHA) is a distributed multiprocessing system that can be expanded to accommodate as many as 32 robots. The initial application will employ eight Cybermotion K2A navmaster robots configured as remote Security platforms in support of the Mobile Detection Assessment and Response System (MDARS) Program. This paper discusses developmental testing of the MRHA in an operational warehouse environment with two actual and four simulated robotic platforms.
DTIC
Robots; Security

20040073651 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Real-World Issues in Warehouse Navigation
Everett, H. R.; Gage, D. W.; Gilbreath, G. A.; Laird, R. T.; Smurlo, R. P.; Nov. 1994; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422535; No Copyright; Avail: CASI; A03, Hardcopy

The MDARS security robotics program has successfully demonstrated the simultaneous control of multiple robots autonomously navigating within an industrial warehouse environment. This real-world warehouse system installation required adapting a navigational paradigm designed for highly structured environments such as office corridors (with smooth walls and regularly spaced doorways) to a semi-structured warehouse environment (with few walls and within which odd- shaped objects unpredictably move about from day to day). A number of challenges some expected and others unexpected were encountered during this transfer of the system to the test/demonstration site. This paper examines these problems (and others previously encountered) in the historical context of the ongoing development of the navigation and other technologies needed to support the operations of a security robotic system and the evolution of these technologies from the research lab to an operational warehouse environment. A key lesson is that a system's robustness can only be ensured by exercising its

capabilities in a number of diverse operating environments in order to (1) uncover latent system hardware deficiencies and software implementation errors not manifested in the initial system hardware or initial development environment; and (2) identify sensor modes or processing algorithms tuned too tightly to the specific characteristics of the initial development environment.
DTIC
Autonomous Navigation; Navigation; Robots

20040073654 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Cost-Optimization of Many-Robot Systems
Gage, Douglas W.; Nov. 1994; 8 pp.; In English
Report No.(s): AD-A422538; No Copyright; Avail: CASI; A02, Hardcopy

Cost optimization will be essential to the economic viability of future many-robot systems. Unfortunately cost-optimal design will often depend sensitively on the performance and costs of candidate sensor and other components and on both explicit mission-specific and implicit common sense application requirements. The development of a standardized integration architecture providing multi-level protocols to support the flexible but tight integration of off the shelf subsysten components into low cost robots will facilitate the development of this soon to emerge class of systems.
DTIC
Costs; Low Cost; Robots

20040073655 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Randomized Search Strategies With Imperfect Sensors
Gage, Douglas W.; Sep. 1993; 11 pp.; In English
Report No.(s): AD-A422539; No Copyright; Avail: CASI; A03, Hardcopy

In two previous papers we explored some of the systems aspects of applying large numbers of inexpensive robots to real world applications. The concept of coverage can help the user of such a system visualize its overall function and performance in mission-relevant terms, and thereby support necessary system command control functions. An important class of coverage applications are those that involve a search, in which a number of searching elements move about within a prescribed search area in order to find one or more target objects, which may be stationary or mobile. A simple analytical framework was employed in the previous work to demonstrate that the design of a cost effective many-robot search system can depend sensitively on the interplay of sensor cost and performance levels with mission-specific functional and performance requirements. In the current paper we extend these results: we consider additional measures of effectiveness for area search systems to provide a broader basis for a tradeoff of coordinated versus random search models, and we explore how to deliberately achieve effectively randomized search strategies that provide uniform search coverage over a specified area.
DTIC
Robots

20040073656 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Command Control for Many-Robot Systems
Gage, Douglas W.; Jun. 1992; 15 pp.; In English
Report No.(s): AD-A422540; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a program of analysis, modeling, algorithm development, and simulation which has been undertaken to develop, refine, and validate this basic approach to real-world problem solving. The initial thrust has been to develop generic behaviors, such as blanket, barrier, and sweep coverage, and various deployment and recovery modes, which can address a broad spectrum of generic applications such as mine deployment, minesweeping, surveillance, sentry duty, maintenance inspection, ship hull cleaning, and communications relaying. Initial simulation results are presented.
DTIC
Command and Control; Robots

20040073657 Naval Ocean Systems Center, San Diego, CA
A General Architecture for Classical Conditioning of Perceptual-Motor Sequences
Blackburn, Michael R.; Jan. 1990; 7 pp.; In English
Report No.(s): AD-A422541; No Copyright; Avail: CASI; A02, Hardcopy

A general neural network architecture, loosely modeled on the cerebral cortex, for the classical conditioning of

perceptual-motor sequences is described. The utility of such an algorithm in robotics applications lies in its potential to adaptively order gross and fine motor actions under sensory control.
DTIC
Adaptive Control; Robotics; Sequencing

20040073659 California State Univ., Fresno, CA
Feature Maps Based Weight Vectors for Spatiotemporal Pattern Recognition With Neural Nets
Yen, Matthew M.; Blackburn, Michael R.; Nguyen, Hoa G.; Jan. 1990; 8 pp.; In English
Report No.(s): AD-A422543; No Copyright; Avail: CASI; A02, Hardcopy

A neural network algorithm is used to generate the spatial pattern classes for Spatiotemporal Pattern Recognition (SPR). This algorithm is known as Kohonen Feature Maps. Training vectors are presented to the network one at a time. The connection strength between the input and output nodes are adaptively updated. The adaptation process is associated with a decay of the adaptation rate as well as a shrinkage of the neighborhood for updating. The final values of connection strength represent the centroid of clusters of training patterns. The algorithm was tested with hypothetical data as well as hydrophone data. Functional forms and constants for the decay and the shrinkage were empirically determined. The algorithm performs well with broadband data than with narrow band data. Also the algorithm works better with smaller number of pattern classes.
DTIC
Neural Nets; Pattern Recognition

20040073661 Naval Ocean Systems Center, San Diego, CA
Current Technical Research Issues of Autonomous Robots Employed in Combat
Harmon, S. Y.; Gage, D. W.; Sep. 1984; 6 pp.; In English
Report No.(s): AD-A422546; No Copyright; Avail: CASI; A02, Hardcopy

The recent upsurge in interest in autonomous robots for combat applications has focused considerable attention on several of the obvious technical issues (e.g. target recognition, autonomous navigation, route planning) . However, several technical issues exist which remain unapproached and, in some cases, even unacknowledged by the robotics community. This paper explores three such issues: (1) robot fault tolerance, (2) robot security and (3) multi-robot coordination. These issues are discussed in terms of the technology limitations and the research issues associated with those limitations. A common message which occurs several times during this discussion denotes the importance in modular implementation and well defined interfaces between subsystems in the development of autonomous combat robots.
DTIC
Autonomy; Combat; Robots

20040073681 Space and Naval Warfare Systems Center, San Diego, CA
Current Thrusts in Ground Robotics: Programs, Systems, Technologies, Issues
Gage, Douglas W.; Mar. 2000; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422580; No Copyright; Avail: CASI; A03, Hardcopy

Presentation of current military research in the application of ground robotics.
DTIC
Military Technology; Research and Development; Robotics; Thrust

20040073682 Space and Naval Warfare Systems Center, San Diego, CA
If Our Robots Are So Smart, Why Aren't We All Rich? (The Challenges of Integrating Autonomous Robots)
Gage, Douglas W.; Nov. 1999; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422581; No Copyright; Avail: CASI; A03, Hardcopy

Presentation of military research efforts into the development and applications of robotic systems.
DTIC
Autonomy; Military Technology; Research and Development; Robotics; Robots

20040073753 Michigan State Univ., East Lansing, MI
Reconfigurable and Adaptable Micro-Robots
Tummala, R. L.; Mukherjee, R.; Xi, N.; Aslam, D.; Mahadevan, S.; Apr. 2004; 55 pp.; In English
Contract(s)/Grant(s): DAAN02-98-C-4025
Report No.(s): AD-A422677; NATICK/RDEC-TR-04/012; No Copyright; Avail: CASI; A04, Hardcopy

This report documents the mechanical structure, kinematic models and control implementation of two micro- robots, called Flipper and Crawler, that can traverse both on walls and floors. They are battery powered and use specially designed feet using suction cups. The design of these feet is described in Section 2. The mechanical design was arrived at through extensive analysis. It has a biped structure with revolute and prismatic hip joints. The underactuated mechanical structure was chosen to reduce weight and power consumption by decreasing the number of actuators. Micro- controllers from Motorola, Inc. and Texas Instruments, Inc. were used as embedded controllers with the ability to implement motion planning and trajectory generation algorithms to control these robots. The details are given in Sections 3 and 4. The report concludes with the summary and suggested improvements.
DTIC
Robots

20040073781 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Proceedings of the Autonomous Vehicles in Mine Countermeasures Symposium, Monterey CA, 4-7 April 1995 Many-Robot MCM Search Systems
Gage, Douglas W.; Apr. 1995; 11 pp.; In English
Report No.(s): AD-A422749; No Copyright; Avail: CASI; A03, Hardcopy

A system comprising a large number of identical and very inexpensive robotic search vehicles may serve as an effective tool in a variety of MCM operations providing improved mine detection and clearance capabilities while reducing cost and the physical risk to MCM personnel. Moreover, the many-robot approach to addressing MCM applications becomes increasingly viable as continuing technological developments provide needed mine detection and other subsystem capabilities at ever decreasing cost. Real challenges remain, however, at the system design level, and the most effective and cost-effective systems will result from careful attention to actual system requirements.
DTIC
Autonomy; Conferences; Countermeasures; Robots

20040073793 Space and Naval Warfare Systems Center, San Diego, CA
Enhancing Functionality and Autonomy in Man- Portable Robots
Pacis, E. B.; Everett, H. R.; Farrington, N.; Bruemmer, D.; Jan. 2004; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422780; No Copyright; Avail: CASI; A03, Hardcopy

Current man-portable robotic systems are too heavy for troops to pack during extended missions in rugged terrain and typically require more user support than can be justified by their limited return in force multiplication or improved effectiveness. As a consequence, today's systems appear organically attractive only in life-threatening scenarios, such as detection of chemical/ biological/radiation hazards, mines, or improvised explosive devices. For the long term, significant improvements in both functionality (i.e., perform more useful tasks) and autonomy (i.e., with less human intervention) are required to increase the level of general acceptance and, hence, the number of units deployed by the user. In the near term, however, the focus must remain on robust and reliable solutions that reduce risk and save lives. This paper describes ongoing efforts to address these needs through a spiral development process that capitalizes on technology transfer to harvest applicable results of prior and ongoing activities throughout the technical community.
DTIC
Autonomy; Robotics; Robots

20040073810 IIT Research Inst., Chicago, IL
Artificial Intelligence Concepts and Applications
McKee, Keith; Wisnosky, Dennis; Walk, Robert; Apr. 1988; 63 pp.; In English
Contract(s)/Grant(s): DLA900-84-C-1508
Report No.(s): AD-A422837; MTIAC-ST-88-01; No Copyright; Avail: CASI; A04, Hardcopy

The scope of this study is focused on the manufacturing applications of Artificial Intelligence as it relates to potential applications in Army or contractor manufacturing facilities. The specific study objectives were to: perform a literature review and summarize relevant articles and books on the subject so that general concepts can be understood. perform a survey of actual installations and summarize important applications for the Army.
DTIC
Artificial Intelligence

20040073814 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
UGV History 101: A Brief History of Unmanned Ground Vehicle (UGV) development Efforts
Gage, Douglas W.; Jan. 1995; 10 pp.; In English
Report No.(s): AD-A422845; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this paper is to provide a brief survey of a number of different threads of development that have brought the Unmanned Ground Vehicle (UGV) field to its current state, together with references to allow the interested reader to probe more deeply. In the broadest "dictionary" sense, a UGV is any piece of mechanized equipment that moves across the surface of the ground and serves as a means of carrying or transporting something, but explicitly does NOT carry a human being. A discussion of such a broad universe of possible UGV systems needs some organizing principle, and in fact a taxonomy of UGV systems could be based upon any of a number of characteristics of each system. To reasonably limit its scope, this survey will focus principally on the large number of systems in which the "long pole" technological challenge is or has been in the area of navigation and control. Within that context, a teleoperated vehicle system is one in which navigational guidance is transmitted to the vehicle from an externally situated human operator; an autonomous vehicle is one that determines its own course using onboard sensor and processing resources; the term "supervisory control" is often given to the myriad of control schemes that combine inputs from both an external human operator and onboard sensors to determine the UGV's path. (53 refs.)
DTIC
Navigation; Unmanned Ground Vehicles

20040074150 Naval Ocean Systems Center, San Diego, CA
A Technique for Coordinating Autonomous Robots
Harmon, S. Y.; Aviles, W. A.; Gage, D. W.; Apr. 10, 1986; 7 pp.; In English
Report No.(s): AD-A422576; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes a technique for coordinating the subsystems of autonomous robots which takes advantage of a distributed blackboard mechanism and a high degree of functional distribution between subsystems to minimize communications and simplify the interfaces. Distributed blackboard memory contains a world model which represents knowledge about itself and its surroundings as collections of objects important to the task and the relations between them. Objects or instances are represented as lists of object- attribute-value-accuracy-confidence-timestamp tuples which are organized into a class tree with inheritance properties and active functions.
DTIC
Autonomy; Robotics; Robots

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040068132 NASA Ames Research Center, Moffett Field, CA, USA
Multiobjective Aerodynamic Shape Optimization Using Pareto Differential Evolution and Generalized Response Surface Metamodels
Madavan, Nateri K.; January 2004; 2 pp.; In English
Report No.(s): 21-302-15-41; No Copyright; Avail: CASI; A01, Hardcopy

Differential Evolution (DE) is a simple, fast, and robust evolutionary algorithm that has proven effective in determining the global optimum for several difficult single-objective optimization problems. The DE algorithm has been recently extended to multiobjective optimization problem by using a Pareto-based approach. In this paper, a Pareto DE algorithm is applied to multiobjective aerodynamic shape optimization problems that are characterized by computationally expensive objective function evaluations. To improve computational expensive the algorithm is coupled with generalized response surface meta-models based on artificial neural networks. Results are presented for some test optimization problems from the literature to demonstrate the capabilities of the method.
Author
Aerodynamic Configurations; Shape Optimization; Neural Nets

20040068141 NASA Ames Research Center, Moffett Field, CA, USA

Quantum Scattering Study of Ro-Vibrational Excitations in N+N(sub 2) Collisions under Re-entry Conditions

Wang, Dunyou; Stallcop, James R.; Dateo, Christopher E.; Schwenke, David W.; Huo, Winifred M.; January 2004; 8 pp.; In English; 42nd AIAA Aerospace Science Meeting, 5-8 Jan. 2004, Reno, NV, USA

Report No.(s): AIAA Paper 2004-0337; No Copyright; Avail: CASI; A02, Hardcopy

A three-dimensional time-dependent quantum dynamics approach using a recently developed ab initio potential energy surface is applied to study ro-vibrational excitation in N+N2 exchange scattering for collision energies in the range 2.1- 3.2 eV. State-to-state integral exchange cross sections are examined to determine the distribution of excited rotational states of N(sub 2). The results demonstrate that highly-excited rotational states are produced by exchange scattering and furthermore, that the maximum value of (Delta)j increases rapidly with increasing collision energies. Integral exchange cross sections and exchange rate constants for excitation to the lower (upsilon = 0-3) vibrational energy levels are presented as a function of the collision energy. Excited-vibrational-state distributions for temperatures at 2,000 K and 10,000 K are included.

Author

Quantum Computation; Scattering; Vibration; Excitation; Collisions; Reentry

20040068294 NASA Ames Research Center, Moffett Field, CA, USA

Discontinuous Spectral Difference Method for Conservation Laws on Unstructured Grids

Liu, Yen; Vinokur, Marcel; January 13, 2004; 2 pp.; In English; Third ICCFD Conference, 12-16 Jul. 2004, Toronto, Canada; No Copyright; Avail: CASI; A01, Hardcopy

A new, high-order, conservative, and efficient discontinuous spectral finite difference (SD) method for conservation laws on unstructured grids is developed. The concept of discontinuous and high-order local representations to achieve conservation and high accuracy is utilized in a manner similar to the Discontinuous Galerkin (DG) and the Spectral Volume (SV) methods, but while these methods are based on the integrated forms of the equations, the new method is based on the differential form to attain a simpler formulation and higher efficiency. Conventional unstructured finite-difference and finite-volume methods require data reconstruction based on the least-squares formulation using neighboring point or cell data. Since each unknown employs a different stencil, one must repeat the least-squares inversion for every point or cell at each time step, or to store the inversion coefficients. In a high-order, three-dimensional computation, the former would involve impractically large CPU time, while for the latter the memory requirement becomes prohibitive. In addition, the finite-difference method does not satisfy the integral conservation in general. By contrast, the DG and SV methods employ a local, universal reconstruction of a given order of accuracy in each cell in terms of internally defined conservative unknowns. Since the solution is discontinuous across cell boundaries, a Riemann solver is necessary to evaluate boundary flux terms and maintain conservation. In the DG method, a Galerkin finite-element method is employed to update the nodal unknowns within each cell. This requires the inversion of a mass matrix, and the use of quadratures of twice the order of accuracy of the reconstruction to evaluate the surface integrals and additional volume integrals for nonlinear flux functions. In the SV method, the integral conservation law is used to update volume averages over subcells defined by a geometrically similar partition of each grid cell. As the order of accuracy increases, the partitioning for 3D requires the introduction of a large number of parameters, whose optimization to achieve convergence becomes increasingly more difficult. Also, the number of interior facets required to subdivide non-planar faces, and the additional increase in the number of quadrature points for each facet, increases the computational cost greatly.

Author

Spectral Methods; Unstructured Grids (Mathematics); Finite Difference Theory; Conservation Laws

20040070704 NASA Langley Research Center, Hampton, VA, USA, National Inst. of Aerospace Research, Hampton, VA, USA

Revisiting the Least-squares Procedure for Gradient Reconstruction on Unstructured Meshes

Mavriplis, Dimitri J.; Thomas, James L., Technical Monitor; December 2003; 26 pp.; In English

Contract(s)/Grant(s): NCC1-02043; 762-20-11-03-00

Report No.(s): NASA/CR-2003-212683; NIA-2003-06; No Copyright; Avail: CASI; A03, Hardcopy

The accuracy of the least-squares technique for gradient reconstruction on unstructured meshes is examined. While least-squares techniques produce accurate results on arbitrary isotropic unstructured meshes, serious difficulties exist for highly stretched meshes in the presence of surface curvature. In these situations, gradients are typically under-estimated by up to an order of magnitude. For vertex-based discretizations on triangular and quadrilateral meshes, and cell-centered discretizations on quadrilateral meshes, accuracy can be recovered using an inverse distance weighting in the least-squares construction. For cell-centered discretizations on triangles, both the unweighted and weighted least-squares constructions fail

to provide suitable gradient estimates for highly stretched curved meshes. Good overall flow solution accuracy can be retained in spite of poor gradient estimates, due to the presence of flow alignment in exactly the same regions where the poor gradient accuracy is observed. However, the use of entropy fixes has the potential for generating large but subtle discretization errors. Author

Unstructured Grids (Mathematics); Least Squares Method; Gradients; Discretization (Mathematics)

20040070733 Case Western Reserve Univ., Cleveland, OH, USA

I-BEM Calculations of the Frequency Dispersion and AC Current Distribution at a Disk/Ring-Disk Electrode

Cahan, B. D.; Space Electrochemical Research and Technology: Abstracts; [1991], pp. 23; In English; See also 20040070726; No Copyright; Available from CASI only as part of the entire parent document

The Iterative Boundary Equation Method (I-BEM) has been applied to the problem of frequency dispersion at a disk electrode in a finite geometry. The I-BEM permits the direct evaluation of the AC potential (a complex variable) using complex boundary conditions. The point spacing was made highly nonuniform, to give extremely high resolution in those regions where the variables chamber most rapidly (i.e., in the vicinity of the edge of the disk). Results are analyzed with respect to "IR correction, 'I equipotential surfaces, and reference electrode placement. The current distribution is also examined for a ring-disk configuration, with the ring and the disk at the same AC potential. It is shown that the apparent impedance of the disk is inductive at higher frequencies. the literature, and usually agree to better than 0.001%.

Author

Alternating Current; Electrodes

20040070784 NASA Langley Research Center, Hampton, VA, USA

Error Analysis of p-Version Discontinuous Galerkin Method for Heat Transfer in Built-up Structures

Kaneko, Hideaki; Bey, Kim S.; [2004]; 22 pp.; In English

Contract(s)/Grant(s): NAG1-01092; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this paper is to provide an error analysis for the p-version of the discontinuous Galerkin finite element method for heat transfer in built-up structures. As a special case of the results in this paper, a theoretical error estimate for the numerical experiments recently conducted by James Tomey is obtained.

Author

Error Analysis; Galerkin Method; Heat Transfer; Parabolic Differential Equations; Finite Element Method; Discontinuity

20040070816

Chiral Analyses of Organic Compounds in Carbonaceous Meteorites

Pizzarello, Sandra; April 22, 2004; 5 pp.; In English

Contract(s)/Grant(s): NAG5-9451; Copyright; Avail: CASI; A01, Hardcopy

Contents include the following: 1. Characterization of Tagish Lake organic content. The first two grant years were largely devoted to the molecular and isotopic analyses of Tagish Lake organic composition. This carbonaceous meteorite fell in Canada in the winter of the year 2000, and its exceptional atmospheric entry and subsequent recovery (e. g., the sample was recovered and stored by avoiding hand contact and above freezing temperatures) contributed in providing a rare and pristine extraterrestrial material. 2. Chiral analyses of Murchison and Murray soluble organics. One of the most intriguing finding in regard to soluble meteorite organics is the presence within the amino acid suite of some compounds displaying L-enantiomeric excesses. This configuration is exclusive in the amino acids of terrestrial proteins and the finding has raised speculations of a possible role of amino acids from meteorites in the origin of homochirality on the early Earth. The main objective for this NASA funding was the characterization of enantiomeric excesses in meteorites and we have conducted several studies toward establishing their distribution and indignity.

Derived from text

Chirality; Organic Compounds; Carbonaceous Meteorites; Extraterrestrial Matter

20040070820 Stanford Univ., Stanford, CA, USA

Validation and Improvement of SRTM Performance over Rugged Terrain

Zebker, Howard A.; [2004]; 7 pp.; In English

Contract(s)/Grant(s): NAG5-9040; No Copyright; Avail: CASI; A02, Hardcopy

We have previously reported work related to basic technique development in phase unwrapping and generation of digital elevation models (DEM). In the final year of this work we have applied our technique work to the improvement of DEM's

produced by SRTM. In particular, we have developed a rigorous mathematical algorithm and means to fill in missing data over rough terrain from other data sets. We illustrate this method by using a higher resolution, but globally less accurate, DEM produced by the TOPSAR airborne instrument over the Galapagos Islands to augment the SRTM data set in this area, We combine this data set with SRTM to use each set to fill in holes left over by the other imaging system. The infilling is done by first interpolating each data set using a prediction error filter that reproduces the same statistical characterization as exhibited by the entire data set within the interpolated region. After this procedure is implemented on each data set, the two are combined on a point by point basis with weights that reflect the accuracy of each data point in its original image. In areas that are better covered by SRTM, TOPSAR data are weighted down but still retain TOPSAR statistics. The reverse is true for regions better covered by TOPSAR. The resulting DEM passes statistical tests and appears quite feasible to the eye, but as this DEM is the best available for the region we cannot fully veri@ its accuracy. Spot checks with GPS points show that locally the technique results in a more comprehensive and accurate map than either data set alone.
Derived from text
Algorithms; Statistical Tests; Interpolation; Digital Elevation Models

20040071158 NASA Langley Research Center, Hampton, VA, USA
DSP Implementation of the Retinex Image Enhancement Algorithm
Hines, Glenn; Rahman, Zia-Ur; Jobson, Daniel; Woodell, Glenn; [2004]; 12 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA
Contract(s)/Grant(s): NNL04AA02A; NCC1-01030; 23-728-60-30
Report No.(s): SPIE-5438-37; No Copyright; Avail: CASI; A03, Hardcopy

The Retinex is a general-purpose image enhancement algorithm that is used to produce good visual representations of scenes. It performs a non-linear spatial/spectral transform that synthesizes strong local contrast enhancement and color constancy. A real-time, video frame rate implementation of the Retinex is required to meet the needs of various potential users. Retinex processing contains a relatively large number of complex computations, thus to achieve real-time performance using current technologies requires specialized hardware and software. In this paper we discuss the design and development of a digital signal processor (DSP) implementation of the Retinex. The target processor is a Texas Instruments TMS320C6711 floating point DSP. NTSC video is captured using a dedicated frame-grabber card, Retinex processed, and displayed on a standard monitor. We discuss the optimizations used to achieve real-time performance of the Retinex and also describe our future plans on using alternative architectures.
Author
Digital Systems; Algorithms; Signal Processing; Signal Analyzers; Image Enhancement

20040073488 NASA Langley Research Center, Hampton, VA, USA
A Discontinuous Galerkin Method for Parabolic Problems with Modified hp-Finite Element Approximation Technique
Kaneko, Hideaki; Bey, Kim S.; Hou, Gene J. W.; [2004]; 22 pp.; In English
Contract(s)/Grant(s): NAG1-01092; NAG1-2300; No Copyright; Avail: CASI; A03, Hardcopy

A recent paper is generalized to a case where the spatial region is taken in R(sup 3). The region is assumed to be a thin body, such as a panel on the wing or fuselage of an aerospace vehicle. The traditional h- as well as hp-finite element methods are applied to the surface defined in the x - y variables, while, through the thickness, the technique of the p-element is employed. Time and spatial discretization scheme based upon an assumption of certain weak singularity of double vertical line u(sub t) double vertical line 2, is used to derive an optimal a priori error estimate for the current method.
Author
Galerkin Method; Finite Element Method; Parabolic Differential Equations; Approximation

20040073489 Old Dominion Univ., Norfolk, VA, USA
Error Analysis for Discontinuous Galerkin Method for Parabolic Problems
Kaneko, Hideaki; May 24, 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG1-01092; No Copyright; Avail: CASI; A01, Hardcopy

In the proposal, the following three objectives are stated: (1) A p-version of the discontinuous Galerkin method for a one dimensional parabolic problem will be established. It should be recalled that the h-version in space was used for the discontinuous Galerkin method. An a priori error estimate as well as a posteriori estimate of this p-finite element discontinuous Galerkin method will be given. (2) The parameter alpha that describes the behavior double vertical line u(sub t)(t) double vertical line 2 was computed exactly. This was made feasible because of the explicitly specified initial condition. For practical

heat transfer problems, the initial condition may have to be approximated. Also, if the parabolic problem is proposed on a multi-dimensional region, the parameter alpha, for most cases, would be difficult to compute exactly even in the case that the initial condition is known exactly. The second objective of this proposed research is to establish a method to estimate this parameter. This will be done by computing two discontinuous Galerkin approximate solutions at two different time steps starting from the initial time and use them to derive alpha. (3) The third objective is to consider the heat transfer problem over a two dimensional thin plate. The technique developed by Vogelius and Babuska will be used to establish a discontinuous Galerkin method in which the p-element will be used for through thickness approximation. This h-p finite element approach, that results in a dimensional reduction method, was used for elliptic problems, but the application appears new for the parabolic problem. The dimension reduction method will be discussed together with the time discretization method.
Author (revised)
Error Analysis; Galerkin Method; Parabolic Differential Equations

20040073529 California Inst. of Tech., Pasadena, CA, USA
Dynamical Chaos in the Wisdom-Holman Integrator: Origins and Solutions
Rauch, Kevin P.; Holman, Matthew; The Astronomical Journal; 1999; Volume 117, pp. 1087-1102; In English
Contract(s)/Grant(s): NAG5-10365; Copyright; Avail: Other Sources; Abstract Only

We examine the nonlinear stability of the Wisdom-Holman (WH) symplectic mapping applied to the integration of perturbed, highly eccentric (e-0.9) two-body orbits. We find that the method is unstable and introduces artificial chaos into the computed trajectories for this class of problems, unless the step size chosen 1s small enough that PeriaPse is always resolved, in which case the method is generically stable. This 'radial orbit instability' persists even for weakly perturbed systems. Using the Stark problem as a fiducial test case, we investigate the dynamical origin of this instability and argue that the numerical chaos results from the overlap of step-size resonances; interestingly, for the Stark-problem many of these resonances appear to be absolutely stable. We similarly examine the robustness of several alternative integration methods: a time-regularized version of the WH mapping suggested by Mikkola; the potential-splitting (PS) method of Duncan, Levison, Lee; and two original methods incorporating approximations based on Stark motion instead of Keplerian motion. The two fixed point problem and a related, more general problem are used to conduct a comparative test of the various methods for several types of motion. Among the algorithms tested, the time-transformed WH mapping is clearly the most efficient and stable method of integrating eccentric, nearly Keplerian orbits in the absence of close encounters. For test particles subject to both high eccentricities and very close encounters, we find an enhanced version of the PS method-incorporating time regularization, force-center switching, and an improved kernel function-to be both economical and highly versatile. We conclude that Stark-based methods are of marginal utility in N-body type integrations. Additional implications for the symplectic integration of N-body systems are discussed.
Author
Eccentric Orbits; Chaos; Robustness (Mathematics); Many Body Problem; Kernel Functions

20040073569 Naval Postgraduate School, Monterey, CA
Sensitivity Analysis for an Assignment Incentive Pay in the U.S. Navy Enlisted Personnel Assignment Process in a Simulation Environment
Logemann, Karsten; Mar. 2004; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422386; No Copyright; Avail: CASI; A05, Hardcopy

The enlisted personnel assignment process is a major part in the USA Navy's Personnel Distribution system. It ensures warfighters and supporting activities receive the right sailor with the right training to the right billet at the right time (R4) and is a critical element in meeting the challenges of Seapower 21 and Global CONOPS. In order to attain these optimal goals the ways-to-do-it need to be customer-centered and should optimize both, the Navy's needs and the sailor's interests. Recent studies and a detailing pilot in 2002 used a web-based marketplace with two- sided matching mechanisms to accomplish this vision. This research examines the introduction of an Assignment Incentive Pay (AlP) as part of the U,S, Navy's enlisted personnel assignment process in a simulation environment. It uses a previously developed simulation tool, including the Deferred Acceptance (DA) and the Linear Programming (LP) matching algorithm to simulate the assignment process. The results of the sensitivity analysis suggested that the Navy should mainly emphasize sailor quality rather than saving AIP funds in order to maximize utility and the possible matches When adopting such an introduction policy also the percentage of unstable matches under the LP as the matching algorithm was reduced.
DTIC
Algorithms; Billets; Incentives; Navy; Personnel; Sensitivity Analysis; Simulation

20040073588 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven

Space-Time Adaptive FIR Filtering with Staggered PRI

Klemm, R.; Mar. 14, 2001; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422432; No Copyright; Avail: CASI; A02, Hardcopy

Space-time least squares far infrared radiation (FIR) filters have shown excellent clutter rejection performance at extremely low computational loads, allowing ground moving target indication (GMTI) to be carried out in real-time. Staggering the pulse repetition interval (PRI) is an appropriate way of avoiding Doppler ambiguities and blind velocities. Fully adaptive space-time processors can cope well with staggered echo data. FIR filtering techniques are based on constant PRI and, therefore, will suffer some degradation if the radar pulses are staggered. This paper presents the concept of re-adaptation of the FIR filter coefficients at each PRI. It is shown by simulations that the total loss caused by staggering the PRI is of the order of magnitude of a few dB. However, applying a constant FIR filter to staggered data results in dramatic losses in signal-to-clutter plus noise ratio. (8 figures, 11 refs.)

DTIC

Adaptive Filters; Clutter; Doppler Radar; Far Infrared Radiation; Ground Effect (Communications); Targets

20040073589 Brigham Young Univ., Provo, UT

Parametric Filters for Non-Stationary Interference Mitigation in Airborne Radars

Parker, Peter; Swindlehurst, A. L.; Mar. 14, 2001; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422433; No Copyright; Avail: CASI; A02, Hardcopy

Multichannel parametric filters are currently being studied as a means of reducing the dimension of Space- Time Adaptive Processing (STAP) algorithms for interference rejection in airborne pulsed-Doppler radar systems. These filters are attractive to use due to the low computational cost associated with their implementation as well as their near-optimal performance with a small amount of training data for a stationary environment. However, such filters do not perform well in certain types of non-stationary environments. This paper presents two modifications to the Space-Time AutoRegressive (STAR) filter that the authors previously proposed. The first modification is based on the Extended Sample Matrix Inversion (ESMI) technique and is used in the presence of range varying clutter that arises from the use of non-linear antenna arrays or bistatic radar systems. The second modification to the STAR filter is for use in the presence of hot clutter and is a three-dimensional STAP algorithm. Using a realistic simulated data set for circular array STAP, the authors show that the modifications to the STAR filter improve its performance when in the presence of non-stationary interference. (6 figures, 8 refs.)

DTIC

Airborne Radar; Antenna Arrays; Clutter; Doppler Radar; Jamming

20040073590 Massachusetts Inst. of Tech., Lexington, MA

Simulation and Analysis of Adaptive Interference Suppression for Bistatic Surveillance Radars

Pearson, Fred; Borsari, Geordi; Mar. 13, 2001; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A422434; No Copyright; Avail: CASI; A03, Hardcopy

The standard training approach for Space Time Adaptive Processing (STAP) works poorly, especially in cases of non-stationary interference. Bistatic clutter interference exhibits a strongly range-dependent structure. The Derivative- based Updating (DBU) algorithm has an advantage over other algorithms in that no knowledge of transmitter position and velocity are required. The disadvantages of DBU are that it doubles the STAP degrees of freedom, doubles the number of training samples required, and increases the cost of weight computation by a factor of eight. The High-Order Doppler Warning (HODW) algorithm has the advantage of not requiring an increase in degrees of freedom and of being fully adaptable in spatial dimension. The disadvantages of HODW is that it requires knowledge of transmitter position and velocity, increases the complexity of Doppler filtering, and FFT techniques may not be possible with its use. These two algorithms are assessed in Air-to-Air and Space-to-Air bistatic scenarios using covariance analysis and time series analysis.

DTIC

Adaptive Filters; Clutter; Doppler Radar; Jamming; Multistatic Radar; Simulation; Surveillance

20040073591 Illinois Univ., Chicago, IL

Interference Estimation and Mitigation for STAP Using the Two-Dimensional Wold Decomposition Parametric Model

Francos, Joseph M.; Fu, Wenyin; Nehorai, Arye; Mar. 14, 2001; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A422435; No Copyright; Avail: CASI; A03, Hardcopy

The goal of space-time adaptive processing (STAP) is to manipulate the available data to achieve high gain at the target angle and Doppler and maximal mitigation along both the jamming and clutter lines. Because the interference covariance matrix is unknown a priori, it is typically estimated using sample covariances obtained from averaging over a few range gates. The authors propose a new approach for parametric modeling and estimation of STAP data, based on the two-dimensional, Wold-like decomposition of random fields. The proposed parametric estimation algorithms of the interference components simplify and improve existing STAP methods. The resulting modeling and processing methods provide new parametric tools to estimate and mitigate the Doppler ambiguous clutter. The estimation algorithms the authors propose enable the estimation of the interference signals using the observations in only a single range gate. The proposed method is particularly suitable for non-stationary clutter and jamming environments. The approach provides a new analytical insight into the STAP problem.
DTIC

Clutter; Decomposition; Doppler Radar; Jamming; Mathematical Models; Two Dimensional Models

20040073592 Science Applications International Corp., McLean, VA

Space-Time Adaptive Matched-Field Processing (STAMP)

Lee, Yung P.; Mar. 14, 2001; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422436; No Copyright; Avail: CASI; A02, Hardcopy

Space-time adaptive processing (STAP) is two- dimensional adaptive filter employed for the purpose of clutter cancellation to enable the detection of moving targets. It has been a major focus of research activity in radar applications for which the platform is in motion (e.g., airborne or space-based systems). In this setting, an antenna sensor array provides spatial discrimination, while a series of time returns or pulses form a synthetic array that provide Doppler (velocity) discrimination. The application of STAP for the mobile towed-array sonar system is non-trivial because of the complex multipaths in the underwater environment. On the other hand, Matched-field processing (MFP) that uses a propagation code to predict the complex multipath structure and coherently combines it to provide range/depth discrimination has been studied and demonstrated. MFP with a synthetic array (a series of snapshots) to estimate the source velocity and localize source in range and depth also has been demonstrated. STAMP combines the adjacent-filter beam space post-Doppler STAP and MFP to provide improved performance for the mobile multi-line-towed-array sonar applications. The processing scheme includes transforming phone time snapshots into frequency domain, at each frequency bin forming horizontal beams in the directions of interest for each towed line, then combining signals from multi-towed lines and adjacent Doppler bins and beams that cover the multi-path Doppler spread due to motion using adaptive MFP. A study of STAMP performance in the towed-array forward-looking problem is discussed. In this problem, the own-ship signal and its bottom-scattered energy can be treated as stationary interference with a moving target at constant speed within processing interval of a few minutes. (9 figures, 3 refs.)
DTIC

Adaptive Filters; Detection; Sonar; Sound Detecting and Ranging; Target Acquisition; Targets

20040073594 Massachusetts Inst. of Tech., Lexington, MA

Beamspace Adaptive Beamforming for Hydrodynamic Towed Array Self-Noise Cancellation

Premus, Vincent E.; Kogon, Stephen M.; Ward, James; Mar. 14, 2001; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A422438; No Copyright; Avail: CASI; A02, Hardcopy

A beamspace adaptive beamformer (ABF) implementation for the rejection of cable strum self-noise on passive sonar towed arrays is presented. The approach focuses on the implementation of a white noise gain constraint based on the scaled projection technique due to Cox et al. IEEE Trans. on ASSP, Vol. 35 (10), Oct. 1987. The objective is to balance the aggressive adaptation necessary for nulling the strong mainlobe interference represented by cable strum against the conservative adaptation required for protection against signal self-nulling associated with steering vector mismatch. Particular attention is paid to the definition of white noise gain as the metric that reflects the level of mainlobe adaptive nulling for an adaptive beamformer. Adaptation control is subsequently performed through the implementation of a constraint on maximum allowable white noise gain at the output of the adaptive processor. The theoretical development underlying the scaled projection-based constraint implementation is reviewed. Towed array data results depicting the performance gain of the new ABF algorithm optimized for strum cancellation relative to that of a more conservative baseline ABF algorithm are presented. (8 figures, 5 refs.)
DTIC

Beamforming; Cancellation; Sonar; Sound Detecting and Ranging

20040073595 Johns Hopkins Univ., Laurel, MD

Covariance Matrix Filtering for Adaptive Beamforming with Moving Interference

Newhall, Bruce K.; Mar. 14, 2001; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A422439; No Copyright; Avail: CASI; A02, Hardcopy

An approach is developed for adaptive beamforming for mobile sonars operating in an environment with moving interference from surface shipping. It is assumed that the sound source of each ship is drawn from an ensemble of Gaussian random noise, but each ship moves at constant speed along a deterministic course. An analytic expression for the ensemble mean covariance is obtained. In practice the location, course, speed, mean noise level, and transmission loss of each interferer are not known with sufficient precision to use the modeled ensemble mean as a basis for adaptive beamforming. The problem is thus to accurately estimate the ensemble mean based on data samples. The analytic ensemble mean is not stationary, and thus is not well estimated by the sample mean. The ensemble of covariance samples consists of rapidly varying random terms associated with the emitted noise and more slowly oscillating deterministic terms associated with the source and receiver motion. The non-stationary ensemble covariance mean can be estimated by filtering out the rapidly varying noise while retaining the slow oscillatory terms. Performance of the filters can be visualized and assessed in the epoch frequency domain, the Fourier transform of the covariance samples. In this domain, higher bearing rates show up at higher frequencies. The traditional sample mean estimator retains only the zero frequency bin corresponding to stationary interference. Techniques that can identify and include the appropriate non-zero frequency contributions are better non- stationary estimators than the sample mean. Several such techniques are offered and compared. Simulations are invaluable in evaluating the filter performance, since the ensemble mean can be precisely calculated analytically in the simulation and compared directly with the sample estimates. Simulations of adaptive beamformers using covariance filtering will be shown to yield improved robustness to shipping motion. (2 figures, 5 refs.)

DTIC

Adaptive Filters; Beamforming; Covariance; Matrices (Mathematics); Ships; Sonar

20040073600 Institut Superieur d'Electronique de Lamediterranee, Toulon

Linear Feature Detection In SAR Images

Courmontagne, Philippe; Mar. 14, 2001; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422452; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Pattern Recognition; Radar Imagery; Synthetic Aperture Radar

20040073667 Massachusetts Inst. of Tech., Cambridge, MA

Experimental Demonstration of Quantum Lattice Gas Computation

Pravia, Marco A.; Chen, Zhiying; Cory, David G.; Yepez, Jeffrey; Apr. 2003; 21 pp.; In English

Report No.(s): AD-A422558; No Copyright; Avail: CASI; A03, Hardcopy

We report an ensemble nuclear magnetic resonance (NMR) implementation of a quantum lattice gas algorithm for the diffusion equation. The algorithm employs an array of quantum information processors sharing classical information, a novel architecture referred to as a type II quantum computer. This concrete implementation provides a test example from which to probe the strengths and limitations of this new computation paradigm. The NMR experiment consists of encoding a mass density onto an array of 16 two-qubit quantum information processors and then following the computation through 7 time steps of he algorithm. the results show good agreement with the analytic solution for diffusive dynamics. We also describe numerical simulations of the NMR implementation. he simulations aid in determining sources of experimental errors and they help define the limits of the implementation.

DTIC

Gas Dynamics; Nuclear Magnetic Resonance; Quantum Computation; Quantum Theory

20040073674 University of Southern California, Los Angeles, CA

Investigation of Time-Dependent Forces on a Nano- Newton-Second Impulse Balance

D'Souza, Brian C.; Ketsdever, Andrew D.; Mar. 25, 2004; 41 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422566; No Copyright; Avail: CASI; A03, Hardcopy

A torsional impulse balance has been developed as a new diagnostic tool to study fundamental physical processes in micropropulsion systems and laser-surface interactions. The impulse balance has been designed and tested with a robust

calibration system to measure impulsive forces with resolution as low as several nano-Newton-seconds. The behavior of the impulse balance was thoroughly studied and characterized. A simple analytical model of the balance s motion was developed from the general equation of motion of an underdamped, harmonically oscillating system. Also, two distinct methods of analyzing the experimental data from the nanoimpulse balance have been investigated. The first method resolves the total impulse as a function of the balance's maximum deflection. The second method enables the determination of the impulse and/or force applied as a function of time from the balance s time- resolved motion. A calibration scheme employing electrostatic actuation techniques is used to experimentally validate the model and impulse measurement techniques.
DTIC
Impulses; Time Dependence; Torsion

20040073707 Johns Hopkins Univ., Laurel, MD
Covariance Matrix Filtering for ABF With Moving Interference
Newhall, B. K.; Mar. 2001; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A422610; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Covariance; Matrices (Mathematics)

20040073728 Michigan Univ., Ann Arbor, MI
A Quantum Computer for Shor's Algorithm
Bucksbaum, Philip H.; Mar. 20, 2004; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0373
Report No.(s): AD-A422644; ARO-40315.2-PH-QC; No Copyright; Avail: CASI; A02, Hardcopy
We employ learning algorithms, optical and terahertz pulse shaping and ultrafast laser techniques to control quantum coherence in Rydberg atom wave packet quantum data registers. Our goals are to discover efficient ways to limit decoherence in these systems, execute arbitrary unitary operations and projection operations, and produce and probe quantum entanglement. Rydberg atoms have many of the same quantum properties of other systems that have been proposed for processing and storing quantum information, and so they are models for techniques that could be employed in proposed quantum computers.
DTIC
Algorithms; Computers; Quantum Theory

20040073769 Army Research Lab., Aberdeen Proving Ground, MD
BRL-CAD Tutorial Series: Volume IV Converting Geometry Between BRLCAD and Other Formats
Anderson, John R.; Edwards, Eric W.; May 2004; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD17-03-D-001
Report No.(s): AD-A422718; ARL-SR-121; No Copyright; Avail: CASI; A04, Hardcopy
Since 1979, the U.S. Army Research Laboratory has been developing and distributing the BRL-CAD constructive solid geometry (CSG) modeling package for a wide range of military and industrial applications. The package includes a large collection of tools and utilities, including an interactive three-dimensional geometry editor, raytracing and generic framebuffer libraries, network-distributed image- processing and signal-processing capabilities, and an embedded scripting language. As part of this effort, a multivolume tutorial series is being developed to assist users in the many features of the BRL-CAD package. Converting Geometry Between BRL-CAD and Other Formats, which is the fourth volume in the series, discusses pertinent characteristics of the BRL-CAD file format and provides specific instruction on converting to/from various other modeling file formats. Also discussed are the steps involved in creating a new BRL-CAD converter and postconversion issues.
DTIC
Computer Aided Design; Computer Aided Manufacturing; Education; Format

20040073773 Naval Research Lab., Washington, DC
An Improved Method for Solving Systems of Linear Equations in Frequency Response Problems
Marcus, Martin H.; Apr. 15, 2004; 10 pp.; In English
Report No.(s): AD-A422723; NRL/FR/7130--04-10; 072; No Copyright; Avail: CASI; A02, Hardcopy
Vibration and acoustics problems that require solving matrix equations for many frequencies have solutions that vary very

little from one frequency to the next. This suggests that an iterative method using the solution at one frequency could be used to obtain the next frequency solution. In this report, the matrix inverse at the first frequency serves as the preconditioner for the preconditioned conjugate gradient method to obtain subsequent frequencies. For the problem examined in this report, in which the matrix comes from the finite-element analysis of a cube, the iterative method is more than an order of magnitude faster than Gaussian elimination.
DTIC
Frequency Response; Linear Equations; Sound Waves

20040073804 North Carolina Agricultural and Technical State Univ., Greensboro, NC
Language Analysis and Generation in Algebra Tutorial Dialogues for Language-Based Intelligent Tutoring Systems
Kim, Jung Hee; May 10, 2004; 18 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0164
Report No.(s): AD-A422821; FRS-4-41204; No Copyright; Avail: CASI; A03, Hardcopy

The North Carolina A&T State University algebra tutoring dialogue project collects and analyzes algebra tutoring dialogues with the aim of describing tutoring strategies and language with enough rigor that they may be evaluated and incorporated in machine tutoring. The tutoring is computer-mediated chat-style, with the tutor and student collaboratively solving a problem and editing equations. Transcripts of these dialogues are annotated for tutorial intentions. language, and behaviors. Comparison of tutoring by more and less expert tutors allows us to focus on the strategies that are most effective. The most prominent we observe is a metacognitive strategy where the tutor tries to elicit from the student a categorization of the problem under discussion and to name a solution method. We combine these strategies into a structured set of tutorial goals, with example sentences for each. In subsequent tutoring the computer then suggests these goals and sentences to the - human tutor, who can pick use them in the dialogue. Measuring how much the tutors follow the computer-assistance, as well as student learning gains, allows to evaluate the validity of our structural analysis of tutoring.
DTIC
Algebra; Computer Assisted Instruction

20040073825 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Age Replacement and Service Rate Control of Stochastically Degrading Queues
Chapin, Patrick S.; Mar. 2004; 101 pp.; In English
Report No.(s): AD-A422880; AFIT/GOR/ENS/04-02; No Copyright; Avail: CASI; A06, Hardcopy

This thesis considers the problem of optimally selecting a periodic replacement time for a multiserver queueing system in which each server is subject to degradation as a function of the mean service rate and a stochastic and dynamic environment. Also considered is the problem of optimal service rate selection for such a system. In both cases, the performance metric is the long-run average cost rate. Analytical expressions are obtained, in terms of Laplace transforms, for the nonlinear objective functions, necessitating the use of numerical Laplace transform inversion to evaluate candidate solutions in conjunction with standard numerical algorithms. Due to the convexity of the objective function, the optimal replacement time is computed using a hybrid bisection-secant method which yields globally optimal solutions. The optimal service rates are obtained via gradient search methods but are only guaranteed to provide locally optimal solutions. The analytical results are implemented on three notional examples that demonstrate the benefits of dynamically adjusting service rates under the described maintenance policy.
DTIC
Aging (Materials); Degradation; Economic Factors; Replacing; Stochastic Processes

20040074229 NASA Langley Research Center, Hampton, VA, USA, National Inst. of Aerospace, Hampton, VA, USA
Stochastic Control Synthesis of Systems with Structured Uncertainty
Padula, Sharon L., Technical Monitor; Crespo, Luis G.; December 2003; 31 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC-1-02043; WU 762-20-61-01; 23-762-45-G6
Report No.(s): NASA/CR-2003-212167; NIA-2003-01; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a study on the design of robust controllers by using random variables to model structured uncertainty for both SISO and MIMO feedback systems. Once the parameter uncertainty is prescribed with probability density functions, its effects are propagated through the analysis leading to stochastic metrics for the system's output. Control designs that aim for satisfactory performances while guaranteeing robust closed loop stability are attained by solving constrained non-linear optimization problems in the frequency domain. This approach permits not only to quantify the probability of having unstable

and unfavorable responses for a particular control design but also to search for controls while favoring the values of the parameters with higher chance of occurrence. In this manner, robust optimality is achieved while the characteristic conservatism of conventional robust control methods is eliminated. Examples that admit closed form expressions for the probabilistic metrics of the output are used to elucidate the nature of the problem at hand and validate the proposed formulations.
Author
Stochastic Processes; Control Systems Design; Optimization; Robustness (Mathematics); Probability Theory; Uncertain Systems

20040074324 Old Dominion Univ., Norfolk, VA, USA
An Investigation of Wave Propagations in Discontinuous Galerkin Method
Hu, Fang Q.; 2004; 4 pp.; In English; 7th AIAA/CEAS Aeroacoustics Conference, 2001, Maastricht, Netherlands
Contract(s)/Grant(s): NAG1-01044; No Copyright; Avail: CASI; A01, Hardcopy

Analysis of the discontinuous Galerkin method has been carried out for one- and two-dimensional system of hyperbolic equations. Analytical, as well as numerical, properties of wave propagation in a DGM scheme are derived and verified with direct numerical simulations. In addition to a systematic examination of the dissipation and dispersion errors, behaviours of a DG scheme at an interface of two different grid topologies are also studied. Under the same framework, a quantitative discrete analysis of various artificial boundary conditions is also conducted. Progress has been made in numerical boundary condition treatment that is closely related to the application of DGM in aeroacoustics problems. Finally, Fourier analysis of DGM for the Convective diffusion equation has also be studied in connection with the application of DG schemes for the Navier-Stokes equations. This research has resulted in five(5) publications, plus one additional manuscript in preparation, four(4) conference presentations, and three(3) departmental seminars, as summarized in part II. Abstracts of papers are given in part 111 of this report.
Author
Wave Propagation; Galerkin Method; Two Dimensional Models; Numerical Analysis

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040073593 Duke Univ., Durham, NC
Moving Target Depth Estimation for Passive Sonar, Using Sequential Resampling Techniques
Kraut, Shawn; Krolik, Jeffrey; Mar. 14, 2001; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A422437; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, the authors investigate an approach of joint estimation of range-rate and depth in a littoral environment, rather than range and depth. Range-rate provides another dimension with which to discriminate targets against interfering sources (such as moving ships). In addition, discrimination based on range-rate is more robust with respect to environmental uncertainties as verified by simulations, and with respect to associated uncertainties in the horizontal wave numbers of the channel modes used for the matched-field target response. Using this approach, the complex amplitudes of the modes are treated as nuisance parameters, which comprise a hidden, first-order Markov state process. In lieu of an analytic expression of the updated likelihood, they have investigated a technique of sequential resampling or particle filtering. They compare its performance with the conventional matched-field processor (MFP), which localizes in depth and range. The limitations of this particular technique seem to be its ability to compensate for low signal-to-noise ratio by integrating over many snapshots. It should be emphasized, however, that this is a limitation of the particle-filter implementation investigated here and not a limitation of the basic state-model approach of localizing with respect to range- rate and depth, rather than range and depth. Future work will be focused on implementations that more effectively exploit the entire data history. (8 figures, 10 refs.)
DTIC
Depth; Depth Measurement; Regions; Sonar; Sound Ranging; Targets

20040073610 Army Research Lab., Aberdeen Proving Ground, MD

Acquiring Data for the Development of a Finite Element Model of an Airgun Launch Environment

Szymanski, Edward A.; Mar. 2004; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422483; ARL-MR-581; No Copyright; Avail: CASI; A03, Hardcopy

The objective was to obtain both strain data (ue) and acceleration data (g) of a test article to aid in the development of a finite element model of an airgun launch environment. A 4-in airgun was utilized to obtain the required data from the test article. The author's responsibility for these series of airgun tests was to instrument the test article, configure and calibrate the on-board recorder, and retrieve and process the acquired data from each of the three airgun tests.

DTIC

Data Acquisition; Finite Element Method; Gas Guns; Launching; Mathematical Models

20040073695 Naval Undersea Warfare Center, Newport, RI

Optimum Detection of Random Signal in Non-Gaussian Noise for Low Input Signal-to-Noise Ratio

Nuttall, Albert H.; Feb. 23, 2004; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422595; NUWC-NPT-TR-11; 512; No Copyright; Avail: CASI; A03, Hardcopy

Optimum detection of a weak stationary random signal in independent non-Gaussian noise requires knowledge of the first-order probability density function of the noise and the covariance function of the signal. More precisely, the first and second derivatives of the input noise probability density function must be known to realize the optimum processor. When these two derivatives must be estimated from a finite segment of noise-only data, a severe demand is placed on the amount of required data. Estimation of higher derivatives of histograms is not accomplished reliably without considerable amounts of data. The presence of heavy-tailed noise data exacerbates this issue. The situation improves when Gaussian noise is considered, mainly because the second derivative of the noise density is not relevant or required for Gaussian noise; all other noise densities must have this information to achieve optimum detection. The samples of the random input signal process need not be taken at an independent rate. However, the covariance of the signal process must be known for optimum processing. The joint probability density function of the input signal is not required for low input signal-to-noise ratios. A simple example of a multipath signal is presented in this report that indicates the need for knowledge of the relative path strengths and the multipath delay time. Lack of knowledge of these parameters in this model requires multiple guesses at their values and parallel processors; the amount of degradation depends on the uncertainty of the medium characteristics.

DTIC

Random Noise; Random Signals; Signal Detection; Signal to Noise Ratios

20040073732 Rice Univ., Houston, TX

Wavelet-Based Bayesian Methods for Image Analysis and Automatic Target Recognition

Nowak, Robert D.; Feb. 15, 2001; 6 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0349

Report No.(s): AD-A422648; 00072804; ARO-P-40447.2-CI-YIP; No Copyright; Avail: CASI; A02, Hardcopy

This work investigates the use or Bayesian multiscale techniques for image analysis and automatic target recognition. We have developed two new techniques. First, we have develop a wavelet-based approach to image restoration and deconvolution problems using Bayesian image models and an alternating-maximation method. Second, we have developed a wavelet-based framework for target modeling and recognition that we call TEMPLAR (TEMPlate Learning from Atomic Representations) . TEMPLAR is can he used to automatically extract low-dimensional wavelet representations (or templates) or target objects from observation data, providing robust and computationally efficient target classifiers. On a more theoretical level, we have developed a framework for multiresolution analysis or likelihood functions, which extends wavelet-like analysis to a wide class or non-Gaussian processes. In another line of investigation, we are exploring a new imaging application known as network tomography. The goal of this work is to characterize the internal performance of communication networks based only on external measurements at the edge (sources and receivers) of the network. In the coming year, we plan to focus on four key research areas. First, we will develop theoretical hounds on the performance of multiscale/wavelet estimators in non-Gaussian environments including Poisson imaging applications. Second, we will study the use of complex wavelets in image restoration and target recognition problems. Third, we will develop automatic methods for segmenting imagery (SAR, FLIR, LADAR) based on complexity- regularization methods. Fourth, we will continue to develop a unified framework for communication network tomography and investigate new tools for network performance visualization.

DTIC

Bayes Theorem; Image Analysis; Image Processing; Restoration; Target Recognition; Templates; Wavelet Analysis

20040073797 Naval Research Lab., Washington, DC

Isotope Ratio Spectrometry Data Processing Software: Multivariate Statistical Methods for Hydrocarbon Source Identification and Comparison

Boyd, Thomas J.; Coffin, Richard B.; Apr. 29, 2004; 145 pp.; In English

Report No.(s): AD-A422798; NRL/MR/6110--04-8774; No Copyright; Avail: CASI; A07, Hardcopy

The IRMS Data Processing software package is designed to allow easy stable isotope data entry and multivariate data analysis. When comparing two of more hydrocarbon samples using compound-specific isotope ratio mass spectrometry, an analyst obtains multiple data variables for each sample. Multivariate statistics allows rigorous comparison(s) to determine if the samples are in fact different and if so, how closely related they are. This software uses three main types of data analyses: Multiple Analysis of Variance (MAN0VA), Principal Components Analysis (PCA), and Cluster Analysis. The layout is a standard Windows interface which should be usable to anyone familiar with modem operating system software.

DTIC

Data Processing; Hydrocarbons; Isotope Ratios; Isotopes; Multivariate Statistical Analysis; Spectrometers; Statistical Analysis

20040073812 Auburn Univ., AL

On Channel Estimation Using Superimposed Training and First-Order Statistics

Tugnait, Jitendra K.; Luo, Weilin; Oct. 6, 2003; 4 pp.; In English

Report No.(s): AD-A422839; ARO-41703.14-CL; No Copyright; Avail: CASI; A01, Hardcopy

Channel estimation for single-input multiple- output (SIMO) time-invariant channels is considered using only the first-order statistics of the data, A periodic (nonrandom) training sequence is added (superimposed) at a low power to the information sequence at the transmitter before modulation and transmission, Recently superimposed training has been used for channel estimation assuming no mean-value uncertainty at the receiver and using periodically inserted pilot symbols, We propose a different method that allows more general training sequences and explicitly exploits the underlying cyclostationary nature of the periodic training sequences, We also allow mean-value uncertainty at the receiver, Illustrative computer simulation examples are presented,

DTIC

Education

20040073828 Air Force Inst. of Tech., Wright-Patterson AFB, OH

An Investigation of the Effects of Correlation, Autocorrelation, and Sample Size in Classifier Fusion

Leap, Nathan J.; Mar. 2004; 119 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422884; AFIT/GOR/ENS/04-06; No Copyright; Avail: CASI; A06, Hardcopy

This thesis extends the research found in Storm, Bauer, and Oxley, 2003. Data correlation effects and sample size effects on three classifier fusion techniques and one data fusion technique were investigated. Identification System Operating Characteristic Fusion (Haspert, 2000), the Receiver Operating Characteristic Within Fusion method (Oxley and Bauer, 2002), and a Probabilistic Neural Network were the three classifier fusion techniques; a Generalized Regression Neural Network was the data fusion technique. Correlation was injected into the data set both within a feature set (autocorrelation) and across feature sets for a variety of classification problems, and sample size was varied throughout. Total Probability of Misclassification (TPM) was calculated for some problems to show the effect of correlation on TPM. Feature selection was performed in some experiments to show the effects of selecting only certain features. Finally, experiments were designed and analyzed using analysis of variance to identify what factors had the most significant impact on fusion algorithm performance.

DTIC

Autocorrelation; Classifications; Classifiers; Multisensor Fusion

20040074143 Department of the Navy, Arlington, VA

Sensitivity of Track Velocity Error to Data Registration and Dynamic Errors within a Distributed System

Apr. 13, 2004; 43 pp.; In English

Report No.(s): AD-A422473; TR-2004-001; No Copyright; Avail: CASI; A03, Hardcopy

The success of accurately tracking an aerospace object is strongly dependent on how well the position, velocity, and acceleration of the object is known. Understanding what contributes to errors in these quantities, and how, is important in predicting the performance of a tracking system or as in the case of a Single Integrated Air Picture (SIAP) a distributed tracking system. A previous JSSEO Technical Report investigated position estimate errors as a function of data registration

and dynamic errors. The Technical Report is a complement to that earlier analysis and outlines a similar methodology for understanding and investigating track velocity estimate errors. The study of velocity estimate errors is relevant not only to the general problem of aerospace object tracking, but also to the analysis of specific operational threads. For example, in an Integrated Fire Control(IFC) engagement, the interceptor will use positional and velocity information about the target. Therefore, knowledge of the errors in both the position and velocity estimates is important to predicting system performance. DTIC

Errors; Missile Tracking; Missiles; Sensitivity; Velocity Errors

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040068278 NASA Ames Research Center, Moffett Field, CA, USA

Identifying Model-Based Reconfiguration Goals through Functional Deficiencies

Benazera, Emmanuel; Trave-Massuyes, Louise; [2004]; 7 pp.; In English; 45th International Workshop on Principles of Diagnosis, 23-25 Jun. 2004, Carcassonne, France

Report No.(s): Rept-1; No Copyright; Avail: CASI; A02, Hardcopy

Model-based diagnosis is now advanced to the point autonomous systems face some uncertain and faulty situations with success. The next step toward more autonomy is to have the system recovering itself after faults occur, a process known as model-based reconfiguration. After faults occur, given a prediction of the nominal behavior of the system and the result of the diagnosis operation, this paper details how to automatically determine the functional deficiencies of the system. These deficiencies are characterized in the case of uncertain state estimates. A methodology is then presented to determine the reconfiguration goals based on the deficiencies. Finally, a recovery process interleaves planning and model predictive control to restore the functionalities in prioritized order.

Author

Failure Analysis; System Failures; Automatic Control; Fault Detection

20040068395 NASA Ames Research Center, Moffett Field, CA, USA

Comparing Methods for UAV-Based Autonomous Surveillance

Freed, Michael; Harris, Robert; Shafto, Michael; February 06, 2004; 6 pp.; In English; National Conference on Artificial Intelligence, 25-29 Jul. 2004, San Jose, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

We describe an approach to evaluating algorithmic and human performance in directing UAV-based surveillance. Its key elements are a decision-theoretic framework for measuring the utility of a surveillance schedule and an evaluation testbed consisting of 243 scenarios covering a well-defined space of possible missions. We apply this approach to two example UAV-based surveillance methods, a TSP-based algorithm and a human-directed approach, then compare them to identify general strengths, and weaknesses of each method.

Author

Pilotless Aircraft; Operator Performance; Surveillance

20040070800 NASA Ames Research Center, Moffett Field, CA, USA, Computer Sciences Corp., Moffett Field, CA, USA

A Comparison of Techniques for Scheduling Earth-Observing Satellites

Globus, Al; Crawford, James; Lohn, Jason; Pryor, Anna; 2004; 8 pp.; In English; Applications of Artificial Intelligence Conference, 25-29 Jul. 2004, San Jose, CA, USA

Contract(s)/Grant(s): AIST-0042; No Copyright; Avail: CASI; A02, Hardcopy

Scheduling observations by coordinated fleets of Earth Observing Satellites (EOS) involves large search spaces, complex constraints and poorly understood bottlenecks, conditions where evolutionary and related algorithms are often effective. However, there are many such algorithms and the best one to use is not clear. Here we compare multiple variants of the genetic algorithm: stochastic hill climbing, simulated annealing, squeaky wheel optimization and iterated sampling on ten realistically-sized EOS scheduling problems. Schedules are represented by a permutation (non-temperal ordering) of the observation requests. A simple deterministic scheduler assigns times and resources to each observation request in the order indicated by the permutation, discarding those that violate the constraints created by previously scheduled observations. Simulated annealing performs best. Random mutation outperform a more ‘intelligent’ mutator. Furthermore, the best mutator,

by a small margin, was a novel approach we call temperature dependent random sampling that makes large changes in the early stages of evolution and smaller changes towards the end of search.
Author
Scheduling; Earth Observing System (Eos); Genetic Algorithms

20040074137 National Defense Univ., Washington, DC
Defense Horizons. Number 19, October 2002. Effects- Based Operations: Building the Analytic Tools
Saunders-Newton, Desmond; Frank, Aaron B.; Oct. 2002; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422463; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Horizon; Military Operations; Operations Research; Planning

20040074225 Defence Science and Technology Organisation, Edinburgh, Australia
An Improvement to Situational Force Scoring for Adjudicating Attrition in Combined Arms Conflicts
Gill, Andrew; March 2004; 41 pp.; In English
Report No.(s): DSTO-TN-0543; DODA-AR-013-056; Copyright; Avail: Other Sources
Situational Force Scoring is routinely used for combined-arms combat adjudication. This paper asserts that there is a basic problem with Situational Force Scoring due to its use of aggregation and disaggregation. Examples are used to show that in certain limiting situations, nonsensical attrition results are predicted. A simple alteration is suggested and the approaches are compared for a typical application whereby optimal force structures are sought. For several situations both approaches suggest identical or similar solutions, although the resulting attrition display a lower level of correlation. Importantly, however, in some situations the new approach suggests somewhat different results. A game theory analysis is also provided to illustrate the potential use of such models in estimating robust force allocations,
Author
Allocations; Combat; Scoring

20040074226 Defence Science and Technology Organisation, Edinburgh, Australia
Towards an Analytical Framework for Evaluating the Impact of Technology on Future Contexts
Dortmans, Peter J.; Curtis, Neville J.; February 2004; 45 pp.; In English
Report No.(s): DSTO-TR- 1554; DODA-AR-013-034; Copyright; Avail: Other Sources
This report provides a framework that supports the capture, classification and collation of technological trends and innovations from their earliest appearance right through to their impact on military thought, both directly, through military application, and indirectly, through impacts on the future context. The approach is centered on postulated effects-based technology concepts, determined through combinations of enabling technologies and designed against delivering required battlespace effects. Such a framework provides the capacity to identify incremental (evolutionary) trends and some truly revolutionary (disruptive) technologies that have the potential to substantially impact on future war-fighting operations. It also discusses the roles of and relationships between the various participants in such a process.
Author
Technology Utilization; Research and Development; Trends; Classifications; Collating

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040068172 NASA Ames Research Center, Moffett Field, CA, USA
Simple Math is Enough: Two Examples of Inferring Functional Associations from Genomic Data
Liang, Shoudan; 2003; 19 pp.; In English
Contract(s)/Grant(s): 302-05-42; No Copyright; Avail: CASI; A03, Hardcopy
Non-random features in the genomic data are usually biologically meaningful. The key is to choose the feature well. Having a p-value based score prioritizes the findings. If two proteins share a unusually large number of common interaction

partners, they tend to be involved in the same biological process. We used this finding to predict the functions of 81 un-annotated proteins in yeast.
Derived from text
Applications of Mathematics; Genome; Genetics

20040068180 NASA Ames Research Center, Moffett Field, CA, USA
Deriving Laws from Ordering Relations
Knuth, Kevin H.; [2004]; 32 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The effect of Richard T. Cox's contribution to probability theory was to generalize Boolean implication among logical statements to degrees of implication, which are manipulated using rules derived from consistency with Boolean algebra. These rules are known as the sum rule, the product rule and Bayes Theorem, and the measure resulting from this generalization is probability. In this paper, I will describe how Cox s technique can be further generalized to include other algebras and hence other problems in science and mathematics. The result is a methodology that can be used to generalize an algebra to a calculus by relying on consistency with order theory to derive the laws of the calculus. My goals are to clear up the mysteries as to why the same basic structure found in probability theory appears in other contexts, to better understand the foundations of probability theory, and to extend these ideas to other areas by developing new mathematics and new physics. The relevance of this methodology will be demonstrated using examples from probability theory, number theory, geometry, information theory, and quantum mechanics.
Author
Bayes Theorem; Boolean Algebra; Probability Theory; Sum Rules; Algebra

20040073531 Princeton Univ., NJ
A High Efficiency Algorithm for Combinatorial Synthesis: Maximum Utilization of Minimal Libraries
Rabitz, Herschel; Jan. 15, 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0297
Report No.(s): AD-A413449; AF-6773-3; AFRL-SR-AR-TR-03-0161; No Copyright; Avail: CASI; A02, Hardcopy

This research addressed the common mathematical characteristics of a broad variety of science and engineering applications having large numbers of input variables for exploration. A family of High Dimensional Model Representation (HDMR) techniques was developed to provide efficient and accurate input-output maps for such problems. HDMR operates by breaking down the original high dimensional map into a hierarchy of interrelated lower dimensional components. The mathematical and numerical foundations of HDMR were developed along with demonstrations of its capabilities in selected chemistry, physics, and engineering applications.
DTIC
Algorithms; Combinatorial Analysis; Libraries

20040073676 Utah Univ., Salt Lake City, UT
Engineered Photonic Materials for Nanoscale Optical Logic Devices
Blair, Steve; Feb. 24, 2004; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0556
Report No.(s): AD-A422569; ARO-41374.6-PH-YIP; No Copyright; Avail: CASI; A02, Hardcopy

Two major activities of this grant were to develop a generalized approach to the enhancement of nonlinear optical effects based upon slow-light propagation in artificial resonators and the study of nonlinear self-focusing in periodic arrays of photonic microcavities, thereby providing a mechanism for the formation of very narrow (i.e. wavelength scale) spatial solitons at very low powers.
DTIC
Optical Equipment; Wave Propagation

20040073696 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Optimal Design of Generalized Multiple Model Adaptive Controllers
Brehm, Thomas E.; Mar. 2004; 298 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422596; AFIT/DS/ENG/04-01; No Copyright; Avail: CASI; A13, Hardcopy

Advanced analysis and optimal design techniques that achieve performance improvement for multiple model adaptive control (MMAC) and multiple model adaptive estimation (MMAE) based control are developed and tested for this dissertation

research. An adjunct area of research yielded modified linear quadratic Gaussian (LQG) control design techniques that also can be applied to nonadaptive control. For the Modified LQG (MLQG) controller, the proposed designs remove the assumption that the Kalman filter as the observer and the controller gain matrix design are necessarily based on the same model as the best system model. The filter and controller gain matrices are both determined by models possibly other than the system model. In order to achieve optimal performance, the interrelationship of the system model to the filter and controller design models is established by minimizing a position correlation (mean square error on output) measure. Enhanced robustness is realized by considering the performance over the range of values of specified parameter(s) of the system model.
DTIC
Adaptive Control; Kalman Filters; Models

20040073697 Florida Agricultural and Mechanical Univ., Tallahassee, FL
Automated Modern Control Design
Collins, Emmanuel G.; Oct. 21, 2003; 3 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0720
Report No.(s): AD-A422597; ARO-41420.1-CI-H; No Copyright; Avail: CASI; A01, Hardcopy

The aim of this research is to demonstrate that fuzzy logic may be used to harness human expertise to automatically tune modern control systems, which can lead to higher performing control systems and savings in the time devoted by the control engineer. Designing controllers for which selected system (input and output) variances are constrained have practical applications to a variety of problems, including control design for flexible structures. This research has demonstrated that a fuzzy algorithm developed by the investigators allows the design of reduced- order, H2 optimal controllers that satisfy bounds on selected system variances. This is the first time that an algorithm has been developed and demonstrated for weight selection in the design of reduced-order controllers. In addition, this research developed a fuzzy algorithm for choosing weights in single-input, single-output H loop shaping control design with multiple time-domain and frequency-domain objectives. As a theoretical extension of the fuzzy weight selection algorithms, this research also developed a fuzzy algorithm for solving inexplicit and undetermined nonlinear systems of the form F(x)=0, where F: R(super n) (right arrow) R(super m). An inexplicit system is one for which there is no analytical expression for the function F(x). An undetermined nonlinear system is one for which m < n. These results have wide applicability since zero-finding problems are prevalent in engineering and science. The report briefly summarizes some of the most important results obtained in this research: H2 Optimal Reduced Order Control Design Using a Fuzzy Logic Methodology with Bounds on System Variances; Facilitating SISO Design of Multiobjective H Loop Shaping Control Systems; and Solution of Inexplicit Systems of Nonlinear Algebraic Equations by Fuzzy Logic. The details of this research can be found in the publications listed at the end of the report.
DTIC
Automatic Control; Fuzzy Systems; Man Machine Systems; Nonlinear Systems

20040073803 Purdue Univ., West Lafayette, IN
Analysis of Statistical Performance Measures
Zoltowski, Michael D.; May 12, 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-01-0077
Report No.(s): AD-A422819; PURDUE-TR-EE-04-7; No Copyright; Avail: CASI; A03, Hardcopy

When only a limited number of snapshots is available for estimating the spatial correlation matrix, a low- rank solution of the MVDR equations, obtained via a small number of iterations of Conjugate Gradients (CG), can yield a higher SINR than the full-rank MVDR beamformer. A primary issue addressed in this effort is whether the unity gain constraint in the look direction should be enforced a-priori via the use of a blocking matrix, constituting Steering Dependent Conjugate Gradients (SD-CG), or effected a- posteriori through simple scaling of the beamforming vector, constituting Steering Independent Conjugate Gradients (SI-CG). A major contribution was that the two methods yield exactly the same low-rank beamformer. This is an important result since the construction, and application to the data, of a blocking matrix for each "look" direction is computationally burdensome. A simplified expression for the power estimate obtained with the SI-CG beamformer was also developed. Extensive simulations were conducted to verify the efficacy of the theory. While it was known that the optimal number of steps of SI-CG varies with look direction, simulations presented here reveal that the optimal number of principal eigenvectors for the PCI beamformer varies substantially with look direction.
DTIC
Beamforming; Sonar

20040073805 Naval Postgraduate School, Monterey, CA
Signal Enhancement Using Time-Frequency Based Denoising
Hughes, John B.; Mar. 2003; 125 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422822; No Copyright; Avail: CASI; A06, Hardcopy

This thesis investigates and compares time and wavelet-domain denoising techniques where received signals contain broadband noise. We consider how time and wavelet- domain denoising schemes and their combinations compare in the mean squared error sense. This work applies Wiener prediction and Median filtering as they do not require any prior signal knowledge. In the wavelet-domain we use soft or hard thresholding on the detail coefficients. In addition, we explore the effect of these wavelet-domain thresholding techniques on the coefficients associated with cycle-spinning and the newly proposed recursive cycle-spinning scheme. Finally, we note that thresholding does not make an attempt to de-noise coefficients that remain after thresholding; therefore we apply time domain techniques to the remaining detail coefficients from the first level of decomposition in an attempt to de-noise them further prior to reconstruction. This thesis applies and compares these techniques using a mean squared error criterion to identify the best performing in a robust test signal environment. We find that soft thresholding with Stein's Unbiased Risk Estimate (SURE) thresholding produces the best mean squared error results in each test case and that the addition of Wiener prediction to the first level of decomposition coefficients leads to a slightly enhanced performance. Finally, we illustrate the effects of denoising algorithms on longer data segments.
DTIC
Algorithms; Augmentation; Frequencies

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*.

20040068234 Lockheed Martin Corp., Syracuse, NY, USA
Experimental and Numerical Investigation of Impinging Jet Flow in Square Ducts Intersecting at 90 degrees
Corson, D.; Vassallo, P.; Oct. 2003; 54 pp.; In English
Report No.(s): DE2004-822274; LM-03K110; No Copyright; Avail: Department of Energy Information Bridge

An experimental and numerical investigation has been conducted on flow through two square ducts with a 2:1 hydraulic diameter ratio joined at a right angle. Measurements of the velocity field were acquired using a laser Doppler velocimeter at various planar locations throughout the ducts at a nominal Reynolds number of 68, 000. Pressure drop measurements were taken for 3 Reynolds numbers between 46,000 and 93,000. Computational fluid dynamics (CFD) analyses were performed using STAR-CD to determine how well the experimental data could be predicted using the k-(var-epsilon), k-(var-epsilon) RNG, k-(var-epsilon)Chen, k-(var-epsilon) quadratic, k-(omega), and Spalart-Allmaras models. The results show that there are distinct differences in the CDF results. The standard k-(var-epsilon) model overpredicted the loss coefficient by 4% and underpredicted the exit swirl magnitude by 43%. The best predictor of the swirl decay was found to be the k-(omega) model, which adequately followed the data throughout the entire geometry and underpredicted the exit swirl by 16%. The best overall model was found to be Spalart-Allmaras, which overpredicted the loss coefficient by 2% and underpredicted the exit swirl magnitude by 40%.
NTIS
Decay; Hydraulics; Ducts

20040068235 Lockheed Martin Corp., Syracuse, NY, USA
Ohmic Contacts to n-type GaSb and n-type GaInAsSb
Huang, R. K.; Wang, C. A.; Harris, C. T.; Connors, M. K.; Shiau, D. A.; Jun. 2003; 22 pp.; In English
Report No.(s): DE2004-822096; LM-03K059; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Gallium Arsenides; N-Type Semiconductors

20040068241 Lawrence Livermore National Lab., Livermore, CA
Thick Liquid-Walled Spheromak Magnetic Fusion Power Plant. Revision 1
Moir, R. W.; Bulmer, R. H.; Fowler, T. K.; Rognlien, T. D.; Youssef, M. Z.; Oct. 03, 2002; In English
Report No.(s): DE2003-15004532; UCRL-ID-148021-R1; No Copyright; Avail: National Technical Information Service (NTIS)

This power plant design study applies liquid walls to the steady state spheromak plasma confinement configuration. A self-consistent point design was the goal. The main theme of this work is the use of liquid wall and steady state operation. The logic of this design process follows: the configuration is based on MHD equilibrium calculations; a discussion of the steady-state gun injection for current drive; the development of the plasma and other related parameters; a discussion of the electrodes and insulators; a discussion of the liquid wall flows with the calculation of surface temperatures (based on incident power on the liquid surface and interior,); the calculation of evaporation rates from the liquid surfaces that depend only on surface temperature; and discussion of the edge plasma, the estimates of evaporation allowed from core plasma contamination with impurities, and the ability to breed tritium.
NTIS
Evaporation Rate; Liquid Flow; Liquid Surfaces; Magnetohydrodynamics; Nuclear Fusion; Plant Design; Wall Flow

20040068251 Lawrence Livermore National Lab., Livermore, CA
Understanding Particle Defect Transport in an ultra-clean Sputter Coating Process
Walton, C.; Kearney, P.; Folta, J.; Sweeney, D.; Mirkarimi, P.; Apr. 2003; In English
Report No.(s): DE2003-15004710; UCRL-JC-152605; No Copyright; Avail: National Technical Information Service (NTIS)
Low-defect mask blanks remain a key technical challenge to Extreme Ultraviolet Lithography (EUVL). The mask blank is ion-beam sputter-coated with an 81-layer Mo/Si multilayer stack for high reflectance at(lambda)= 13. 4nm. The current mask coating process can achieve a median added defect level of 0.05 defects/sq cm (12 added defects 90nm or larger on a 200mm Si-wafer test substrate), but this must be reduced by about a factor of 10 to meet mask cost requirements for EUVL. To further reduce the particle defect level, we have studied pathways for particle transport, using test particles and particles native to the coating process, and combined the results into a computational model of particle transport in an ion-beam sputter system. At process pressure, gas drag is negligible for particles above 100nm, so particles travel ballistically until they hit a surface. Bounce from chamber walls allows particles to reach all surfaces in the chamber if they have initial velocities above(approx)100m/s. The ion beam has sufficient momentum to entrain slower particles and accelerate them toward the sputter target, where some can bounce to the substrate. The model shows preliminary agreement with experimental defect distributions on witness wafers at various positions within the coating chamber.
NTIS
Coating; Particle Emission; Walls; Substrates; Ion Beams

20040068256 Lawrence Livermore National Lab., Livermore, CA
Quiescent Double Barrier H-Mode Plasmas in the DIII-D Tokamak
Burrell, K. H.; Austin, M. E.; Brennan, D. P.; DeBoo, J. C.; Doyle, E. J.; Nov. 01, 2000; In English
Report No.(s): DE2003-15004388; UCRL-JC-152983; No Copyright; Avail: National Technical Information Service (NTIS)
High confinement (H-mode) operation is the choice for next-step tokamak devices based either on conventional or advanced tokamak physics. This choice, however, comes at a significant cost for both the conventional and advanced tokamaks because of the effects of edge localized modes (ELMs). ELMs can produce significant erosion in the divertor and can affect the beta limit and reduced core transport regions needed for advanced tokamak operation. Experimental results from DIII-D (J. L. Luxon, et al., Plasma Phys. and Contr. Nucl. Fusion Research 1986 (International Atomic Energy Agency, Vienna, 1987) Vol. I, p. 159) this year have demonstrated a new operating regime, the quiescent H-mode regime, which solves these problems. We have achieved quiescent H-mode operation which is ELM-free and yet has good density and impurity control.
NTIS
Erosion; Impurities; Nuclear Electric Power Generation; Plasmas (Physics); Tokamak Devices

20040068257 Lawrence Livermore National Lab., Livermore, CA
US ICF Ignition Program and the Inertial Fusion Energy Program
Lindl, J. D.; Hammel, B. A.; Logan, B. G.; Meyerhofer, D. D.; Payne, S. A.; Jul. 02, 2003; In English
Report No.(s): DE2003-15004422; UCRL-JC-152987; No Copyright; Avail: National Technical Information Service (NTIS)
There has been rapid progress in inertial fusion in the past few years. This progress spans the construction of ignition facilities, a wide range of target concepts, and the pursuit of integrated programs to develop fusion energy using lasers, ion beams and z-pinches. Two ignition facilities are under construction (NIF in the U.S. and LMJ in France) and both projects are progressing toward an initial experimental capability. The LIL prototype beamline for LMJ and the first 4 beams of NIF

will be available for experiments in 2003. The full 192 beam capability of NIF will be available in 2009 and ignition experiments are expected to begin shortly after that time.
NTIS
Ignition; Ion Beams; Lasers

20040068258 Stanford Linear Accelerator Center, Stanford, CA, USA
First Measurement of the B to Pi Lepton Neutrino and B to Rho(Omega) Lepton Neutrino Branching Fractions
2003; In English
Report No.(s): DE2003-813146; SLAC-PUB-9869; No Copyright; Avail: National Technical Information Service (NTIS)
CLEO has studied B decays to the final states (pi)(ell)(nu),(rho)(ell)(nu), and (omega)(ell)(nu), where (ell)=e or (mu). We fully reconstruct these modes using a measurement of the missing energy and momentum in each event to infer the neutrino momentum. With the B(sup 0) and B(sup+) modes combined according to isospin predictions for the relative partial widths, we obtain (Beta)(B(sup 0)(yields)(pi)(sup -)(ell)(sup+)(nu))=(1.8(+/-) 0.4(+/-) 0.3(+/-) 0.2) x 10(sup -4) and (Beta)(B(sup 0)(yields)(rho)(sup -)(ell)(sup+)(nu))= (2.5(+/-) 0.4(sub 0.7)(sup -.5)(+/-) 0.5) x 10(sup -4), where the errors are statistical, systematic and the estimated model-dependence. We also estimate (V(sub ub))= (3.3(+/-) 0.2(sub 0.4)(sup+0. 3)(+/-) 0.7) x 10(sup -3).
NTIS
Leptons; Neutrinos; Estimating

20040068259 California Univ., Santa Barbara, CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Irvine, CA, USA
Impact of Tag-Side Interference on Time-Dependent CP Asymmetry Measurements using Coherent B(sup O)(bar B)(sup O) Pairs
Long, O.; Baak, M.; Cahn, R. N.; Kirby, D.; 2003; In English
Report No.(s): DE2003-812971; SLAC-PUB-9687; No Copyright; Avail: National Technical Information Service (NTIS)
Interference between CKM-favored b(yields) c(bar u)d and doubly-CKM-suppressed (bar b)(yields)(bar u)c(bar d) amplitudes in final states used for B flavor tagging gives deviations from the standard time evolution assumed in CP-violation measurements at B factories producing coherent B(sup 0)(bar B)(sup 0) pairs. We evaluate these deviations for the standard time-dependent CP-violation measurements, the uncertainties they introduce in the measured quantities, and give suggestions for minimizing them. The uncertainty in the measured CP asymmetry for CP eigenstates is (approx.) 2% or less. The time-dependent analysis of D*(pi), proposed for measuring sin(2(beta)+(gamma)), must incorporate possible tag-side interference, which could produce asymmetries as large signal asymmetry.
NTIS
Interference; Impact; Time Dependence; Asymmetry; CP Violation

20040068260 Istituto Nazionale di Fisica Nucleare, Frascati, Italy
Longitudinal Quadrupole Instability and Control in the Frascati DAphiNE Electron Ring
Drago, A.; Gallo, A.; Ghigo, A.; Zobov, M.; 2003; In English
Report No.(s): DE2003-813183; SLAC-PUB-9829; No Copyright; Avail: National Technical Information Service (NTIS)
A longitudinal quadrupole (q-pole) instability was limiting the maximum stable current in the DA(Phi)NE e(sup -) ring at a level of 700-800 mA. In order to investigate the phenomenon, the instability threshold has been measured as a function of various machine parameters as radio frequency voltage (V(sub rf)), momentum compaction ((alpha)(sub c)), number of bunches, fill pattern, etc. An unexpected interaction with the longitudinal feedback system, built to control the dipole motion, has been found and a proper feedback tuning has allowed increasing the threshold. The maximum stable beam current has now exceeded 1.80 A and it is no longer limited by the quadrupole instability.
NTIS
Longitudinal Control; Quadrupoles; Feedback Control

20040068263 Lawrence Livermore National Lab., Livermore, CA
Simulation of Time-Reversal Processing for Electromagnetic Communication
Burke, G. J.; Poggio, A. J.; Jul. 25, 2003; In English
Report No.(s): DE2003-15004937; UCRL-ID-154698; No Copyright; Avail: National Technical Information Service (NTIS)
Time-reversal processing was simulated for several possible electromagnetic communication channels, including random

point scatterers, large plates and a conducting cavity. Communication was from a single transmitting antenna to a receiving array. The effectiveness of time-reversal processing was compared for a single receiver and the array. The aim of these simulations was to determine a communication environment that would give an interesting level of multipath interference and that can be constructed in a laboratory.
NTIS
Multipath Transmission; Channels (Data Transmission); Simulation; Time Dependence; Electromagnetic Wave Transmission

20040068267 Lawrence Livermore National Lab., Livermore, CA
Solution Based Deposition of Polymide Ablators for NIF Capsules
Cook, R.; Jul. 11, 2002; In English
Report No.(s): DE2003-15004914; UCRL-ID-149602; No Copyright; Avail: National Technical Information Service (NTIS)
Between June 1997 and March 2002 Luxel Corporation was contracted to explore the possibility of preparing NIF scale capsules with polyimide ablators using solution-based techniques. This work offered a potential alternative to a vapor deposition approach talking place at LLNL. The motivation for pursuing the solution-based approach was primarily two-fold. First, it was expected that much higher strength capsules (relative to vapor deposition) could be prepared since the solution precursors were known to produce high strength films. Second, in applying the ablator as a fluid it was expected that surface tension effects would lead to very smooth surfaces. These potential advantages were offset by expected difficulties, primary among them that the capsules would need to be levitated in some fashion (for example acoustically) during coating and processing, and that application of the coating uniformly to thicknesses of 150 pm on levitated capsules would be difficult. Because of the expected problems with the coupling of levitation and coating, most of the initial effort was to develop coating and processing techniques on stalk-mounted capsules.
NTIS
Ablative Materials; Coating; Polyimides; Vapor Deposition

20040068274 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility
Miller, G. H.; Dec. 19, 2003; 18 pp.; In English
Report No.(s): DE2004-15006533; UCRL-CONF-155806; No Copyright; Avail: Department of Energy Information Bridge
The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory is a stadium-sized facility containing a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber and room for 100 diagnostics. NIF is the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion and matter at extreme energy densities and pressures. NIF's energetic laser beams will compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. Other NIF experiments will study physical processes at temperatures approaching 10(sup 8) K and 10 inches bar; conditions that exist naturally only in the interior of stars and planets.
NTIS
Ignition; Lasers; Flux Density

20040068276 Lawrence Livermore National Lab., Livermore, CA
Measurements of the Radiated Fields and Conducted Current Leakage from the Pulsed Power Systems in the National Ignition Facility at LLNL
Anderson, R. A.; Clancy, T. J.; Fulkerson, S.; Petersen, D.; Pendelton, D.; Jul. 31, 2003; In English
Report No.(s): DE2003-15004894; UCRL-JC-151432; No Copyright; Avail: National Technical Information Service (NTIS)
An important pulsed power system consideration is that they inherently generate fields and currents that can cause interference in other subsystems and diagnostics. Good pulsed power design, grounding and isolation practices can help mitigate these unwanted signals. During the laser commissioning shots for the NIF Early Light milestone at LLNL, measurements were made of the radiated field and conducted currents caused by the Power Conditioning System (PCS) modules with flash lamp load and the Plasma Electrode Pockels Cell (PEPC) driver. The measurements were made in the capacitor bay, laser bay, control room and target bay. The field measurements were made with B-dot and E-dot probes with bandwidth of about 100MHz. The current measurements were made with a clamp on probe with a bandwidth of about 20 MHz. The results of these measurements show fields and currents in the NIF Facility well below that required for interference

with other subsystems. Currents on the target chamber from the pulsed power systems are well below the background noise currents.
NTIS
Background Noise; Currents; Leakage; Pulse Duration; Power Conditioning

20040068280 Lawrence Livermore National Lab., Livermore, CA
Extraction Kickers and Modulators for the Advanced Hydrodynamic Facility
Walstrom, P. L.; Cook, E. G.; Jun. 12, 2001; In English
Report No.(s): DE2003-15004787; UCRL-JC-144172; No Copyright; Avail: National Technical Information Service (NTIS)
In order to exploit the full potential of the Advanced Hydrodynamic Facility (AHF) facility to produce a time sequence of proton transmission radiographs throughout the dynamic event, a kicker/modulator for extraction from the 50 GeV ring that is capable of generating a string of 25 pulse pairs at arbitrary times within a total time duration of 100 microseconds or more is desired. The full range of desired pulse-train requirements cannot be met with the commonly used pulse-forming cables or networks (PFNs) switched with thyratrons. The preferred modulator design approach at present is a transformer voltage-adder concept with primary-side pulses formed with MOSFET-switched capacitors. This modulator will be a scale-up of an existing modulator that has been developed by Lawrence Livermore National Laboratory for use in DARHT, an electron induction accelerator facility at Los Alamos National Laboratory. Before the voltage-adder concept can be adopted for use in AHF, a working prototype that meets the AHF requirements for the pulse voltage, current, rise and fall time, and total pulse number must be built and tested. Additional requirements for pulse-to-pulse flattop height variation and baseline shift must also be met. A development and testing plan for the voltage-adder kicker modulator for AHF is described.
NTIS
Capacitors; Electron Accelerators; Extraction; Field Effect Transistors; Protons

20040068285 Lawrence Livermore National Lab., Livermore, CA
Investigation into the Role of Initial Conditions on Rayleigh-Taylor Instabilities by Low Atwood Experiments and Simulations
Mueschke, N.; Andrews, M.; Schilling, O.; Jul. 16, 2003; In English
Report No.(s): DE2003-15004813; UCRL-ID-154412; No Copyright; Avail: National Technical Information Service (NTIS)
The primary goal of the research being conducted this summer is to investigate the role of initial conditions in the development of a two fluid mix driven by Rayleigh-Taylor instability. The effects of initial conditions will be studied through the use of experimental facilities located at the Buoyancy-Driven Mixing Lab at Texas A&M University and through high resolution direct numerical simulations of the experiment by the MIRANDA code developed at Lawrence Livermore National Lab.
NTIS
Research Facilities; Simulation; Taylor Instability

20040068288 Rutherford Appleton Lab., Oxford, UK
Investigation of a Low-Energy X-Ray Spectrometer Based on Pixellated Hybrid Silicon Detectors
Seller, P.; Feb. 2004; 18 pp.; In English
Report No.(s): PB2004-105658; Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Silicon; X Ray Spectrometers

20040068295 Lawrence Livermore National Lab., Livermore, CA
Slow Radio-Frequency Processing of Large Oil Shale Volumes to Produce Petroleum-like Shale Oil
Burnham, A. K.; Aug. 20, 2003; In English
Report No.(s): DE2003-15004663; UCRL-ID-155045; No Copyright; Avail: National Technical Information Service (NTIS)
A process is proposed to convert oil shale by radio frequency heating over a period of months to years to create a product similar to natural petroleum. Electrodes would be placed in drill holes, either vertical or horizontal, and a radio frequency chosen so that the penetration depth of the radio waves is of the order of tens to hundreds of meters. A combination of excess volume production and overburden compaction drives the oil and gas from the shale into the drill holes, where it is pumped to the surface. Electrical energy for the process could be provided initially by excess regional capacity, especially off-peak power, which would generate (approx)3 x 10(exp 5) bbl/day of synthetic crude oil, depending on shale grade. The electricity

cost, using conservative efficiency assumptions, is$4.70 to $6.30/bbl, depending on grade and heating rate. At steady state, co-produced gas can generate more than half the electric power needed for the process, with the fraction depending on oil shale grade. This would increase production to 7.3 x 10 (exp 5) bbl/day for 104 l/Mg shale and 1.6 x 10(exp 6) bbl/day for 146 l/Mg shale using a combination of off-peak power and power from co-produced gas.
NTIS
Radio Frequencies; Crude Oil; Electricity; Shale Oil

20040068299 Lawrence Livermore National Lab., Livermore, CA
Effects of Radiation Induced carbon Contamination on the Performance of an EUV Lithographic Optic
Barty, A.; Goldberg, K. A.; Mar. 2003; In English
Report No.(s): DE2003-15004704; UCRL-JC-151235; No Copyright; Avail: National Technical Information Service (NTIS)
Carbon deposition in extreme ultraviolet lithography (EUVL) is known to occur when optical surfaces in a hydrocarbon environment are exposed to EUV light. Carbon contamination on EUV optical elements affects both the absorption and phase of the reflected light. Because the carbon deposition alters the phase structure of the reflected EUV light it effectively alters the figure of these optics and, thus, the aberrations as well. Absorption by deposited carbon not only reduces throughput but also leads to apodisation of the pupil, which in turn affects imaging performance.
NTIS
Carbon; Contamination; Extreme Ultraviolet Radiation; Lithography

20040068319 Lawrence Livermore National Lab., Livermore, CA
Development of Superconducting Focusing Quadrupoles for Heavy Ion Drivers
Martovetsky, N. N.; Manahan, R.; Lietzke, A. F.; Sep. 20, 2001; In English
Report No.(s): DE2003-15004701; UCRL-JC-145352; No Copyright; Avail: National Technical Information Service (NTIS)
Heavy Ion Fusion (HIF) is exploring a promising path to a practical inertial-confinement fusion reactor. The associated heavy ion driver will require a large number of focusing quadrupole magnets. A concept for a superconducting quadrupole array, using many simple racetrack coils, was developed at LLNL. Two, single-bore quadrupole prototypes of the same design, with distinctly different conductor, were designed, built, and tested. Both prototypes reached their short sample currents with little or no training. Magnet design, and test results, are presented and discussed.
NTIS
Quadrupoles; Inertial Confinement Fusion; Prototypes

20040070989 Stanford Linear Accelerator Center, Stanford, CA, USA
Search for the DeCay tau (sup-)-> 4 pi (sup -) 3 pi (sup +)(pi(sup 0) nu(sub tau))
2003; In English
Report No.(s): DE2003-813070; SLAC-PUB-9768; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Decay Rates; Particle Decay

20040070991 Fermi National Accelerator Lab., Batavia, IL, USA
Systematic Uncertainties on (delta)M2 from Neutrino Physics, using Calorimetric Energy Reconstruction
Harris, D. A.; Aug. 2003; In English
Report No.(s): DE2003-812828; FERMILAB-CONF-03/216-E; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes how uncertainties in neutrino interactions, particularly at neutrino energies of a few GeV, can contribute to uncertainties in measurements of neutrino oscillation parameters for experiments using calorimetric devices. Uncertainties studied include those on final state multiplicities, cross sections, electron-hadron calorimeter differences, and nuclear rescattering.
NTIS
Scattering; Neutrinos

20040070994 Lawrence Livermore National Lab., Livermore, CA
X-Ray Dose and Spot Size Calculations for the DARHT-II Distributed Target
McCarrick, J.; Apr. 05, 2001; In English
Report No.(s): DE2003-15005549; UCRL-ID-145186; No Copyright; Avail: National Technical Information Service (NTIS)

The baseline DARHT-II converter target consists of foamed tantalum within a solid-density cylindrical tamper. The baseline design has been modified by D. Ho to further optimize the integrated line density of material in the course of multiple beam pulses. LASNEX simulations of the hydrodynamic expansion of the target have been performed by D. Ho (documented elsewhere). The resulting density profiles have been used as inputs in the MCNP radiation transport code to calculate the X-ray dose and spot size assuming a incoming Gaussian electron beam with (sigma)= 0.65mm, and a PIC-generated beam taking into account the 'swept' spot emerging from the DARHT-II kicker system.
NTIS
X Rays; Dosage; Computation; Electron Beams

20040070997 Lawrence Livermore National Lab., Livermore, CA
Predicting the Equilibrium Deuterium-Tritium Fuel Layer Thickness Profile in an Indirect-Drive Hohlraum Capsule
Sanchez, J. J.; Giedt, W. H.; Oct. 27, 2003; In English
Report No.(s): DE2003-15005466; UCRL-CONF-154933; No Copyright; Avail: National Technical Information Service (NTIS)

A numerical procedure for calculating the equilibrium thickness distribution of a thin layer of deuterium and tritium on the inner surface of an indirect drive target sphere ((approx) 2.0 mm in diameter) is described. Starting with an assumed uniform thickness layer and with specified thermal boundary conditions, the temperature distribution throughout the capsule and hohlraum (including natural convection in the hohlraum gas) is calculated. Results are used to make a first estimate of the final non-uniform thickness distribution of the layer. This thickness distribution is then used to make a second calculation of the temperature distribution with the same boundary conditions. Legendre polynomial coefficients are evaluated for the two temperature distributions and the two thickness profiles. Final equilibrium Legendre coefficients are determined by linear extrapolation. From these coefficients, the equilibrium layer thickness can be computed.
NTIS
Numerical Analysis; Equilibrium; Deuterium; Tritium; Boundary Layers; Thickness; Hohlraums

20040071021 Lawrence Livermore National Lab., Livermore, CA
Radiative Power Loss Calculations for Krypton and Argon in Intermediate-to-High Density Plasmas
Fournier, K. B.; Chung, H.; Lee, R. W.; Dec. 01, 2001; In English
Report No.(s): DE2003-15005445; UCRL-ID-14681; No Copyright; Avail: National Technical Information Service (NTIS)

The scope of work for this subcontract requires that state-of-the-art, detailed atomic kinetics calculations be applied to compute the total radiative cooling rates for Ar and Kr in high density plasmas. This is in support of the Defense Threat Reduction Agency's program of development of simulators with high-fluence radiation and spectral fidelity. Using collisional-radiative modeling codes and unique expertise at Lawrence Livermore National Laboratory (LLNL), the total radiative yields from Ar and Kr, integrated over all photon energies, have been computed. Spectrally resolved yields from K-shell Ar and K- and L-shell Kr have also been tabulated. The present calculations show that high electron density in the plasma sources is essential to maximize the fraction of power output in various x-ray bands.
NTIS
Computation; Power Loss; Krypton; Argon; Plasmas (Physics); Electron Density (Concentration)

20040071026 Lawrence Livermore National Lab., Livermore, CA
Parallel Algorithm for Contact in a Finite Element Hydrocode
Pierce, T. G.; Jun. 2003; In English
Report No.(s): DE2003-15005375; UCRL-LR-154063; No Copyright; Avail: National Technical Information Service (NTIS)

A parallel algorithm is developed for contact/impact of multiple three dimensional bodies undergoing large deformation. As time progresses the relative positions of contact between the multiple bodies changes as collision and sliding occurs. The parallel algorithm is capable of tracking these changes and enforcing an impenetrability constraint and momentum transfer across the surfaces in contact. Portions of the various surfaces of the bodies are assigned to the processors of a distributed-memory parallel machine in an arbitrary fashion, known as the primary decomposition. A secondary, dynamic decomposition is utilized to bring opposing sections of the contacting surfaces together on the same processors, so that opposing forces may

be balanced and the resultant deformation of the bodies calculated. The secondary decomposition is accomplished and updated using only local communication with a limited subset of neighbor processors. Each processor represents both a domain of the primary decomposition and a domain of the secondary, or contact, decomposition. Thus each processor has four sets of neighbor processors: (1) those processors which represent regions adjacent to it in the primary decomposition, (2) those processors which represent regions adjacent to it in the contact decomposition, (3) those processors which send it the data from which it constructs its contact domain, and (4) those processors to which it sends its primary domain data, from which they construct their contact domains. The latter three of these neighbor sets change dynamically as the simulation progresses. By constraining all communication to these sets of neighbors, all global communication, with its attendant nonscalable performance, is avoided. A set of tests are provided to measure the degree of scalability achieved by this algorithm on up to 1024 processors. Issues related to the operating system of the test platform which lead to some degradation of the results are analyzed.
NTIS
Algorithms; Finite Element Method; Three Dimensional Bodies; Deformation; Degradation

20040071027 Lawrence Livermore National Lab., Livermore, CA
Entangled States, Holography, and Quantum Surfaces
Chapline, G. F.; Aug. 13, 2003; In English
Report No.(s): DE2003-15005372; UCRL-ID-155131; No Copyright; Avail: National Technical Information Service (NTIS)
Starting with an elementary discussion of quantum holography, we show that entangled quantum states of qubits provide a 'local' representation of the global geometry and topology of quantum Riemann surfaces. This representation may play an important role in both mathematics and physics. Indeed, the simplest way to represent the fundamental objects in a 'theory of everything' may be as multi-qubit entangled states.
NTIS
Holography; Quantum Efficiency

20040071045 Lawrence Livermore National Lab., Livermore, CA
Science and Technology Review: Semiconductors at the Nanoscale
Nov. 2003; In English
Report No.(s): DE2004-15005751; No Copyright; Avail: National Technical Information Service (NTIS)
This issue of Science & Technology Review covers the following topics: (1) We Will Always Need Basic Science--Commentary by Tomas Diaz de la Rubia; (2) When Semiconductors Go Nano--experiments and computer simulations reveal some surprising behavior of semiconductors at the nanoscale; (3) Retinal Prosthesis Provides Hope for Restoring Sight--A microelectrode array is being developed for a retinal prosthesis; (4) Maglev on the Development Track for Urban Transportation--Inductrack, a Livermore concept to levitate train cars using permanent magnets, will be demonstrated on a 120-meter-long test track; and (5) Power Plant on a Chip Moves Closer to Reality--Laboratory-designed fuel processor gives power boost to dime-size fuel cell.
NTIS
Research and Development; Semiconductors (Materials); Nanotechnology; Science

20040071046 Lawrence Livermore National Lab., Livermore, CA
Switchyard Enclosure Seismic Criteria Calculations
Patton, B.; Aug. 27, 2001; In English
Report No.(s): DE2004-15005730; UCRL-ID-145893; No Copyright; Avail: National Technical Information Service (NTIS)
Finite Element Analysis (FEA) was conducted on these four Beam Enclosure Assembly drawings: (1) AAA97-108954 (Quad); (2) AAA97-108981 (Quad Intermediate); (3) AAA98-101193 (Bundle); and (4) AAA97-108982 (Double Quad). Each drawing chosen represents one of the four enclosure types: Quad, Quad Intermediate, Bundle, and Double Quad. They were chosen because they have the longest length between supports for their type and are therefore the worse case condition from the standpoint of seismic induced stress. The purpose of the analysis was to find the maximum acceleration that each enclosure assembly can withstand and with this value determine the safety factor.
NTIS
Seismology; Finite Element Method

20040071060 Brookhaven National Lab., Upton, NY
Twenty-Year Planning Study for the Relativistic Heavy Ion Collider Facility at Brookhaven National Laboratory
2003; 30 pp.; In English
Report No.(s): DE2004-15006730; BNL-71881-2003-IR; No Copyright; Avail: Department of Energy Information Bridge
At the request of DOE's Office of Nuclear Physics (ONP), Brookhaven National Laboratory (BNL) has created this planning document to assemble and summarize a planning exercise that addresses the core scientific thrust of the Relativistic Heavy Ion Collider (RHIC) for the next twenty years and the facilities operation plan that will support this program. The planning work was carried out by BNL in close collaboration with the RHIC user community and within budgetary guidelines for the next five years supplied by the ONP. The resulting plans were reviewed by the BNL High Energy and Nuclear Physics Program Advisory Committee (PAC) at a special RHIC planning meeting held in December 2003. Planning input from each of the four RHIC experimental collaborations was absolutely central to the preparation of this overall Laboratory plan. Each collaboration supplied two key documents, a five-year 'Beam Use Proposal' and a ten-year 'Decadal Plan'.
NTIS
Nuclear Physics; High Energy Interactions; Relativistic Particles; Planning; Heavy Ions

20040071070 Brookhaven National Lab., Upton, NY, USA
Lattice QCD at Finite Temperature and Density
Blum, T.; Creutz, M.; Petreczky, P.; 2004; 188 pp.; In English
Report No.(s): DE2004-15006985; BNL-72083-2004; No Copyright; Avail: Department of Energy Information Bridge
With the operation of the RHIC heavy ion program, the theoretical understanding of QCD at finite temperature and density has become increasingly important. Though QCD at finite temperature has been extensively studied using lattice Monte-Carlo simulations over the past twenty years, most physical questions relevant for RHIC (and future) heavy ion experiments remain open. In lattice QCD at finite temperature and density there have been at least two major advances in recent years. First, for the first time calculations of real time quantities, like meson spectral functions have become available. Second, the lattice study of the QCD phase diagram and equation of state have been extended to finite baryon density by several groups. Both issues were extensively discussed in the course of the workshop.
NTIS
Quantum Chromodynamics; Heavy Ions; Lattices; Temperature

20040071081 Brookhaven National Lab., Upton, NY, USA
High pT Physics at RHIC
Kretzer, S.; Morrison, D.; Venugopalan, R.; Vogelsang, W.; 2004; 306 pp.; In English
Report No.(s): DE2004-15006981; BNL-72069-2004; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Quarks; Quantum Chromodynamics; Matter (Physics); Heavy Ions

20040071083 Brookhaven National Lab., Upton, NY, USA
RHIC Spin Collaboration Meetings XV and XVI
Fox, B.; 2004; 192 pp.; In English
Report No.(s): DE2004-15006834; BNL-71539-2003; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Heavy Ions; Particle Spin

20040071084 Brookhaven National Lab., Upton, NY
ERHIC Interaction Region Design
Montag, C.; Parker, B.; Ptitsyn, V.; Tepikian, S.; 2004; 12 pp.; In English
Report No.(s): DE2004-15006739; BNL-71918-2004-CP; No Copyright; Avail: Department of Energy Information Bridge
This paper presents the current interaction region design status of the ring-ring version of the electron-ion collider eRHIC (release 2.0).
NTIS
Beam Interactions; Electron Beams

20040071087 Brookhaven National Lab., Upton, NY, USA
RCRC Scientific Review Committee Meeting
Samios, N. P.; Lee, T. D.; Nov. 2003; 270 pp.; In English
Report No.(s): DE2004-15006731; BNL-71899-2003; No Copyright; Avail: Department of Energy Information Bridge

The sixth evaluation of the RIKEN BNL Research Center (RBRC) took place on November 20-21, 2003, at Brookhaven National Laboratory. The present members of the Scientific Review Committee are Dr. Jean-Paul Blaizot, Professor Makoto Kobayashi, Dr. Akira Masaike, Professor Charles Young Prescott (absent), Professor Stephen Sharpe, and Professor Jack Sandweiss, Committee Chair. In order to illustrate the breadth and scope of the program, each member of the Center made a presentation on his research efforts. In addition, a special presentation was given jointly by our collaborators, Professors Norman Christ and Robert Mawhinney of Columbia University, on the progress and status of the IRBRC QCDSP/QCDOC Supercomputer program. A demonstration of a 64-node (64 Gflops peak speed) QCDOC machine in action followed. Although the main purpose of this review is a report to RIKEN Management (Dr. Ryoji Noyori, RIKEN President) on the health, scientific value, management and future prospects of the Center, the RBRC management felt that a compendium of the scientific presentations are of sufficient quality and interest that they warrant a wider distribution. Therefore we have made this compilation and present it to the community for its information and enlightenment.
NTIS
Research and Development; Conferences; Project Management

20040071091 Helsinki Univ. of Technology, Espoo, Finland
Island Growth and Step Instabilities on Flat and Vicinal Surfaces
Rusanen, M.; 2003; 74 pp.; In English
Report No.(s): PB2004-105763; DISSERTATION-120; No Copyright; Avail: CASI; A04, Hardcopy

Surface physics aims at understanding the basic atomistic processes and mechanisms responsible for the variety of observed structures during surface growth. In addition, surface growth has important consequences in modern technological applications. Molecular beam epitaxy (MBE) is an established method to grow surface structures, admitting also modeling surface growth through simple microscopic processes such as dilusion and deposition of atoms. The rather limited parameter range in MBE where smooth layer by layer growth is realized can be extended, e.g., with ion assisted deposition techniques. Thus new microscopic processes are added to traditional MBE growth. Customarily island growth and step-ow are treated as separate growth modes. Consequently, there does not exist a growth model which includes all relevant aspects of surface growth in a realistic way. The aim of this thesis is to bridge the gap between these traditional approaches.
NTIS
Flat Surfaces; Molecular Beam Epitaxy; Stability; Finland

20040071098 Lawrence Livermore National Lab., Livermore, CA
Surface Damage Growth Mitigation on KDP/DKDP Optics Using Single-Crystal Diamond Micro-Machining
Hrubesh, L.; Adams, J.; Feit, M.; Sell, W.; Stanley, J.; Nov. 12, 2003; In English
Report No.(s): DE2004-15005752; UCRL-CONF-153480; No Copyright; Avail: National Technical Information Service (NTIS)

A process whereby laser-initiated surface damage on KDP/DKDP optics is removed by spot micro-machining using a high-speed drill and a single-crystal diamond bit, is shown to mitigate damage growth for subsequent laser shots. Our tests show that machined dimples on both surfaces of an AR coated doubler (KDP) crystal are stable, for 526nm, (approx.) 3.2ns pulses at (approx.) 12J/cm(sup 2) fluences. Other tests also confirmed that the machined dimples on both surfaces of an AR coated tripler (DKDP) crystal are stable, for 351nm, (approx.) 3ns pulses at (approx.) 8J/cm(sup 2). We have demonstrated successful mitigation of laser-initiated surface damage sites as large as 0.14mm diameter on DKDP, for up to 1000 shots at 351nm, 13J/cm(sup 2), (approx.) 11ns pulse length, and up to 10 shots at 351nm, 8J/cm(sup 2), 3ns. Details of the method are presented, including estimates for the heat generated during micro-machining and a plan to implement this method to treat pre-initiated or retrieved-from-service, large-scale optics for use in high-peak-power laser applications.
NTIS
Diamonds; Laser Damage

20040073464 NASA Langley Research Center, Hampton, VA, USA

A Deconvolution Approach for the Mapping of Acoustic Sources (DAMAS) Determined from Phased Microphone Arrays

Brooks, Thomas F.; Humphreys, William M., Jr.; May 04, 2004; 18 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

Contract(s)/Grant(s): 781-10-11-02

Report No.(s): AIAA Paper 2004-2954; No Copyright; Avail: CASI; A03, Hardcopy

Current processing of acoustic array data is burdened with considerable uncertainty. This study reports an original methodology that serves to demystify array results, reduce misinterpretation, and accurately quantify position and strength of acoustic sources. Traditional array results represent noise sources that are convolved with array beamform response functions, which depend on array geometry, size (with respect to source position and distributions), and frequency. The Deconvolution Approach for the Mapping of Acoustic Sources (DAMAS) method removes beamforming characteristics from output presentations. A unique linear system of equations accounts for reciprocal influence at different locations over the array survey region. It makes no assumption beyond the traditional processing assumption of statistically independent noise sources. The full rank equations are solved with a new robust iterative method. DAMAS is quantitatively validated using archival data from a variety of prior high-lift airframe component noise studies, including flap edge/cove, trailing edge, leading edge, slat, and calibration sources. Presentations are explicit and straightforward, as the noise radiated from a region of interest is determined by simply summing the mean-squared values over that region. DAMAS can fully replace existing array processing and presentations methodology in most applications. It appears to dramatically increase the value of arrays to the field of experimental acoustics.

Author

Acoustic Properties; Aerodynamic Noise; Beamforming

20040073562 Naval Postgraduate School, Monterey, CA

Performance Analysis of the IEEE 802.11A WLAN Standard Optimum and Sub-Optimum Receiver in Frequency-Selective, Slowly Fading Nakagami Channels with AWGN and Pulsed Noise Jamming

Kalogrias, Christos; Mar. 2004; 169 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422366; No Copyright; Avail: CASI; A08, Hardcopy

The objective of this thesis is to investigate the performance of the orthogonal frequency division multiplexing (OFDM) based IEEE 802.11a wireless local area network (WLAN) standard receiver when the signal is transmitted over a frequency selective, slow fading Nakagami channel in a worst case, pulse-noise jamming environment. The different combinations of modulation type (both binary and non-binary modulation) and convolutional code rate specified by the WLAN standard are examined. Receiver performance with Viterbi soft decision decoding (SDD) is analyzed for additive white Gaussian noise (AWGN) alone as well as for AWGN plus pulse- noise jamming (PNJ). The performance of the IEEE 802.11a WLAN standard receiver is examined both for the scenario in which perfect side information is assumed (optimum receiver) and when it is not (sub-optimum receiver). For the sub-optimum receiver scenario, the receiver performance is examined both when noise-normalization is utilized and when only linear combining is utilized. The analysis indicates that the receiver performance is severely affected by the pulse-noise jamming environment for the linear combining scenario; however, the sub-optimum receiver performance is significantly improved when noise-normalization is implemented. (2 tables, 74 figures, 11 refs.)

DTIC

Frequencies; Frequency Division Multiplexing; Jamming; Local Area Networks; Multipath Transmission; Radio Receivers; Receivers; Reliability Analysis; Selective Fading; Wireless Communication

20040073602 Naval Postgraduate School, Monterey, CA

Synchronization Analysis and Simulation of a Standard IEEE 802.11G OFDM signal

Lowham, Keith D.; Mar. 2004; 176 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422455; No Copyright; Avail: CASI; A09, Hardcopy

Synchronization of orthogonal frequency-division multiplexed (OFDM) signals is significantly more difficult than synchronization of a single-carrier system. The recently approved IEEE Standard 802,1 ig specifies a packet-based OFDM system that provides a basis for the discussion of OFDM synchronization in a packet-based enviwnment. Algorithms that synchronize the receiver can'ier demodulation frequency and phase, the data flame, the OFDM symbol timing, and the data symbol timing are discussed and analyzed in an AWGN channel. System View simulation is used to implement the flame and

carrier frequency synchronization algorithms, where the perton%ance of these algon'thms is analyzed and they are shown to be useful detection algorithms for Standard 802.1 ig sig- nal reception.
DTIC
Algorithms; Carrier Frequencies; Signal Processing; Simulation; Synchronism

20040073616 Air Force Research Lab., Edwards AFB, CA
Energy Release Rate in a Constrained Polymeric Disk under Internal Pressure and Thermal Loads
Ching, H.; Liu, C.; Yen, S.; Mar. 8, 2004; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A422491; No Copyright; Avail: CASI; A02, Hardcopy

In this study, the energy release rates in a centrally perforated star-shaped disk, which was made of a polymeric material, under internal pressure and thermal loads, were determined. The deformations of the disk were constrained by a circular steel ring enclosing the disk. Two constitutive models, namely, Hookean model and Ogden model, were used to model the constitutive behavior of the material. Three different loadings, internal pressure, isothermal load, and combined internal pressure and isothermal load, were considered. Numerical results showed that values of the energy release rate were very sensitive to Poisson's ratio for the pressure load. The decrease in the compressibility gave a higher value of energy release rate for the pressure load and a lower value of that for the isothermal load. The deformed crack profiles were also determined to address the compressibility effect on the energy release rate.
DTIC
Internal Pressure; Loads (Forces); Pressure Distribution; Thermodynamic Properties

20040073641 Air Force Research Lab., Edwards AFB, CA
The Development of a Methodology to scale Between Cold-Flow and Hot-Fire Evaluations of Gas-Centered Swirl Coaxial Injectors
Strakey, P. A.; Cohn, R. K.; Talley, D. G.; Mar. 23, 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A422524; No Copyright; Avail: CASI; A03, Hardcopy

Uni-element cold flow and hot fire evaluations were performed on a variety of gas-centered swirl coaxial injectors. Gaseous oxygen and various liquid hydrocarbons were used in the combustion evaluations, while water and gaseous nitrogen were the simulants for the cold flow experiments. The connections between the two sets of data were examined. The cold flow experiments demonstrated that the mixing efficiency of the various injector designs was highly sensitive to the internal geometry of the injector as well as the scaling methodology used to simulate the hot-fire conditions. When the proper scaling methodology was employed, a correlation which captures the general trend of injector geometry and c* performance between the measured cold-flow mixing efficiency and hot-fire c* performance was observed. This semi-empirical correlation was developed based on a film stripping mechanism that relates the measured c* efficiency of these injectors to the injector geometry and fuel properties. The effects of injector geometry on the injector internal flowfield were ascertained with a combination of cold-flow CFD simulations and experimental measurements. The correlation also implies that fuel properties are secondary to injector geometry effects in determining the performance of various injector configurations. Hot-fire testing of several common hydrocarbon fuels including RP-1, Butane, JP-10, JP-7 and JP-8 confirmed that injector geometric effects dominated performance and demonstrated that c* efficiency in excess of 95% is achievable with all of these fuels. However, the effect of fuel properties does appear to be within the measurement limits of the experiments and a correlating parameter which captures these effects was found.
DTIC
Combustion; Fires; Injectors

20040073672 Air Force Research Lab., Edwards AFB, CA
Micromechanics Study of a Polymer with/without Microparticles
Chang, Sheng; Liu, Chi Tsieh; Chiang, Fu-Pen; Mar. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A422564; No Copyright; Avail: CASI; A02, Hardcopy

SIEM (Speckle Interferometry with Electron Microscopy) is a micro/nano experimental mechanics technique that is able to perform the full field displacement mapping over a region of only several microns in size. In this study we tested specimens made of a pure binder material, a polymer, and binder material mixed with 6 micron aluminum particles under uniaxial

tension. The binder material with microparticles was made by adding 10% by weight aluminum particles into the pure binder material. The technique SIEM was used to map the strain distributions of the specimen under various magnifications, 40x, 200x, 800x, and 1500x. The relationships between the coefficient of variation of epsilon(sub yy), epsilon(sub xx) and the examined area were obtained. We found at magnification about 200x the microstructure had a significant effect on the strain distributions in the binder material with microparticles whereas, for pure binder material, the effect was not observed until at 1500x.
DTIC
Micromechanics; Microparticles

20040073685 University of Southern California, Los Angeles, CA
Analytical and Experimental Studies of Nonlinear System Modeling and Simulation
Masri, Sami F.; Mar. 10, 2004; 13 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0125
Report No.(s): AD-A422584; AFRL-SR-AR-TR-04-0222; No Copyright; Avail: CASI; A03, Hardcopy

The research objectives of this project were to study and resolve some of the daunting problems that hinder the development of reliable general-purpose computer simulation programs, which are capable of reflecting precisely the dynamic behavior of distributed nonlinear systems, spanning the range from large joint-dominated space structures, to intricate electro-mechanical systems, to MEMS, as well as civil infrastructure systems, by conducting a comprehensive analytical and experimental study to investigate an important subset of the challenging issues.
DTIC
Nonlinear Systems; Simulation

20040073711 Public Health Service, Washington, DC
On the Use of Electrically Stimulated Muscle as a Controlled Actuator of a Limb
Crochetiere, William J.; Jun. 1967; 232 pp.; In English
Contract(s)/Grant(s): RD-1814-M
Report No.(s): AD-A422620; EDC-4-67-17; No Copyright; Avail: CASI; A11, Hardcopy

The feasibility of inducing controlled movement of a paralyzed limb by means of applying electric currents is discussed. This is preceded by a functional description of muscle and its electrical excitability and the musculo- skeletal system of the human arm. Experiments are described which were performed to gain a basic understanding of the mechanical response of the lower arm due to stimulation of the biceps muscle. The dynamic model of this single degree of freedom system thus obtained is then used to synthesize suitable feedback control schemes. Two basically different systems are discussed: the control of the angular position, and the control of the angular velocity of the elbow joint. The velocity controller is found to be superior-and is implemented in hardware. Three types of velocity controllers are compared: open loop, proportional closed loop, and proportional plus integral closed-loop. The proportional plus integral closed loop is found to be superior. The author also indicates that a closed loop torque control may perform as well or better and also is simpler to implement.
DTIC
Actuators; Electric Current; Muscles

20040073712 Northwestern Univ., Evanston, IL
Adaptive Signal Processing Techniques for Robust, High Capacity Spread-Spectrum Multiple Access
Honig, Michael L.; Sep. 2, 2003; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0288
Report No.(s): AD-A422622; ARO-39184.32-CI; No Copyright; Avail: CASI; A02, Hardcopy

This project is concerned with signal processing and coding techniques, which can improve the performance of spread-spectrum multiple-access systems. Specific topics investigated during the course of this project include: (1) Reduced-rank interference suppression; (2) Combined coding and interference suppression, (3) Joint transmitter-receiver optimization in the presence of multiple access interference; and (4) The effect of limited feedback on the performance of joint transmitter-receiver optimization schemes. The theory of large random matrices has been used to analyze the performance of both interference suppression and interference avoidance schemes. For example, we have used these techniques to analyze the performance of adaptive reduced- and full-rank least squares filtering for interference suppression with limited training. This analysis shows the effects of algorithm parameters, which determine the initialization and data windowing, along with system load and noise level. Other contributions include optimization of the ratio of pilot-to- data power and code rate with adaptive

linear interference suppression, and signature optimization for combined interference avoidance and pre-equalization of multi-path. Transmitter optimization with limited feedback has also been considered, and bounds on the achievable performance as a function of feedback bits per dimension have been obtained. This project has resulted in a patent application for an adaptive reduced-rank filter, a paper award (for work on reduced-rank filtering), and numerous journal and conference publications on the preceding topics.
DTIC
Multipath Transmission; Multiple Access; Signal Processing; Spread Spectrum Transmission

20040073720 City Univ. of New York, NY
Electromagnetic Propagation, Localization and Lasing in Random and Periodic Media
Genack, A. Z.; Dec. 30, 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0362
Report No.(s): AD-A422634; ARO-40044.12-PH; No Copyright; Avail: CASI; A03, Hardcopy

Our measurements of the frequency and spatial variation of the microwave field in ensembles of random samples have revealed the underlying structure of wave correlation and photon localization. The intensity correlation was found in terms of displacement and polarization shift of the source and detector can be expressed in terms of the square of the corresponding field correlation function. Nonexponential decay of pulsed transmission through disordered media was found in nominally diffusive media, in which the level width exceeds the spacing between levels. This departure from diffusion theory is interpreted in terms of the decay rate statistics of electromagnetic quasi-normal modes. The influence of these modes of the electromagnetic field is an indication of the breakdown of the particle diffusion theory. Measurements of spatial and polarization correlation as a function of time delay from an exciting pulse show that the structure of the intensity correlation function is the same as found in steady state propagation, being a function only of the corresponding field correlation functions. The degree of correlation in the speckle pattern is seen to be the key parameter in dynamics and hence in steady state propagation. We have discovered a localization laser in random one dimensional systems.
DTIC
Electromagnetic Fields; Electromagnetic Wave Transmission; Lasing; Position (Location)

20040074161 Army Engineer Research and Development Center, Vicksburg, MS
Ashtubula River, Ohio, Sedimentation Study. Report 3 Erosion Experiments on Bed Sediments
Teeter, Allen M.; Brister, Doug; Parman, Joe W.; Coleman, Clara J.; Sep. 1999; 49 pp.; In English
Report No.(s): AD-A422689; CHL-99-9; No Copyright; Avail: CASI; A03, Hardcopy

Bed-sediment samples from the Ashtabula River in Ohio were subjected to stepwise increasing shear stresses to assess erodibility. Ten erosion experiments were performed in an oscillating-screen erosion chamber, and five experiments were performed in a water tunnel. Imposed shear stress ranged from 0.2 to 2.33 Pa. Sediments were characterized by grain size, density, pH, moisture content, loss on ignition, and rheological behavior. Sediments were mostly silt (42-72 percent) with clay content ranging from 15 to 30 percent. Scatter in the experimental erosion results did not appear to be related to sample location or other factors. Taken by device, the indicated threshold for erosion was 0.34 Pa for the oscillating-screen erosion chamber and 0.8 Pa for the water tunnel. Taking all tests together, a reasonable threshold for erosion was 0.28 Pa. Mean erosion rate constant, or erosion rate at twice the threshold shear stress, was 7.2 g/sq m/min.
DTIC
Erosion; Hydraulic Test Tunnels; Rivers; Sediments; Water Pollution

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ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040070813 Texas A&M Univ., TX, USA
Mitigation of the Impact of Sensing Noise on the Precise Formation Flying Control Problem
Alfriend, K. T.; [2004]; 6 pp.; In English
Contract(s)/Grant(s): NCC5-724; No Copyright; Avail: CASI; A02, Hardcopy

The specific objectives of this proposed research were: 1. Further investigation into the impact of CDGPS sensing errors for high Earth orbit missions. 2. Identify augmentation approaches of the CDGPS that will improve the relative state for low

and high Earth orbit missions. 3. Integration of the navigation and control concepts into the GSFC Formation Flying Testbed. In addition this was a cooperative effort with Dr. Jonathan How at MIT. Dr. Alfriend was to spend two weeks working with Dr. How and his students. The travel for these two weeks was paid by the Texas Engineering Experiment Station (TEES) as cost sharing.
Derived from text
Control Theory; Augmentation; Sound Propagation; Errors; Impact Tolerances

20040073456 NASA Langley Research Center, Hampton, VA, USA
Design and Evaluation of Modifications to the NASA Langley Flow Impedance Tube
Jones, Michael G.; Watson, Willie R.; Parrott, Tony L.; Smith, Charles D.; [2004]; 13 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): 23-781-30-14
Report No.(s): AIAA Paper 2004-2837; No Copyright; Avail: CASI; A03, Hardcopy

The need to minimize fan noise radiation from commercial aircraft engine nacelles continues to provide an impetus for developing new acoustic liner concepts. If the full value of such concepts is to be attained, an understanding of grazing flow effects is crucial. Because of this need for improved understanding of grazing flow effects, the NASA Langley Research Center Liner Physics Group has invested a large effort over the past decade into the development of a 2-D finite element method that characterizes wave propagation through a lined duct. The original test section in the Langley Grazing IncidenceTube was used to acquire data needed for implementation of this finite element method. This test section employed a stepper motor-driven axial-traversing bar, embedded in the wall opposite the test liner, to position a flush-mounted microphone at pre-selected locations. Complex acoustic pressure data acquired with this traversing microphone were used to educe the acoustic impedance of test liners using this 2-D finite element method and a local optimization technique. Results acquired in this facility have been extensively reported, and were compared with corresponding results from various U.S. aeroacoustics laboratories in the late 1990 s. Impedance data comparisons acquired from this multi-laboratory study suggested that it would be valuable to incorporate more realistic 3-D aeroacoustic effects into the impedance eduction methodology. This paper provides a description of modifications that have been implemented to facilitate studies of 3-D effects. The two key features of the modified test section are (1) the replacement of the traversing bar and its flush-mounted microphone with an array of 95 fixed-location microphones that are flush-mounted in all four walls of the duct, and (2) the inclusion of a suction device to modify the boundary layer upstream of the lined portion of the duct. The initial results achieved with the modified test section are provided in this report, and a comparison of these results with those achieved using the original test section is used to demonstrate that the data acquisition and analysis with the new test section can be confidently used for impedance eduction.
Author
Acoustic Impedance; Design Analysis; Evaluation; Noise Propagation

20040073459 NASA Langley Research Center, Hampton, VA, USA
Investigation of Volumetric Sources in Airframe Noise Simulations
Casper, Jay H.; Lockard, David P.; Khorrami, Mehdi R.; Streett, Craig L.; 2004; 10 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 may 2004, Manchester, UK
Contract(s)/Grant(s): 23-781-10-10
Report No.(s): AIAA Paper 2004-2805; No Copyright; Avail: CASI; A02, Hardcopy

Hybrid methods for the prediction of airframe noise involve a simulation of the near field flow that is used as input to an acoustic propagation formula. The acoustic formulations discussed herein are those based on the Ffowcs Williams and Hawkings equation. Some questions have arisen in the published literature in regard to an apparently significant dependence of radiated noise predictions on the location of the integration surface used in the solution of the Ffowcs Williams and Hawkings equation. These differences in radiated noise levels are most pronounced between solid-body surface integrals and off-body, permeable surface integrals. Such differences suggest that either a non-negligible volumetric source is contributing to the total radiation or the input flow simulation is suspect. The focus of the current work is the issue of internal consistency of the flow calculations that are currently used as input to airframe noise predictions. The case study for this research is a computer simulation for a three-element, high-lift wing profile during landing conditions. The noise radiated from this flow is predicted by a two-dimensional, frequency-domain formulation of the Ffowcs Williams and Hawkings equation. Radiated sound from volumetric sources is assessed by comparison of a permeable surface integration with the sum of a solid-body surface integral and a volume integral. The separate noise predictions are found in good agreement.
Author
Airframes; Aerodynamic Noise; Acoustic Propagation; Computerized Simulation; Noise Intensity

20040073462 NASA Langley Research Center, Hampton, VA, USA

Jet-Pylon Interaction of High Bypass Ratio Separate Flow Nozzle Configurations

Thomas, Russell H.; Kinzie, Kevin W.; April 26, 2004; 16 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

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

Report No.(s): AIAA Paper 2004-2827; No Copyright; Avail: CASI; A03, Hardcopy

NASA Langley Research Center, Hampton, Virginia, 23681-0001 USA An experimental investigation was performed of the acoustic effects of jet-pylon interaction for separate flow and chevron nozzles of both bypass ratio five and eight. The models corresponded to an approximate scale factor of nine. Cycle conditions from approach to takeoff were tested at wind tunnel free jet Mach numbers of 0.1, 0.2 and 0.28. An eight-chevron core nozzle, a sixteen chevron fan nozzle, and a pylon were primary configuration variables. In addition, two orientations of the chevrons relative to each other and to the pylon were tested. The effect of the pylon on the azimuthal directivity was investigated for the baseline nozzles and the chevron nozzles. For the bypass ratio five configuration, the addition of the pylon reduces the noise by approximately 1 EPNdB compared to the baseline case and there is little effect of azimuthal angle. The core chevron produced a 1.8 EPNdB reduction compared to the baseline nozzle. Adding a pylon to the chevron core nozzle produces an effect that depends on the orientation of the chevron relative to the pylon. The azimuthal directivity variation remains low at less than 0.5 EPNdB. For the bypass ratio eight configuration the effect of adding a pylon to the baseline nozzle is to slightly increase the noise at higher cycle points and for the case with a core chevron the pylon has little additional effect. The azimuthal angle effect continues to be very small for the bypass ratio eight configurations. A general impact of the pylon was observed for both fan and core chevrons at both bypass ratios. The pylon reduces the typical low frequency benefit of the chevrons, even eliminating it in some cases, while not impacting the high frequency. On an equal ideal thrust basis, the bypass ratio eight baseline nozzle was about 5 EPNdB lower than the bypass ratio five baseline nozzle at the highest cycle condition, however, with a pylon installed the difference decreased to about 4 EPNdB.

Author

Free Jets; Pylons; Wind Tunnel Tests; Aeroacoustics; Bypass Ratio; Nozzle Design; Separated Flow

20040073463 NASA Langley Research Center, Hampton, VA, USA

Investigation of Acoustical Shielding by a Wedge-Shaped Airframe

Gerhold, Carl H.; Clark, Lorenzo R.; Dunn, Mark H.; Tweed, John; 2004; 18 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK

Contract(s)/Grant(s): 781-30-14

Report No.(s): AIAA Paper 2004-2866; No Copyright; Avail: CASI; A03, Hardcopy

Experiments on a scale model of an advanced unconventional subsonic transport concept, the Blended Wing Body (BWB), have demonstrated significant shielding of inlet-radiated noise. A computational model of the shielding mechanism has been developed using a combination of boundary integral equation method (BIEM) and equivalent source method (ESM). The computation models the incident sound from a point source in a nacelle and determines the scattered sound field. In this way the sound fields with and without the airfoil can be estimated for comparison to experiment. An experimental test bed using a simplified wedge-shape airfoil and a broadband point noise source in a simulated nacelle has been developed for the purposes of verifying the analytical model and also to study the effect of engine nacelle placement on shielding. The experimental study is conducted in the Anechoic Noise Research Facility at NASA Langley Research Center. The analytic and experimental results are compared at 6300 and 8000 Hz. These frequencies correspond to approximately 150 Hz on the full scale aircraft. Comparison between the experimental and analytic results is quite good, not only for the noise scattering by the airframe, but also for the total sound pressure in the far field. Many of the details of the sound field that the analytic model predicts are seen or indicated in the experiment, within the spatial resolution limitations of the experiment. Changing nacelle location produces comparable changes in noise shielding contours evaluated analytically and experimentally. Future work in the project will be enhancement of the analytic model to extend the analysis to higher frequencies corresponding to the blade passage frequency of the high bypass ratio ducted fan engines that are expected to power the BWB.

Author

Airframes; Blended-Wing-Body Configurations; Mathematical Models; Wedges; Engine Inlets; Aeroacoustics; Scale Models

20040073472 Taitech, Inc., Beavercreek, OH, USA
Computation of Low Speed Cavity Noise
Blech, Richard A., Technical Monitor; Loh, Ching Y.; April 2004; 17 pp.; In English; 42nd Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): NAS3-03072; WBS 22-708-90-25
Report No.(s): NASA/CR-2004-212892; AIAA Paper 2004-0680; E-14310; No Copyright; Avail: CASI; A03, Hardcopy

Over the last five years, the Aircraft Icing Project of the NASA Aviation Safety Program has developed a number of in-flight icing education and training aids to support increased awareness for pilots of the hazards associated with atmospheric icing conditions. Through the development of this work, a number of new instructional design approaches and media delivery methods have been introduced to enhance the learning experience, expand user interactivity and participation, and, hopefully, increase the learner retention rates. The goal of using these multimedia techniques is to increase the effectiveness of the training materials. This paper will describe the multimedia technology that has been introduced and give examples of how it was used.
Author
Aircraft Icing; Cavities; Low Speed; Multimedia; Numerical Analysis; Aeroacoustics

20040073596 Space and Naval Warfare Systems Center, San Diego, CA
Distributed Surveillance Sensor Network
Nov. 1997; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422440; No Copyright; Avail: CASI; A02, Hardcopy

Develop capabilities for multiple undersea vehicles to support and interact with assorted undersea surveillance sensors in a manner which enhances the overall capabilities of the Fleet in the area of undersea 15k. Integrate the technologies developed by the AOSN (Autonomous Ocean Sampling Network), the ULITE underwater acoustic sensor array and the Flying Plug underwater connectivity device into a coherent demonstration of new technological capabilities in which the whole is greater than the sum of the various parts (Figure 1).
DTIC
Acoustics; Signal Detectors; Surveillance

20040073675 Washington Univ., Seattle, WA
Experimental Study of Sound Waves in Sandy Sediment
Yargus, Michael W.; May 2003; 117 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0040
Report No.(s): AD-A422568; APL-UW-TR-0301; No Copyright; Avail: CASI; A06, Hardcopy

This dissertation describes experiments intended to help understand the physics of sound (compressional waves) propagating through sandy sediments (unconsolidated porous media). The theory (using a lumped parameter model) and measurements (using a reflection ratio technique) includes derivations and measurements of acoustic impedance, effective densities, wave speeds (phase velocities), effective pressures, mode shapes, pressure reflection coefficients, and material moduli. The results show the acoustic impedance divided by the phase velocity, rendering an "effective density," is less than the total density of the sediment (effective density 89% plus or minus 3% of total). The results also show the fluid in the sediment oscillates back-and-forth 2.2 plus or minus 0.4 times farther than the sand in the sediment (mode shape) during the passing of a sound wave. These facts suggest the existence of Biot waves (two compressional waves) in water- saturated sand.
DTIC
Sands; Sediments; Sound Waves

20040073698 Washington Univ., Seattle, WA
ASIAEX, East China Sea, Cruise Report of the Activities of the R/V melville, 29 May to 9 June 2001
Dahl, Peter H.; Jul. 2001; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-96-1-0325
Report No.(s): AD-A422598; APL-UW-TM-7-01; No Copyright; Avail: CASI; A03, Hardcopy

Science teams from APL-UW, MPL-SIO, and URI deployed a constellation of instruments from the R/V Melville to measure acoustic propagation and scattering over a broad frequency range (100 Hz to 20 kHz), and environmental acoustic variables in the East China Sea (ECS). This work was completed from 29 May 2001 to 9 June 2001 as part of the Asian Seas

International Acoustics Experiment (ASIAEX). From 2 to 5 June, operations from the Melville were coordinated with those of the Chinese research vessels Shi Yan 2 and Shi Yan 3 in order to conduct studies in wide-band propagation and reverberation using explosive charges deployed from both Chinese vessels. The ASIAEX ECS 2001 experiment produced a remarkable set of measurements on acoustic propagation and scattering in an Asian littoral sea, along with environmental measurements required for its interpretation.
DTIC
China; Seas; Sound Waves; Wave Propagation

20040073714 Duke Univ., Durham, NC
Passive Differential Matched-Field Depth Estimation of Moving Acoustic Sources
Kraut, Shawn; Krolik, Jeffrey; Mar. 14, 2001; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422624; No Copyright; Avail: CASI; A03, Hardcopy

Workshop presentation of passive differential matched-field depth estimation of moving acoustic sources. The objective of Passive Moving Target Depth Estimation (MTDE) is to discriminate submerged versus surface targets by exploiting changes in the spatial wavefront at the array due to multipath propagation from a moving source.
DTIC
Depth; Depth Measurement; Sound Generators

20040073743 Naval Research Lab., Stennis Space Center, MS
Dynamic Ambient Noise Model (DANM) Evaluation Using Port Everglades Data
Pflug, Lisa A.; Thompson, Charles; Hall, Tracy; Apr. 5, 2004; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-71-7076-A3
Report No.(s): AD-A422664; NRL/FR/7185--04-10064; No Copyright; Avail: CASI; A03, Hardcopy

Measured omnidirectional noise at a shallow water site near Port Everglades and radar tracks for local ships were used to evaluate a new ambient noise model, the Dynamic Ambient Noise Model (DANM), developed for use on board Navy systems. For four consecutive days of data, the daily means of the modeled noise levels were higher than the data. The most likely cause of mismatch was two factors associated with the ship sources. The first was the relative assignments of ship classes to the radar track vessels for input to the model. The vessels were assigned classes by speed with no means to discriminate between large vessels traveling at low speeds and recreational vessels that do not contribute significantly to the noise field. The second factor was the source level model within DANM, which is implemented with no speed dependence. A dependence was introduced into the model through the ships class assignments, but would be more properly implemented within the model itself, and may be necessary for accurate predictions near a port. The lack of speed-dependent source levels and the source level curves themselves may be the causes of the frequency dependence seen in the model/measurement mismatch. Model predictions with all radar vessels assigned to the minimum source level resulted in lower but better model/measurement agreement. This spread of about 10 dB in daily means with different source level assignments confirms that source level assignments for dynamic shipping are critical to accurate model predictions. There was frequency dependence to the mismatch, with the model matching better at higher frequencies. Shear propagation is unaccounted for in the propagation models used by DANM and is a likely source of error for this environment at the lower frequencies.
DTIC
Ambience; Dynamic Models; Everglades (Fl); Noise (Sound); Ships

20040074216 NASA Langley Research Center, Hampton, VA, USA
Aeroacoustic Analysis of a Simplified Landing Gear
Lockard, David P.; Khorrami, Mehdi, R.; Li, Fei; [2004]; 12 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-13 May 2004, Manchester, UK
Contract(s)/Grant(s): 23-781-10-10
Report No.(s): AIAA Paper 2004-2887; No Copyright; Avail: CASI; A03, Hardcopy

A hybrid approach is used to investigate the noise generated by a simplified landing gear without small scale parts such as hydraulic lines and fasteners. The Ffowcs Williams and Hawkings equation is used to predict the noise at far-field observer locations from flow data provided by an unsteady computational fluid dynamics calculation. A simulation with 13 million grid points has been completed, and comparisons are made between calculations with different turbulence models. Results indicate that the turbulence model has a profound effect on the levels and character of the unsteadiness. Flow data on solid surfaces and a set of permeable surfaces surrounding the gear have been collected. Noise predictions using the porous surfaces appear

to be contaminated by errors caused by large wake fluctuations passing through the surfaces. However, comparisons between predictions using the solid surfaces with the near-field CFD solution are in good agreement giving confidence in the far-field results.
Author
Aeroacoustics; Noise Prediction; Landing Gear; Simulation; Computational Fluid Dynamics

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*.

20040070969 Lawrence Livermore National Lab., Livermore, CA
Multiscale Modeling of Dislocation Processes in Bcc Tantalum: Bridging Atomistic and Mesoscale Simulations
Yang, L. H.; Tang, M.; Moriarty, J. A.; Jan. 09, 2001; In English
Report No.(s): DE2004-15005763; UCRL-JC-139517; No Copyright; Avail: National Technical Information Service (NTIS)

Plastic deformation in bcc metals at low temperatures and high-strain rates is controlled by the motion of a/2<111> screw dislocations, and understanding the fundamental atomistic processes of this motion is essential to develop predictive multiscale models of crystal plasticity. The multiscale modeling approach presented here for bcc Ta is based on information passing, where results of simulations at the atomic scale are used in simulations of plastic deformation at mesoscopic length scales via dislocation dynamics (DD). The relevant core properties of a/2<111>; screw dislocations in Ta have been obtained using quantum-based interatomic potentials derived from model generalized pseudopotential theory and an ab-initio data base together with an accurate Green's-function simulation method that implements flexible boundary conditions. In particular, the stress-dependent activation enthalpy for the lowest-energy kink-pair mechanism has been calculated and fitted to a revealing analytic form. This is the critical quantity determining dislocation mobility in the DD simulations, and the present activation enthalpy is found to be in good agreement with the previous empirical form used to explain the temperature dependence of the yield stress.
NTIS
Screw Dislocations; Tantalum; Body Centered Cubic Lattices; Plastic Deformation; Multiscale Models

20040073518 NASA Marshall Space Flight Center, Huntsville, AL, USA
Numerical Modeling and Fluids Experiments for Materials Processing and Protein Crystallization
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 27-28; In English; See also 20040073490; No Copyright; Avail: CASI; A01, Hardcopy

An important component in biotechnology, particularly in the area of protein engineering and rational drug design is the knowledge of the precise three-dimensional molecular structure of proteins. The quality of structural information obtained from X-ray diffraction methods is directly dependent on the degree of perfection of the protein crystals. As a consequence, the growth of high quality macromolecular crystals for diffraction analyses has been the central focus for biochemists, biologists, and bioengineers. Macromolecular crystals are obtained from solutions that contain the crystallizing species in equilibrium with higher aggregates, ions, precipitants, other possible phases of the protein, foreign particles, the walls of the container, and a likely host of other impurities. By changing transport modes in general, i.e., reduction of convection and sedimentation, as is achieved in "microgravity", we have been able to dramatically affect the movement and distribution of macromolecules in the fluid, and thus their transport, formation of crystal nuclei, and adsorption to the crystal surface. While a limited number of high quality crystals from space flights have been obtained, as the recent National Research Council (NRC) review of the NASA microgravity crystallization program pointed out, the scientific approach and research in crystallization of proteins has been mainly empirical yielding inconclusive results.
Derived from text
Mathematical Models; Numerical Analysis; Protein Crystal Growth; Biotechnology; Crystal Surfaces; Crystallization

20040074183 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atomic Data and Spectral Line Intensities for Ne III
Landi, E.; Bhartia, A. K.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Electron impact collision strengths, energy levels, oscillator strengths, and spontaneous radiative decay rates are calculated for Ne III. The configurations used are 2s(sup 2)2p(sup 4), 2s2p(sup 5), 2p(sup 6), 2s(sup 2)2p(sup 3)3(sub s),

2s(sup 2)2p(sup 3)3p, and 2s(sup 2)2p(sup 3)3d giving rise to 86 fine-structure levels in intermediate coupling. Collision strengths are calculated at five incident energies, 5.2, 10, 15, 20 and 25 Ry. Excitation rate coefficients are calculated as a function of electron temperature by assuming a Maxwellian electron velocity distribution. Using the excitation rate coefficients and the radiative transition rates, statistical equilibrium equations for level populations are solved at electron densities covering the range of 10(exp 8) - 10(exp 14)/cc at an electron temperature of logTe/K = 5.0, corresponding to maximum abundance of Ne III. Relative spectral line intensities are calculated.
Author
Atoms; Line Spectra; Nitrogen Isotopes; Electron Impact; Collisions; Energy Levels

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*.

20040070967 Lawrence Livermore National Lab., Livermore, CA
Fundamental Nucleon-Nucleon Interaction: Probing Exotic Nuclear Structure using GEANIE at LANSCE/WNR
Lee, R. W.; Feb. 25, 2000; 22 pp.; In English
Report No.(s): DE2004-15006435; UCRL-ID-137793; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Nucleon-Nucleon Interactions; Nuclear Structure

20040071089 Oak Ridge National Lab., TN
Method for Concurrent and Continuous Measurement of Rn-222 and Rn-220 Using Scintillation Cells
Coleman, R. L.; 2003; In English
Report No.(s): DE2003-814040; ORNL/TM-2002/37; No Copyright; Avail: National Technical Information Service (NTIS)
A method is described for the continuous and simultaneous measurement of both (sup 220)Rn and (sup 222)Rn in air. Two scintillation flasks are arranged in a serial configuration and the concentrations of (sup 222)Rn and (sup 220)Rn are determined by making use of the difference between the half-lives of the two radon isotopes. The method was developed for directly measuring (sup 220)Rn in occupied areas where fuel materials containing (sup 228)Th were being used, but could also be useful for other applications. Since (sup 222)Rn is usually present from either naturally occurring materials or due to the presence of process material, the method was designed to allow measurement of the two isotopes at coincident times.
NTIS
Calibrating; Scintillation Counters; Radon Isotopes

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*.

20040068194 National Inst. of Standards and Technology, USA
Novel Electrically Substituted Optical Detectors
Rice, Joseph; Lorentz, Steven; Houston, Jeanne; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-14; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
Several new thermal-type optical detectors have been developed at NIST for various measurement applications over the past few years. These detectors share a common feature in that they incorporate a form of electrical substitution where chopper-synchronized electrical power, controlled by a servo loop, maintains the detector at a fixed operating temperature. This mode of operation increases temporal stability, improves time response, and provides a relatively straightforward basis for calibration. While related to operating modes utilizing electro-thermal feedback, electrical substitution is quite distinct, as will be shown. We will present a general introduction to electrically substituted thermal-type optical detectors, and then provide specific details on up to four new examples: 1) An electrically substituted liquid helium cooled bolometer (ESB) that

uses a gold-black coating for optical absorption and as the electrical substitution heater. This detector serves as a spectrally flat reference standard in a new calibration facility at NIST that measures the spectral responsivity of customer infrared detectors using tunable infrared lasers. 2) A liquid helium cooled active cavity radiometer that will serve as a next generation primary standard for optical detector responsivity measurements at NIST, the High Accuracy Cryogenic Radiometer 2 (HACR2). 3) The High-Tc Active Cavity Radiometer (High-Tc ACR), which uses YBCO thin-film sensors on the receiver cavity and only requires cooling to below about 85 K. It has been tested with the YBCO sensors operating both at the midpoint of the superconductive resistive transition (89 K, resistive-edge mode), and at slightly lower temperatures along the critical current versus temperature curve (85 89 K, critical current mode). One could imagine flying this with radiative cooling. 4) The Scripps-NIST Advanced Radiometer (Scripps-NISTAR), a spaceflight instrument that was developed with NASA and Scripps sponsorship for a flight to the Earth s L-1 point, where it will view the Earth and measure total Earth-emitted and solar-reflected irradiance for a better understanding of the Earth s radiative balance. The Scripps-NISTAR thermal detectors themselves are active cavity radiometers that operate at 40 degrees Celcius near the midpoint of the resistive transition in polycrystalline, doped BST (Barium Strontium Titanate) that is associated with the ferroelectric phase transition. These provide sensitivity that is adequate for accurate measurements of the total irradiance from the Earth at L-1, which is 4 or 5 orders of magnitude lower than the irradiance levels measured by existing spaceflight active cavity radiometers.
Author
Optical Measuring Instruments; Infrared Detectors; Electromagnetic Absorption; Superconductors (Materials)

20040068203 Naval Research Lab., USA
Resonance Modes of Meshes with Rectangular and Hexagonal Structures
Sternberg, Oren; Shah, J.; Moeller, K. D.; Fettig, R.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P3; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We compare simulation results of inductive cross-shaped, square, and hex-shaped meshes for different sizes and thicknesses in the far-infrared spectral region. We present the dependence of the peak transmittance, bandwidth and sidebands structures of square-shaped, round, cross, and hex structures. Experimental data and simulations are presented for meshes of hexagonal structure as well as other structures. In addition the dipole model and the TE-mode theory are compared for various meshes. An empirical formulas and cutoff frequencies are discussed.
Author
Mesh; Simulation; Far Infrared Radiation

20040068222 Wales Univ. Inst. of Science and Technology, Cardiff, UK
Anti-reflection Coatings for Far IR Filters
Tucker, Carole; Haynes, Vic; Ade, Peter; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P2; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The far-infrared bandpass and blocking filters developed at Cardiff University are made from layers of a dielectric substrate. This technique makes the filters solid and robust, however, we are always left with a dielectric slab of the overall filter thickness which creates fringing in the spectrum and hence loss in transmission at certain frequencies. We present results obtained from an antireflection technique, providing near 100% transmission over a desired band of frequencies. This technology is also being developed for use on windows and lenses. Comparison with a theoretical model shows good agreement allowing us freedom to explore designs before manufacture.
Author
Antireflection Coatings; Infrared Filters; Far Infrared Radiation

20040068243 Lockheed Martin Corp., Syracuse, NY, USA
Infrared Frequency Selective Surfaces Fabricated using Optical Lithography and Phase-Shift Masks
Spector, S. J.; Astolfi, D. K.; Doran, S. P.; Lyszczarz, T. M.; Raynolds, J. E.; Jun. 2001; In English
Report No.(s): DE2004-821683; LM-01K062; No Copyright; Avail: National Technical Information Service (NTIS)

A frequency selective surface (FSS) structure has been fabricated for use in a thermophotovoltaic system. The FSS provides a means for reflecting the unusable light below the bandgap of the thermophotovoltaic cell while transmitting the usable light above the bandgap. This behavior is relatively independent of the light's incident angle. The fabrication of the FSS was done using optical lithography and a phase-shift mask. The FSS cell consisted of circular slits spaced by 1100 nm. The diameters and widths of the circular slits were 870 nm and 120 nm, respectively. The FSS was predicted to pass wavelengths

near 7(micro)m and reflect wavelengths outside of this pass-band. The FSSs fabricated performed as expected with a pass-band centered near 5(micro)m.
NTIS
Images; Lithography

20040068250 Lawrence Livermore National Lab., Livermore, CA
RadSensor: X-ray Detection by Direct Modulation of an Optical Probe Beam
Lowry, M. E.; Bennett, C. V.; Vernon, S. P.; Bond, T.; Welty, R.; Aug. 01, 2003; In English
Report No.(s): DE2003-15004431; UCRL-JC-154709; No Copyright; Avail: National Technical Information Service (NTIS)
We present a new X-ray detection technique based on optical measurement of the effects of X-ray absorption and electron hole pair creation in a direct band-gap semiconductor. The electron-hole pairs create a frequency dependent shift in optical refractive index and absorption. This is sensed by simultaneously directing an optical carrier beam through the same volume of semiconducting medium that has experienced an X-ray induced modulation in the electron-hole population. If the operating wavelength of the optical carrier beam is chosen to be close to the semiconductor band-edge, the optical carrier will be modulated significantly in phase and amplitude.
NTIS
Detection; Light Beams; Light Transmission; Optical Measurement; X Ray Absorption

20040068261 Lawrence Livermore National Lab., Livermore, CA
Laser-Induced Back-Ablation of Aluminum Thin Films using Picosecond Laser Pulses
Bullock, A. B.; May 26, 1999; 182 pp.; In English
Report No.(s): DE2004-15006367; UCRL-LR-128723; No Copyright; Avail: Department of Energy Information Bridge
Experiments were performed to understand laser-induced back-ablation of Al film targets with picosecond laser pulses. Al films deposited on the back surface of BK-7 substrates are ablated by picosecond laser pulses propagating into the Al film through the substrate. The ablated Al plume is transversely probed by a time-delayed, two-color sub-picosecond (500 fs) pulse, and this probe is then used to produce self-referencing interferograms and shadowgraphs of the Al plume in flight. Optical emission from the Al target due to LIBA is directed into a time-integrated grating spectrometer, and a time-integrating CCD camera records images of the Al plume emission. Ablated Al plumes are also re-deposited on to receiving substrates. A post-experimental study of the Al target and recollected deposit characteristics was also done using optical microscopy, interferometry, and profilometry. In this high laser intensity regime, laser-induced substrate ionization and damage strongly limits transmitted laser fluence through the substrate above a threshold fluence. The threshold fluence for this ionization-based transmission limit in the substrate is dependent on the duration of the incident pulse. The substrate ionization can be used as a dynamic control of both transmitted spatial pulse profile and ablated Al plume shape. The efficiency of laser energy transfer between the laser pulse incident on the Al film and the ablated Al plume is estimated to be of order 5% and is a weak function of laser pulsewidth.
NTIS
Laser Outputs; Ablation; Aluminum; Thin Films; Picosecond Pulses

20040068271 NASA Goddard Space Flight Center, Greenbelt, MD, USA
PhyLM: A Mission Design Concept for an Optical/Lidar Instrument to Measure Ocean Productivity and Aerosols from Space
Gervin, Janette C.; Behrenfeld, Michael; McClain, Charles R.; Spinhirne, James; Purves, Lloyd; Wood, H. John; Roberto, Michael R.; 2004; 1 pp.; In English; IGARSS 2004: 2004 IEEE International Geoscience and Remote Sensing Symposium, 20-24 Sep. 2004, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only
The Physiology Lidar-Multispectral Mission (PhyLM) is intended to explore the complex ecosystems of our global oceans. New "inversion" methods and improved understanding of marine optics have opened the door to quantifying a range of critical ocean properties. This new information could revolutionize our understanding of global ocean processes, such as phytoplankton growth, harmful algal blooms, carbon fluxes between major pools and the productivity equation. The new science requires new measurements not addressed by currently planned space missions. PhyLM will combine active and advanced passive remote sensing technologies to quantify standing stocks and fluxes of climate-critical components of the Ocean carbon cycle to meet these science providing multispectral bands from the far UV through the near infrared (340 - 1250 nm) at a ground resolution of 250 m. Improved detectors, filters, mirrors, digitization and focal plane design will offer an overall higher-quality data product. The unprecedented accuracy and precision of the absolute

water-leaving radiances will support inversion- based quantification of an expanded set of ocean carbon cycle components. The dual- wavelength (532 & 1064 nm) Nd:Yag Lidar will enhance the accuracy and precision of the passive data by providing aerosol profiles for atmospheric correction and coincident active measurements of backscattering. The Lidar will also examine dark-side fluorescence as an additional approach to quantifying phytoplankton biomass in highly productive regions.
Derived from text
Design Analysis; Optical Radar; Productivity; Oceans; Aerosols; Space Missions

20040068300 Lawrence Livermore National Lab., Livermore, CA
Yb:S-FAP Lasers
Schaffers, K. I.; Jan. 20, 2004; 20 pp.; In English
Report No.(s): DE2004-15006526; UCRL-CONF-154575; No Copyright; Avail: Department of Energy Information Bridge
It has recently been reported that several high power, diode-pumped laser systems have been developed based on crystals of Yb:S-FAP(Yb(sup 3+):Sr(sub 5)(PO(sub 4)(sub 3)F). The Mercury Laser, at Lawrence Livermore National Laboratory, is the most prominent system using Yb:S-FAP and is currently producing 23J at 5 Hz in a 15 nsec pulse, based on partial activation of the system. In addition, a regenerative amplifier is being developed at Waseda University in Japan and has produced greater than 12 mJ with high beam quality at 50Hz repetition rate. Q-peak has demonstrated 16 mJ of maximum energy/output pulse in a multi-pass, diode side-pumped amplifier and ELSA in France is implementing Yb:S-FAP in a 985 nm pump for an EDFA, producing 250 mW. Growth of high optical quality crystals of Yb:S-FAP is a challenge due to multiple crystalline defects.
NTIS
Lasers; Crystal Defects; Diodes

20040068303 National Telecommunications and Information Administration, Washington, DC, USA
Color Correction Matrix for Digital Still and Video Imaging Systems
Wolf, S.; Dec. 2003; In English
Report No.(s): PB2004-105433; NTIA-TM-04-406; No Copyright; Avail: National Technical Information Service (NTIS)
This document discusses a method for correcting inaccurate color output by digital still and video imaging systems. The method uses a known reference image together with a least-squares algorithm to estimate the optimal color channel mixing matrix that must be applied to the output images in order to correct their color inaccuracies. The techniques presented in this document will provide users of digital photography and video equipment with an automated tool for correcting color output. For instance, digital photography users currently may try to correct color distortions in their images by trial and error using photo editing software. However, these correction procedures are time consuming and subjective and do not normally allow for arbitrary mixing of the color channels. The automated color correction matrix computation presented in this document allows each color component in the corrected image (e.g., red) to be calculated as a linear summation of a DC component and all the color components (e.g., red, green, and blue) in the uncorrected image. Methods to correct non-linearities in the color response of digital imaging systems are also discussed.
NTIS
Cameras; Photographic Equipment

20040068317 Lawrence Livermore National Lab., Livermore, CA
CO(2)-Laser Polishing for Reduction of 351-nm Surface Damage Initiation in Fused Silica
Brusasco, R. M.; Penetrante, B. M.; Peterson, J. E.; Maricle, S. M.; Butler, J. A.; Nov. 2001; In English
Report No.(s): DE2003-15004628; UCRL-JC-144293; No Copyright; Avail: National Technical Information Service (NTIS)
We have applied a carbon dioxide (CO2) raster scanning laser polishing technique on two types of fused silica flat optics to determine the efficacy of CO2-laser polishing as a method to increase the 351-nm laser damage resistance of optic surfaces. R-on-1 damage test results show that the fluence for any given 355-nm damage probability is 10- 15 J/cm2 higher (at 3 ns pulse length, scaled) for the CO2-laser polished samples. Poor quality and good quality surfaces respond to the treatment such that their surface damage resistance is brought to approximately the same level. Surface stress and the resultant effect on wavefront quality remain key technology issues that would need to be addressed for a robust deployment.
NTIS
Radiation Damage; Carbon Dioxide Lasers; Probability Theory

20040068318 Lawrence Livermore National Lab., Livermore, CA

Results of Raster Scan Laser Conditioning Studies on DKDP Triplers Using Nd: YAG and Excimer Lasers

Runkel, M.; Neeb, K.; Staggs, M.; Auerbach, J.; Burnham, A.; Nov. 2001; In English

Report No.(s): DE2003-15004629; UCRL-JC-144299; No Copyright; Avail: National Technical Information Service (NTIS)

In this paper we present the results of damage tests performed at 1064 and 355-nm at 8-10 ns on conventional and rapid growth DKDP tripler crystals. The crystals were laser conditioned prior to damage testing by raster scanning using either Nd:YAG (1064 and 355 nm, 8-10ns) or excimer lasers at 248, 308 or 351 nm with pulse durations of approximately 30-47 ns. The results show that it is possible to attain increases in 355-nm damage probability fluences of 2 for excimer conditioning at 248 and 308 nm. However these wavelengths can induce absorption sufficient to induce bulk fracture by thermal shock when impurities such as arsenic, rubidium and sulfur are present in the crystals in sufficient quantity. Tests to evaluate the efficiency of 351-nm conditioning (XeF excimer) show improvements of 2 and that thermal fracture by induced absorption is not a problem. We also discuss our recent discovery that low fluence raster scanning at UV wavelengths leads to 1064-nm damage thresholds of over 100 J/cm2 (10-ns pulses).

NTIS

Excimer Lasers; Raster Scanning; Yag Lasers; Neodymium Lasers

20040070984 Goodrich Corp., Burnsville, VA, USA

Development of a Wide Area Optical Surface Contamination Detection System for Public Transportation Application

Schmokel, P.; Apr. 2004; 26 pp.; In English

Report No.(s): PB2004-105015; No Copyright; Avail: CASI; A03, Hardcopy

This project developed and tested a laser-based remote sensing technology for detecting ice on road surfaces. The system is an adaptation of a wide area ice detection system (IceHawk) that utilizes laser polarization properties and has been applied successfully to detect ice on typical aircraft surfaces. The work involved analysis of target materials, improving range performance and detection of wet surfaces. A system requirement document was generated based on initial testing and analysis. The existing IceHawk system was modified to allow for stationary mount and remote operation. Target materials (concrete, asphalt, etc.) were evaluated for polarization reflection behavior. Test data collected during winter was used to improve and refine the system. Initial results showed the adaptability of a station pole mounted IceHawk system to detect ice and snow on roadway surfaces. Test results showed a distinguishable difference between a clean surface and that covered with snow or ice. Data was gathered to determine the minimum thickness threshold settings for ice, snow and wet roadway conditions. In addition, pixel-filtering technique was evaluated to determine the ice, snow and wet area criteria necessary to alert the operator of unacceptable conditions. Work on range improvement enhanced the signal to noise ratio and led to an increase of 25 percent in the detection range for ice, snow and wet surface. Additional improvements involved creating larger collecting optics and increasing the amount of light energy delivered to the photodetector. Further research, development and testing will be needed before the technology can be applied to the highways.

NTIS

Remote Sensing; Ice; Snow; Lasers; Optical Measurement

20040071023 Lawrence Livermore National Lab., Livermore, CA

UV Laser Conditioning for Reduction of 351-nm Damage Initiation in Fused Silica

Brusasco, R. M.; Penetrante, B. M.; Peterson, J. E.; Maricle, S. M.; Menapace, J. A.; Dec. 20, 2001; In English

Report No.(s): DE2003-15005418; UCRL-JC-144300; No Copyright; Avail: National Technical Information Service (NTIS)

This paper describes the effect of 355-nm laser conditioning on the concentration of UV-laser-induced surface damage sites on large-aperture fused silica optics. We will show the effect of various 355-nm laser conditioning methodologies on the reduction of surface-damage initiation in fused silica samples that have varying qualities of polishing. With the best, generally available fused silica optic, we have demonstrated that 355-nm laser conditioning can achieve up to 10x reduction in surface damage initiation concentration in the fluence range of 10-14 J/sq cm (355-nm(at) 3 ns).

NTIS

Ultraviolet Lasers; Laser Damage; Silica Glass; Cooling

20040071054 Brookhaven National Lab., Upton, NY, USA, Stanford Linear Accelerator Center, Stanford, CA, USA

Femtosecond X-ray Pulses from a Frequency Chirped SASE FEL

Krinsky, S.; Huang, Z.; Sep. 2003; 18 pp.; In English

Report No.(s): DE2004-15006738; BNL-71913-2004-CP; No Copyright; Avail: Department of Energy Information Bridge

We discuss the temporal and spectral properties of self-amplified spontaneous emission (SASE) utilizing an energy-chirped electron beam. A short temporal pulse is generated by using a monochromator to select a narrow radiation bandwidth from the frequency chirped SASE. For the filtered radiation, the minimum pulse length is limited by the intrinsic SASE bandwidth, while the number of modes and the energy fluctuation can be controlled through the monochromator bandwidth. Two cases are considered: (1) placing the monochromator at the end of a single long undulator; (2) placing the monochromator after an initial undulator and amplifying the short-duration output in a second undulator. We analyze these cases and show that tens of femtosecond x-ray pulses may be generated for the linac coherent light source.
NTIS
Free Electron Lasers; Electron Beams

20040071085 Brookhaven National Lab., Upton, NY
Saturation of a High-Gain Single-Pass FEL
Krinsky, S.; 2003; 12 pp.; In English
Report No.(s): DE2004-15006737; BNL-71912-2003-CP; No Copyright; Avail: Department of Energy Information Bridge
We study a perturbation expansion for the solution of the nonlinear one-dimensional FEL equations. We show that in the case of a monochromatic wave, the radiated intensity satisfies a scaling relation that implies, for large distance z traveled along the undulator, a change in initial value of the radiation field corresponds to a translation in z (lethargy). Analytic continuation using Pade approximates yields accurate results for the radiation field early in saturation.
NTIS
Free Electron Lasers; High Gain; Saturation; Perturbation

20040071090 Helsinki Univ. of Technology, Espoo
Spatial Correlations and Partial Polarization in Electromagnetic Optical Fields: Effects of Evanescent Waves
Setala, T.; 2003; 60 pp.; In English
Report No.(s): PB2004-105764; No Copyright; Avail: CASI; A04, Hardcopy
In this thesis, partial polarization and spatial correlation properties of electromagnetic optical fields are investigated. The emphasis is on near fields which exist only within the distance of the light wavelength from the emitting or scattering object. In the near-field region, the contribution of the evanescent (non-radiating) waves is overwhelming compared to the propagating waves that can be observed far from the source. Certain fundamental issues related to the optical near-fields are studied. The decomposition of the free-space Green tensor into its evanescent and propagating parts is performed. This issue is of importance in near-field optics and it has attracted considerable attention in the recent literature. Another fundamental issue investigated in the thesis concerns the three-dimensional degree of polarization needed to characterize of electromagnetic fields having arbitrary planar or non-planar wave structures. The physical interpretation of the concept is presented, and its differences in comparison with the conventional two-dimensional formulation of the degree of polarization are brought out. The theory is applied to investigate the effects of evanescent waves and resonant surface waves on the polarization state of the near fields generated by some thermal half-space sources. The thesis also includes a study of the partial polarization and spatial correlation properties of homogeneous free electromagnetic fields. The fields are modelled as an isotropic distribution of angularly uncorrelated and, in the 2D-sense, unpolarized plane waves propagating within a solid angle. When the solid angle extends over the full space, the spatial correlations are found to be determined by the imaginary part of the associated Green tensor, and the field is fully unpolarized in the 3D-sense. These results are the same as for black-body fields, although here no thermal equilibrium is assumed. The same behavior is discovered for any electromagnetic field generated by a statistically homogeneous and isotropic current distribution, which fluctuates within a medium having a vanishingly small absorption. For the fields whose electric cross-spectral density tensor is proportional to the imaginary part of the Green tensor, the degree of coherence has a universal form given by the sinc law.
NTIS
Electromagnetism; Evanescent Waves; Polarized Electromagnetic Radiation; Spatial Distribution; Correlation

20040071093 Lawrence Livermore National Lab., Livermore, CA
Spectral and Imaging Characterization of Tabletop X-ray Lasers
Dunn, J.; Faenov, A. Y.; Pikuz, T. A.; Osterheld, A. L.; Moon, S. J.; Dec. 01, 2000; In English
Report No.(s): DE2004-15005759; UCRL-JC-138687; No Copyright; Avail: National Technical Information Service (NTIS)
We have performed L-shell spectroscopy and one-dimensional (1-D) imaging of a line focus plasma from a laser-heated Fe polished slab using the tabletop COMET laser system at the Lawrence Livermore National Laboratory. These plasmas are

used to generate a Ne-like Fe transient gain x-ray laser that is recorded simultaneously. A spherically-curved crystal spectrometer gives high resolution x-ray spectra of the n= 3-2 and n= 4-2 resonance lines with 1-D spatial resolution along the line focus. Spectra are presented for different laser pulse conditions. In addition, a variety of x-ray imaging techniques are described. We discuss imaging results from a double-slit x-ray camera with a spherically-curved crystal spectrometer. We show a high resolution Fe K-(alpha) spectrum from the x-ray laser target that indicates the presence of hot electrons in the x-ray laser plasma.
NTIS
X Ray Lasers; Spectroscopy

20040071097 Lawrence Livermore National Lab., Livermore, CA
Influence of Subsurface Cracks on Laser Induced Surface Damage
Feit, M. D.; Rubenchik, A. M.; Nov. 07, 2003; In English
Report No.(s): DE2004-15005753; UCRL-CONF-153481; No Copyright; Avail: National Technical Information Service (NTIS)

Cracks can affect laser damage susceptibility in three ways. These are field intensification due to interference, enhanced absorption due to trapped material in the cracks, and increased mechanical weakness. Enhanced absorption is the most important effect. The purpose of this report is to describe the ways in which near surface cracks can affect laser-induced damage susceptibility. It is organized according to the three necessary conditions for macroscopic damage listed above. Laser beam intensification due to either electromagnetic boundary conditions at crack walls or to total internal reflection at cracks and free surfaces along with interference increases the available light energy density. Particulate matter, especially that derived from polishing, can be trapped in cracks. Together with chemical bond changes at crack walls, such trapping adds absorbing centers near the surface. Finally, the presence of cracks mechanically weakens the material making it easier to cause macroscopic damage for given energy input. We consider both intrinsic (dielectric breakdown) and extrinsic (absorption by small particles) mechanisms. We find that enhanced absorption due to either particulate matter trapped in cracks or clusters of oxygen deficient chips formed during crack formation are the most likely source of the crack related damage enhancement in fused silica surface damage.
NTIS
Laser Damage; Cracks

20040073598 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Underwater Docking of Autonomous Undersea Vehicles Using Optical Terminal Guidance
Cowen, Steve; Briest, Susan; Dombrowski, James; Oct. 1997; 6 pp.; In English
Report No.(s): AD-A422445; No Copyright; Avail: CASI; A02, Hardcopy

Missions in which an autonomous undersea vehicle docks with an underwater node for the purpose of battery recharging and/or data transfer greatly increase the scope of potential applications possible with UUV's. Robust and accurate vehicle guidance to a small, simple and reliable docking structure is a critical capability which must be developed in order to achieve this end. This paper describes a simple but highly effective underwater vehicle guidance scheme which is based upon an optical quadrant tracker which locks onto a visible light source located at the dock in the same manner as a Sidewinder air-to-air missile tracks its target in air. An optical terminal guidance system based upon this concept was developed by NRaD. Optical guidance and docking was demonstrated using two autonomous underwater vehicles: a SeaGrant Odyssey IIB and the NRaD flying Plug. The optical docking system was demonstrated to be accurate and robust for vehicle terminal guidance during field operations and provided targeting accuracy on the order of 1 centimeter under real- world conditions, even in turbid bay water. Such a system is projected to provide reliable terminal vehicle guidance to an underwater dock from a maximum acquisition range of approximately 100 meters in typical continental shelf ocean water.
DTIC
Autonomy; Spacecraft Docking; Terminal Guidance; Underwater Vehicles

20040073731 Oregon Univ., Eugene, OR
Optical Processes in High-Q Semiconductor Microcavities
Wang, Hailin; Mar. 22, 2004; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-01-0393
Report No.(s): AD-A422647; ARO-40671.1-PH-QC; No Copyright; Avail: CASI; A03, Hardcopy

This final progress report summarizes research efforts in two areas: cavity QED of quantum dots and electromagnetically

induced transparency (EIT) in GaAs quantum wells. Cavity QED studies are based on the development of a composite nanocrystal-microsphere system, in which CdSe/ZnS core/shell nanocrystals couple to whispering gallery modes (WGMs) in a fused silica microsphere. The composite microcavity system can feature a Q-factor as high as 108 and a nanocrystal decoherence rate as small as 3 microneV (0.75 GHz), indicating that the composite system can in principle reach the strong coupling regime of cavity QED. EIT studies have exploited the use of Coulomb interactions between excitons to induce and manipulate exciton spin coherence and biexciton coherence. These studies have led to the first experimental demonstration of EIT in inter-band optical transitions in semiconductors in A-type, cascaded, and V-type three-level systems.
DTIC
Q Factors; Quantum Wells; Semiconductors (Materials); Switching

20040073738 Northwestern Univ., Evanston, IL
MURI Fellow on Quantum Information Technology: Entanglement, Teleportation, and Quantum Memory
Kumar, Prem; Sharping, Jay E.; Jan. 31, 2004; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0469
Report No.(s): AD-A422655; ARO-41618.7-PH-MUR; No Copyright; Avail: CASI; A01, Hardcopy

This grant supported a MURI Fellow to work on topics in the area of Quantum Information Technology. Specifically, Jay E. Sharping worked on the following research tasks: i) Generation of polarization-entangled photon-pair pulses near 1.5 micron wavelength by use of the Kerr nonlinearity of standard dispersion-shifted optical fiber and ii) applying the same techniques to obtain polarization- entangled photon-pair pulses near the 0.8 micron wavelength by use of novel micro-structured optical fibers (also called holey fibers). In both cases, nondegenerate four-wave mixing was used to simultaneously generate signal/idler photon pairs. Thorough studies of the classical nonlinear optical processes were performed and several useful applications such as parametric amplification, parametric oscillation, and all- optical switching were demonstrated. Direct detection and photon counting techniques were used to experimentally verify quantum-correlated signal/idler pair production. Photon counting tools for detection at wavelengths of 1.5 micron were built and characterized. Time and polarization multiplexed four-wave mixing processes were then used to generate polarization-entangled photon pairs, and the quality of the entanglement was evaluated through quantum interference and Bell-inequality-violation measurements.
DTIC
Quantum Optics

20040073740 Air Force Research Lab., Edwards AFB, CA
A Novel Wave Front Method Used for Tracking Terrestrial Concentrator Focal Spot Location
Beasley, Joseph N.; Mar. 26, 2004; 13 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A422658; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a new sensing method for tracking terrestrial concentrator focal spot location. The new method utilizes the shape and mirror-like surfaces of the absorber as a wave front sensor. The paper begins with a discussion of wave front sensing and how it can be used in optical systems to measure phase differences in light waves across an aperture. The wave front sensing method is then modified from an aperture or lens system into a mirror system. After the method wa-s developed for mirrors, it was developed into a method of detecting focal spot location errors.
DTIC
Concentrators; Position (Location); Wave Fronts

20040073809 Stanford Univ., Stanford, CA
Research Studies on Electromagnetically Induced Transparency
Harris, Stephen E.; Apr. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0028
Report No.(s): AD-A422836; ARO-41376.15-PH; No Copyright; Avail: CASI; A03, Hardcopy

The final report describes progress in the use of electromagnetically induced transparency for the realization of new types of nonlinear interactions and processes. We have worked in two areas: (1) The generation of femtosecond pulses by phased and anti-phased molecular states and the use of this radiation for new types of physical processes, and (2) The demonstration of elementary nonlinear optical processes at low- light-levels. Highlights of the work on this program include the suggestion and first demonstration of the use of an EIT- like Raman process to produce a spectrum with a width over 50, 000 cm-1 of

bandwidth, and the compression of this radiation to pulses of several femtoseconds in length. By using a technique, which we call multiplicative, we are able to obtain over 200 sidebands. In the future this should allow the synthesis of sub-cycle waveforms of arbitrary shape. In other work under this contract, we have observed an efficient nonlinear optical process at an energy of several pJ.
DTIC
Nonlinear Optics; Transparence

20040074224 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optical Design of the RAISE Sounding Rocket Instrument
Thomas, Roger J.; Hassler, Donald M.; [2004]; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA
Contract(s)/Grant(s): NNG04WC01G; No Copyright; Avail: Other Sources; Abstract Only

The Rapid Acquisition Imaging Spectrograph Experiment (RAISE) is a recently selected sounding rocket program to investigate the dynamics and heating of the outer solar atmosphere on time scales as short as looms. Its optical design represents the first in a new class of two-reflection W / E W imaging spectrometers with Toroidal Varied-Line Space (TVLS) gratings. Due to the remarkable imaging properties of such gratings, RAISE will measure spectra simultaneously over four different wavelength bands (1205-1243 & 1524-1559 A in first order, 602.5-621.5 & 762.0-779.5 A in second), with an unprecedented combination of spatial, spectral, and temporal resolutions. These spectral regions include many bright, well-resolved lines covering the temperature range from the low chromosphere up to the 2 MK Fe XI1 corona. The RAISE optical design features an extremely fast beam (f/7.0) and a minimum number of reflections, which together allow enough throughput to provide high quality spectral data even at its very short exposure times. Moreover, by operating with high magnification (x4.25), the RAISE spectrometer can most effectively utilize the full length and width available in the sounding rocket payload. First launch of this exciting new instrument is scheduled for 2006 June 21.
Author
Sounding Rockets; Optical Equipment; Design Analysis; Imaging Spectrometers; Solar Atmosphere; Heating

20040074274 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The DART System for Far-IR/Submillimeter Space Missions
Dragovan, Mark, et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 415-420; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The DART is a system of two cylindrical-parabolic reflectors. One reflector will produce a line focus; two reflectors properly oriented will produce a point focus. For far-infrared/submillimeter missions, the DART presents a compelling new telescope architecture that is scalable to alrge apertures, and with it's large membrane area is well suited to passive cooling.
Author
Reflecting Telescopes; Parabolic Reflectors

20040074310 Composite Optics, Inc., San Diego, CA, USA
The Status of Composite Telescope Technology for Space Astronomy
Connell, Steve; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 438-444; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

Carbon Fiber Reinforced Composites (CFRP) are promising material for segmented mirrors on spaceborne telescopes. A 2-meter Herschel telescope demonstrator is profiled in this viewgraph presentation, which shows the surface figure of the primary mirror through thermal cycling at Herschel temperatures.
CASI
Carbon Fibers; Fiber Composites; Spaceborne Telescopes

20040074321 TRW Space and Electronics Group, USA
An Infrared Telescope for Planet Detection and General Astrophysics
Lillie, C. F.; Atkinson, C. B.; Casement, L. S.; Flannery, M. R.; Kroening, K. V.; Moses, S. L.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 214-223; In English; See also 20040074260
Contract(s)/Grant(s): JPL-1217284; No Copyright; Avail: CASI; A02, Hardcopy

NASA plans to launch a Terrestrial Planet Finder (TPF) mission in 2014 to detect and characterize Earth-like planets around nearby stars, perform comparative planetology studies, and obtain general astrophysics observations. During our

recently completed a TPF Mission Architecture study for NASA/JPL we developed the conceptual design for a 28-meter telescope with an IR Coronagraph that meets these mission objectives. This telescope and the technology it embodies are directly applicable to future Far-IR and Submillimeter space missions. The detection of a 30th magnitude planet located within 50 milli-arc-seconds of a 5th (Visual) magnitude star is an exceptionally challenging objective. Observations in the thermal infrared (7-17 microns) are somewhat easier since the planet is "only" 15(sup m) fainter than the star at these wavelengths, but many severe challenges must still be overcome. These challenges include: 1. Designing a coronagraph for star:planet separations less than or equal to lambda/D. 2. Developing the deployment scheme for a 28m space telescope that can fit in an existing launch vehicle payload fairing. 3. Generating configuration layouts for the IR telescope, coronagraph, spacecraft bus, sunshade, solar array, and high-gain antenna. 4. Providing: Structural stability to within 10 microns to support the optics. Thermal control to achieve the necessary structural stability, as well as providing a stable (approx. 30K) thermal environment for the optics. Dynamics isolation from potential jitter sources. 5. Minimizing launch mass to provide the maximum payload for the science mission Interfacing to an EELV Heavy launch vehicle, including acoustic and stress loads for the launch environment. 6. Identifying the key technologies (which can be developed by 2009) that will enable TPF mission to be performed. 7. Generating a manufacturing plan that will permit TPF to be developed at a reasonable cost and schedule. Many of these design challenges result in inherently conflicting requirements on the design of TPF. Drawing on our experience with large space telescopes such as the Chandra X-ray Observatory and the Next Generation Space Telescope, we have created a conceptual design for TPF that successfully meets these challenging requirements. This paper describes our solution to these challenges.

Author

Infrared Telescopes; Planet Detection; Astrophysics; Far Infrared Radiation; Temperature Control

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040068247 Lawrence Livermore National Lab., Livermore, CA

Active Feedback Stabilization of the Resistive Wall Mode on the DII D-Device

Okabayashi, M.; Bialek, J.; Chance, M. S.; Chu, M. S.; Fredrickson, E. D.; Nov. 01, 2000; In English

Report No.(s): DE2003-15004386; UCRL-JC-152981; No Copyright; Avail: National Technical Information Service (NTIS)

A proof of principle magnetic feedback stabilization experiment has been carried out to suppress the resistive wall mode (RWM), a branch of the ideal magnetohydrodynamic (MHD) kink mode under the influence of a stabilizing resistive wall, on the DIII-D tokamak device (Plasma Phys. and Contr. Fusion Research (International Atomic Energy Agency, Vienna, 1986), p. 159). The RWM was successfully suppressed and the high beta duration above the no wall limit was extended to more than 50 times the resistive wall flux diffusion time. It was observed that the mode structure was well preserved during the time of the feedback application. Several lumped parameter formulations were used to study the feedback process. The observed feedback characteristics are in good qualitative agreement with the analysis.

NTIS

Feedback; Magnetohydrodynamics; Nuclear Electric Power Generation; Tokamak Devices

20040068270 Lawrence Livermore National Lab., Livermore, CA

Demonstration of Symmetry Control of Infrared Heated Deuterium Layers in Hohlraums

Kozioziemski, B. J.; London, R. A.; McEachern, R. L.; Bittner, D. N.; Aug. 22, 2003; In English

Report No.(s): DE2003-15004896; UCRL-JC-154640-R1; No Copyright; Avail: National Technical Information Service (NTIS)

Infrared smoothed deuterium ice layers inside capsules have been successfully demonstrated for capsules inside cylindrical hohlraums. Improved characterization methods and infrared illumination enables low mode control in both the axial and azimuthal directions. Experimental results agree well with computer models. Results of these experiments will be used to derive accuracy requirements for an infrared heating system for ice layers in hohlraums on National Ignition Facility (NIF).

NTIS

Deuterium; Symmetry; Automatic Control; Infrared Radiation; Heating

20040068273 Lawrence Livermore National Lab., Livermore, CA

Target Diagnostic Technology Research and Development for the LLNL ICF and HED Programs

Bell, P.; Bennett, C.; Holder, J.; Kimbrough, J.; Landen, O.; Aug. 22, 2003; In English

Report No.(s): DE2003-15004897; UCRL-JC-152371; No Copyright; Avail: National Technical Information Service (NTIS)

The National Ignition Facility (NIF) is under construction at LLNL for the Department of Energy Stockpile Stewardship Program. It will be used for experiments for Inertial Confinement Fusion (ICF) Ignition, High Energy Density (HED) science, and basic science. Many issues confront experimentalists who wish to design, fabricate, and install diagnostics on the NIF. To foster this process the ICF and HED programs at LLNL have formed a diagnostic research and development group to look at issues outside the charter of facility diagnostics (core diagnostics). We will present data from instrumentation and associated technology that is being developed by this group. A major portion of our instrumentation work is on improvements for readout systems. We have several efforts related to CCD device development.

NTIS

Targets; Construction; Diagnosis; Inertial Confinement Fusion; Research Facilities

20040073671 Naval Research Lab., Washington, DC

Advanced Radiation Theory Support Annual Report 2003, Final Report

Davis, J.; Thornhill, J. W.; Giuliani, J. L.; Apruzese, J. P.; Chong, Y.; Apr. 19, 2004; 103 pp.; In English

Report No.(s): AD-A422562; NRL/MR/6720-04-8750; No Copyright; Avail: CASI; A06, Hardcopy

This report describes the work of the Radiation Hydrodynamics Branch during FY 2003 in support of the DTRA PRS Program. Critical issues covered are (1) issues and directions for future research, (2) zero and one-dimensional modeling of DQ experiments, (3) enhanced energy coupling and x-ray emission in z-pinch implosions, (4) confinement and compression of magnetic flux by plasma shells, and (6) flashover and energy coupling in the DQ machine.

DTIC

Implosions; Plasmas (Physics); X Rays

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*.

20040068191 NASA Goddard Space Flight Center, Greenbelt, MD, USA

In situ Pulsed Laser Deposition of C-Axis Oriented MgB2 Films and Their Characterization

Shinde, Sanjay; Lakew, Brook; Ogale, S. B.; Kulkarni, V. N.; Kale, S. N.; Venkatesan, T.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P2; In English; See also 20040068186

Contract(s)/Grant(s): N00014-96-1-1026; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The recent discovery of an intermetallic superconductor MgB2 has renewed interest in the area of superconductivity not only because of fundamental understanding of superconductivity but also due to its potential applicability in devices such as thermal detectors. Considerable amount of research has been devoted to obtain MgB2 films by an all in situ growth technique. We have grown MgB2 thin films by an all in situ pulsed laser deposition process from pure B and Mg targets. Ultrathin layers of B and Mg were deposited in a multilayer configuration. Hundreds of such Mg-B bilayers with a capping Mg layer on the top were deposited on sapphire substrate. These depositions were done in high vacuum (approx. 10(exp -7) Torr) and at room temperature. After deposition, such a configuration was annealed at high temperature for a short time in a forming gas (4% H2 in Ar). The best films, obtained by this procedure, showed superconducting transition temperature approx. 30 K. These films have been characterized by x-ray diffraction, Rutherford Backscattering Spectrometry, AC susceptibility-, resistivity- (with and without magnetic field) and 1/f noise-measurements. The physical properties of these films will be presented and discussed.

Author

Magnesium Compounds; Boron Compounds; Intermetallics; Superconducting Films; Thin Films

20040068201 Academy of Sciences of the Armenian SSR, Ashtarack, Armenia

Thermoelectric Cooling Utilizing CeB6 Single Crystal at Cryogenic Temperatures

Harutyunyan, Sergey; Vartanyan, Violetta; Nikoghosyan, Vahan; Kuzanyan, Armen; Wood, Kent; Gulian, Armen;

International Thermal Detectors Workshop (TDW 2003); February 2004, pp. P2; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermoelectric refrigerators operating at cryogenic temperatures will considerably simplify and facilitate the problem of obtaining temperatures below 4.2 K, which is required for different types of sensitive photon detectors. The results of investigation of the cooling on the basis of the Peltier effect in a single crystal of CeB6 grown by the floating zone method are presented. The temperature dependencies of thermopower S(T), resistivity rho(T), and thermal conductivity k(T) have been measured, and the parameter ZT=TS(exp 2)/rho k has been calculated in the temperature range 3.5 K-300 K. The value of 0.2 at 4.5 K has been obtained for ZT, which allows one to expect noticeable Peltier cooling in this material at that temperature. Initial measurements of thermoelectric cooling vs. electric current value were made at temperatures 3.5 K, 4.5 K, 5.5 K, 9.5 K. A single-stage prototype solid-state micro-refrigerator demonstrated a temperature drop of 0.2 K at the temperature 4.5 K. Author

Thermoelectric Cooling; Single Crystals; Cryogenic Temperature; Cerium Compounds; Boron Compounds

20040068218 Pennsylvania State Univ., PA, USA

Epitaxial Superconducting MgB2 Thin Films by HPCVD

Xi, Xiao-Xing; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 4-6; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The recently discovered superconductor MgB2 with Tc at 39 K has great potential in superconducting electronics. In this paper, we present results of in situ epitaxial MgB2 thin films grown by Hybrid Physical-Chemical Vapor Deposition (HPCVD) technique which successfully achieves a high Mg pressure necessary for in situ growth of MgB2 thin films. Excellent superconducting properties have been abtained in these films.

Author

Thin Films; Vapor Deposition; Magnesium Compounds; Superconductors (Materials); Epitaxy

20040068219 Hypres, Inc., Elmsford, NY, USA

Superconducting Digital Multiplexers for Sensor Arrays

Kadin, Alan M.; Brock, Darren K.; Gupta, Deepnarayan; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 4-7 - 4-10; In English; See also 20040068186

Contract(s)/Grant(s): NAS3-03044; No Copyright; Avail: CASI; A01, Hardcopy

Arrays of cryogenic microbolometers and other cryogenic detectors are being developed for infrared imaging. If the signal from each sensor is amplified, multiplexed, and digitized using superconducting electronics, then this data can be efficiently read out to ambient temperature with a minimum of noise and thermal load. HYPRES is developing an integrated system based on SQUID amplifiers, a high-resolution analog-to-digital converter (ADC) based on RSFQ (rapid single flux quantum) logic, and a clocked RSFQ multiplexer. The ADC and SQUIDs have already been demonstrated for other projects, so this paper will focus on new results of a digital multiplexer. Several test circuits have been fabricated using Nb Josephson technology and are about to be tested at T = 4.2 K, with a more complete prototype in preparation.

Author

Multiplexing; Squid (Detectors); Superconductivity; Digital Electronics; Arrays; Fabrication

20040068220 Wales Univ. Inst. of Science and Technology, Cardiff, UK

Far-infrared and Submillimeter Filters

Haynes, C. V.; Ade, P. A. R.; Budd, J.; Lee, C.; Tucker, C. E.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 5-1 - 5-5; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

Filters are critical for thermal detector systems, which are responsive to a wide frequency range. Without spectral limitation the detectors respond to frequencies outside those of interest with the consequence of increased photon noise and detector loading. For cooled systems it is also important to filter out high frequency radiation, minimising the thermal load and cooling power necessary. At Cardiff University we are developing far-infrared and submillimeter bandpass, high-pass, and low-pass blocking filters using a metal mesh technology. We have been able to maintain high in-band transmission with good out of band rejection to UV wavelengths. This technology is space qualified and has been used in a number of Astronomical and Earth Observation projects. Here we present our latest advancements.

Author

Submillimeter Waves; Far Infrared Radiation; Low Pass Filters; Bandpass Filters; Fabrication

20040068232 Lockheed Martin Corp., Syracuse, NY, USA
Self-Organized Superlattices in GaInAsSb Grown on Vicinal Substrates
Wang, C. A.; Vineis, C. J.; Calawa, D. R.; Jun. 2003; 18 pp.; In English
Report No.(s): DE2004-822275; LM-03K116; No Copyright; Avail: Department of Energy Information Bridge

Self-organized superlattices are observed in GaInAsSb epilayers grown lattice matched to vicinal GaSb substrates. The natural superlattice (NSL) is oriented at a slight angle of about 4(sup o) with respect to the vicinal (001) GaSb substrate. This vertical composition modulation is detected at the onset of growth. Layers in the NSL are continuous over the lateral extent of the substrate. Furthermore, the NSL persists throughout several microns of deposition. The NSLs have a period ranging from 10 to 30 nm, which is dependent on deposition temperature and GaInAsSb alloy composition. While the principle driving force for this type of phase separation is chemical, the mechanism for the self-organized microstructure is related to local strains associated with surface undulations. By using a substrate with surface undulations, the tilted NSL can be induced in layers with alloy compositions that normally do not exhibit this self-organized microstructure under typical growth conditions. These results underscore the complex interactions between compositional and morphological perturbations.
NTIS
Superlattices; Gallium Arsenides; Gallium Antimonides; Alloys

20040068239 Lockheed Martin Corp., Syracuse, NY, USA
GaAs Films Prepared by RF-Magnetron Sputtering
Ouyang, L. H.; Rode, D. L.; Zulkifli, T.; Abraham-Shrauner, B.; Lewis, N.; Aug. 2001; 32 pp.; In English
Report No.(s): DE2004-821684; LM-01K067; No Copyright; Avail: Department of Energy Information Bridge

The authors reported on the optical absorption, adhesion, and microstructure of RF-magnetron sputtered films of hydrogenated amorphous and microcrystalline GaAs films for the 1 to 25(micro)m infrared wavelength rate. Sputtering parameters which were varied include sputtering power, temperature and pressure, and hydrogen sputtering-gas concentration. TEM results show a sharp transition from purely amorphous GaAs to a mixture of microcrystalline GaAs in an amorphous matrix at 34(+-) 2 C. By optimizing the sputtering parameters, the optical absorption coefficient can be decreased below 100 cm(sup -1) for wavelengths greater than about 1.25(micro)m. These results represent the lowest reported values of optical absorption for sputtered films of GaAs directly measured by spectrophotometry for the near-infrared wavelength region.
NTIS
Gallium Arsenides; Sputtering

20040068255 Lockheed Martin Corp., Syracuse, NY, USA
Reduction of Micro-Cracks in Large Diameter InxGa1-xSb Bulk Crystals
Vogel, J.; Dutta, P. S.; Apr. 2003; 12 pp.; In English
Report No.(s): DE2004-821510; LM-03K034; No Copyright; Avail: Department of Energy Information Bridge

The ternary alloy, In(sub x)Ga(sub 1-x)Sb, is a compound semiconductor of tunable bandgap in the range of 0.18-0.72 eV, making it useful for infrared range optoelectronic devices. Utilizing a unique system based upon vertical Bridgman technique, large diameter (50 millimeter) In(sub x)Ga(sub 1-x)Sb polycrystals of composition ranging in x from 0.015 to 0.988 were grown. Methods of mixing the melt during solidification, including the accelerated crucible rotation technique (ACRT), have been used in conjunction with optimization of the furnace temperature gradient profile to significantly reduce micro-cracking in the crystal boules while accelerating the growth rate from less than a millimeter per hour to three millimeters per hour. In this paper, the experimental system and crystal growth parameters for a set of ternary experiments will be detailed.
NTIS
Alloys; Crystal Growth

20040068266 Lawrence Livermore National Lab., Livermore, CA
Estimates of Imaging Times for Conventional and Synchrotron X-Ray Sources
Kinney, J.; May 20, 2003; In English
Report No.(s): DE2003-15004930; UCRL-ID-153337; No Copyright; Avail: National Technical Information Service (NTIS)

The following notes are to be taken as estimates of the time requirements for imaging NIF targets in three-dimensions with absorption contrast. The estimates ignore target geometry and detector inefficiency, and focus only on the statistical question of detecting compositional (structural) differences between adjacent volume elements in the presence of noise. The basic equations, from the classic reference by Grodzins, consider imaging times in terms of the required number of photons necessary to provide an image with given resolution and noise. The time estimates, therefore, have been based on the

calculated x-ray fluxes from the proposed Advanced Light Source (ALS) imaging beamline, and from the calculated flux for a tungsten anode x-ray generator operated in a point focus mode.
NTIS
Imaging Techniques; Time Dependence; X Ray Sources

20040070819 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Microcalorimeters with NTD and Expitaxial Germanium Thermistors for High Resolution X-Ray Spectroscopy
Silver, Eric; Brinton, John C., Technical Monitor; April 2004; 6 pp.; In English
Contract(s)/Grant(s): NAG5-5269; No Copyright; Avail: CASI; A02, Hardcopy

This is a progress report for the second year of a three year SR&T grant to continue the advancement of NTD-based microcalorimeters. We reported last year that we re-prioritized certain aspects of the statement of work and chose to emphasize issues of array development in the first year rather than wait until year two. Consequently, some of the projects scheduled for the first year were delayed to the second year and we report on those topics here. These include: a) Measurements that map out JFET , thermistor, l/f and feedback resistor noise; b) Investigations that evaluate the limits of the JFET preamplifier circuitry as it pertains to stability at the 2 eV level; The results of a) and b) have led to preliminary measurements that demonstrate 3.08 eV resolution at 6 keV. c) Calculations that can predict the current performance.
Derived from text
Calorimeters; Germanium; High Resolution; Thermistors; X Ray Spectroscopy; Epitaxy

20040070995 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility (NIF) Control Network Design and Analysis
Bryant, R. M.; Carey, R. W.; Claybourn, R. V.; Pavel, G.; Schaefer, W. J.; 2004; In English
Report No.(s): DE2003-15005546; No Copyright; Avail: National Technical Information Service (NTIS)

The control network for the National Ignition Facility (NIF) is designed to meet the needs for common object request broker architecture (CORBA) inter-process communication, multicast video transport, device triggering, and general TCP/IP communication within the NIF facility. The network will interconnect approximately 650 systems, including the embedded controllers, front-end processors (FEPs), supervisory systems, and centralized servers involved in operation of the NIF. All systems are networked with Ethernet to serve the majority of communication needs, and asynchronous transfer mode (ATM) is used to transport multicast video and synchronization triggers. CORBA software infra-structure provides location-independent communication services over TCP/IP between the application processes in the 15 supervisory and 300 FEP systems. Video images sampled from 500 video cameras at a 10-Hz frame rate will be multicast using direct ATM Application Programming Interface (API) communication from video FEPs to any selected operator console. The Ethernet and ATM control networks are used to broadcast two types of device triggers for last-second functions in a large number of FEPs, thus eliminating the need for a separate infrastructure for these functions. Analysis, design, modeling, and testing of the NIF network has been performed to provide confidence that the network design will meet NIF control requirements.
NTIS
Research Facilities; Design Analysis; Synchronism; Plant Design; Network Analysis

20040071145 Cleveland State Univ., Cleveland, OH, USA
Dye-Sensitized Solar Cells for Space Power
Harris, Jerry D.; Hehemann, David G.; Duraj, Stan A.; [2003]; 11 pp.; In English
Contract(s)/Grant(s): NCC3-869; No Copyright; Avail: CASI; A03, Hardcopy

During the course of this grant, dye-sensitized solar cells were prepared and characterized. The solar cells were prepared using materials (dyes, electrolytes, transparent conductive oxide coated glass, nanocrystalline TiO2) entirely prepared in-house, as well as prepared using materials available commercially. Complete cells were characterized under simulated AM0 illumination. The best cell prepared at NASA had an AM0 efficiency of 1.22% for a 1.1 sq cm cell. Short circuit current (Isc), open circuit voltage (Voc) and fill factor (FF) for the cell were 6.95 mA, 618 mV and 42.8%, respectively. For comparison purposes, two commercially prepared dye-sensitized solar cells were obtained from Solaronix SA, Aubonne, Switzerland. The Solaronix cells were also characterized under simulated AM0 illumination. The best cell from Solaronix had an active area of 3.71 sq cm and measured an AM0 efficiency of 3.16%. with Isc, Voc and FF of 45.80 mA, 669.6 mV and 52.3%, respectively. Both cells from Solaronix were rapid thermal cycled between -80 C and 80 C. Thermal cycling led to a 4.6%

loss of efficiency in one of the cells and led to nearly a complete failure in the second cell.
Author
Solar Cells; Titanium Oxides; Thermal Cycling Tests; Losses; Failure

20040073497 NASA Marshall Space Flight Center, Huntsville, AL, USA
Crystal Growth of ZnSe and Related Ternary Compound Semiconductors by Vapor Transport
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 21; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The objective of the project is to determine the relative contributions of gravity-driven fluid flows to the compositional distribution, incorporation of impurities and defects, and deviation from stoichiometry observed in the crystals grown by vapor transport as results of buoyancy-driven convection and growth interface fluctuations caused by irregular fluid-flows. ZnSe and related ternary compounds, such as ZnSeS and ZnSeTe, were grown by vapor transport technique with real time in situ non-invasive monitoring techniques. The grown crystals were characterized extensively to correlate the grown crystal properties with the growth conditions. Significant effects of gravity vector orientation on the growth crystal morphology and point defect distribution were observed.
Author
Crystal Growth; Semiconductors (Materials); Vapors; Zinc Selenides; Chemical Compounds

20040073499 NASA Marshall Space Flight Center, Huntsville, AL, USA
New Programs Utilizing Light Scattering and Flow Imaging Techniques for Macromolecular Crystal Growth and Fluid Dynamics Studies
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 36; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dr. Phil Segre, a physicist by training, is a recent addition to the Biotech group, SD46, having joined NASA in August of 2000. Over the past two years he has been developing a laboratory for the study of macromolecular and protein crystal growth. The main apparatus for this work is a Dynamic Light Scattering apparatus, DLS, which is capable of making highly precise measurements of size distributions of both protein solutions and protein crystals. With Drs. Chernov and Thomas (USRA), he has begun a collaboration studying the affects of protein impurities on protein crystal growth and subsequent crystal quality. One of the hypotheses behind the differences between Earth and space grown protein crystals is that the absorption of harmful impurities is reduced in space due to the absence of convective flows. Using DLS measurements we are examining crystal growth with varying amounts of impurities and testing whether there is a strong physical basis behind this hypothesis. With Dr. Joe Ng of UAH he has been collaborating on a project to examine the folding/unfolding dynamics of large RNA complexes. A detailed understanding of this process is necessary for the handling of RNA in biotech applications, and the DLS instrument gives details and results beyond that of other instruments. With Prof. Jim McClymer of the University of Maine (summer faculty visitor to NASA in 2001, 2002), we have been studying the crystallization process in model colloidal suspensions whose behavior in some cases can mimic that of much smaller protein solutions. An understanding of the self-assembly of colloids is the first step in the process of engineering novel materials for photonic and light switching applications. Finally, he has begun an investigation into the physics of particle sedimentation. In addition to the DLS instrument he also has an instrument (called PIV) that can measure flow fields of fluids. The applications are to the dynamics of protein crystal motions both on earth and in low-gravity.
Author
Protein Crystal Growth; Ribonucleic Acids; Macromolecules; Light Scattering

20040073517 NASA Marshall Space Flight Center, Huntsville, AL, USA
Particle Engulfment and Pushing By Solidifying Interfaces
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 26; In English; See also 20040073490; No Copyright; A01, Hardcopy; Abstract only; Available from CASI only as part of the entire parent document.

The study of particle behavior at solid/liquid interfaces (SLI s) is at the center of the Particle Engulfment and Pushing (PEP) research program. Interactions of particles with SLI s have been of interest since the 1960 s, starting with geological observations, i.e., frost heaving. Ever since, this field of research has become significant to such diverse areas as metal matrix composite materials, fabrication of superconductors, and inclusion control in steels. The PEP research effort is geared towards understanding the fundamental physics of the interaction between particles and a planar SLI. Experimental work including 1-g and mu-g experiments accompany the development of analytical and numerical models. The experimental work comprised of

substantial groundwork with aluminum (Al) and zinc (Zn) matrices containing spherical zirconia particles, mu-g experiments with metallic Al matrices and the use of transparent organic metal-analogue materials. The modeling efforts have grown from the initial steady-state analytical model to dynamic models, accounting for the initial acceleration of a particle at rest by an advancing SLI. To gain a more comprehensive understanding, numerical models were developed to account for the influence of the thermal and solutal field. Current efforts are geared towards coupling the diffusive 2-D front tracking model with a fluid flow model to account for differences in the physics of interaction between 1-g and -g environments. A significant amount of this theoretical investigation has been and is being performed by co-investigators at NASA MSFC.
Derived from text
Solidification; Interfaces; Liquid-Solid Interfaces; Zirconium Oxides; Dynamic Models

20040074221 Massachusetts Inst. of Tech., Cambridge, MA, USA
Identification and Control of Gravity Related Defect Formation During Melt Growth of Electro-Optic Single Crystals Bismuth Silicate(Bi12SiO20)
Becia, Piotr; Wiegel, Michaela E. K.; May 2004; 45 pp.; In English
Contract(s)/Grant(s): NAG8-1487; No Copyright; Avail: CASI; A03, Hardcopy

A research carried out under Award Number NAG8-1487 was aimed at to the design, conduct and analysis of experiments directed at the identification and control of gravitational effects on crystal growth, segregation and defect formation in the Sillenite system: bismuth silicate (Bi(12)SiO(20)). Correlation analyses was conducted in order to establish the influence of gravity related defects introduced during crystal growth on critical, application specific properties. Achievement of the states objective was conducted during the period from Feb. 01, 1998 to Dec. 31, 2003 with the following anticipated milestones: 1. Establishment of capabilities for (a) reproducible Czochralski and Bridgman-type growth of BSO single crystals and (b) for comprehensive analysis of crystalline and chemical defects as well as for selective property characterization of grown crystals (year 1). 2. Design and execution of critical space growth experiment(s) based on analyses of prefatory space results (experiments aimed at establishing the viability of planned approaches and procedures) and on unresolved issues related to growth, segregation and defect formation associated with conventional growth in Bridgman geometries. Comparative analysis of growth under conventional and under mu-g conditions; identification of gravity related defect formation during conventional Bridgman growth and formulation of approaches for their control (years 2 and 3). Development of charge confinement system which permits growth interface demarcation (in a mu-g environment) as well as minimization of confinement related stress and contamination during growth; design of complementary mu-g growth experiments aimed at quantitative mu-g growth and segregation analyses (year 4). 3. Conduct of quantitative mu-g growth experiments directed at: (a) identification and control of gravity related crystalline and chemical defect formation during single crystal growth of Bi(12)SiO(20) and at (b) defect engineering -the development of approaches to the controlled generation during crystal growth of specified point defects in homogeneous distribution (year 5). The proposed research places focus on a class of materials which have outstanding electrical and optical properties but have so far failed to reach their potential, primarily because of our inability to control adequately their stoichiometry and crystal defect formation as well as confinement related contamination and lattice stress.
Author
Gravitational Effects; Crystal Defects; Formation; Melts (Crystal Growth); Electro-Optics; Single Crystals; Bismuth; Silicates

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*.

20040073778 Engineering Research and Consulting, Inc., Huntsville, AL
Design of a High Heat Flux Facility for Thermal Stability Testing of Advanced Hydrocarbon Fuels
Bates, R. W.; Maas, E. D.; Irvine, S. A.; Auyeung, T. P.; Peroomian, O.; Apr. 14, 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A422733; No Copyright; Avail: CASI; A03, Hardcopy

With both the Air Force and NASA interested in developing reusable hydrocarbon-fueled engine technologies for reusable launch vehicles, there is an increased need to better understand the thermal stability of hydrocarbon fuels under high heat

fluxes encountered during regenerative cooling. Currently, no existing thermal stability test rig can accurately simulate the high heat flux conditions that will exist in the cooling channels of these new high-pressure hydrocarbon engines. To meet the high reliability and reusability requirements proposed for these engines, the Air Force Research Laboratory (AFRL) has designed a High Heat Flux Facility (HHFF) using experience gained from past and present thermal stability test rigs. CFD++, a Metacomp Technologies Inc. computational fluid dynamics software suite, was employed to optimize the design prior to manufacture. Conjugate heat transfer calculations were performed in a single computational domain containing the copper heater block and the fluid channel of the new test rig design. The first tests conducted in the facility will be highly instrumented and will be used to validate the CFD++ calculations. The parameters of interest for a given geometry are the heat transfer coefficient, the degree of coking and corrosion in the channel, and the pressure drop as functions of heat flux, wall temperature, Reynolds number, channel material, fuel composition and pressure. The HHFF will be an important tool to facilitate the development and transition of new advanced hydrocarbon fuels under study by AFRL.
DTIC
Fuels; Heat Flux; Hydrocarbon Fuels; Hydrocarbons; Stability Tests; Thermal Stability

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*.

20040070778 NASA, Washington, DC, USA
The Explorer's Guide to the Universe: A Reading List for Planetary and Space Science
French, Bevan M., Compiler; McDonagh, Mark S., Compiler; January 1984; 35 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

During the last decade, both scientists and the public have been engulfed by a flood of discoveries and information from outer space. Distant worlds have become familiar landscapes. Instruments in space have shown us a different Sun by the "light" of ultraviolet radiation and X-rays. Beyond the solar system, we have detected a strange universe of unsuspected violence, unexplained objects, and unimaginable energies. We are completely remarking our picture of the universe around us, and scientists and the general public alike are curious and excited about what we see. The public has participated in this period of exploration and discovery to an extent never possible before. In real time, TV screens show moonwalks, the sands of Mars, the volcanoes of Io, and the rings of Saturn. But after the initial excitement, it is hard for the curious non-scientist to learn more details or even to stay in touch with what is going on. Each space mission or new discovery is quickly skimmed over by newspapers and TV and then preserved in technical journals that are neither accessible nor easily read by the average reader. This reading list is an attempt to bridge the gap between the people who make discoveries in space and the people who would like to read about them. The aim has been to provide to many different people--teachers, students, scientists, other professionals, and curious citizens of all kinds--a list of readings where they can find out what the universe is like and what we have learned about it. We have included sections on the objects that seem to be of general interest--the Moon, the planets, the Sun, comets, and the universe beyond. We have also included material on related subjects that people are interested in--the history of space exploration, space habitats, extraterrestrial life, and U F O ' s . The list is intended to be self-contained; it includes both general references to supply background and more specific sources for new discoveries. Although the list can be used by a wide range of people, it has been compiled with the non-scientist specifically in mind. A s a general rule, we have not included technical symposia or the special issues of
Author
Extraterrestrial Life; Space Exploration; Ultraviolet Radiation

20040070864 INTEL Corp., Hillsboro, OR, USA
Keeping the Bureaucracy in Check
Bolte, Keith A.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 111-116; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Intel Corp., with not one job lost, says program to cut administrative costs has saved it $17 million in 41/2 years. It has been said that good management is nothing more than the application of common sense to the obvious. If there is much truth in this axiom then the middle management of most corporations has suffered from a common-sense deficiency over the past decade regarding white collar productivity. More important, however, is that senior management has allowed it to happen by accepting the myth that nothing much can be done to reduce administrative costs. Such was the case at Intel Corp. until July

1979, when we decided it was time to destroy the myth. Over the previous 10 years, we discovered, our allocation of human resources had subtly shifted. Whereas administrative workers had once represented about one-third of our U.S. payroll, they now accounted for almost two-thirds. Management was shocked at the extent of this administrative overhead. The explanation that white we had effectively implemented controls and productivity measures on the factory floor, we had virtually ignored the administrative side. As we began to explore potential ways to contain the "administrative marshmallow", we found there was very little practical information available on how to pleasure and improve white collar productivity and how to limit employee growth. In our research we found no companies that had developed a key that would open this "black box" called up white collar productivity. So we developed our own approach to the problem.
Derived from text
Cost Reduction; Human Resources; Mental Performance; Productivity

20040074213 Louisiana Tech Univ., Ruston, LA, USA
Development of K-12 Engineering Outreach Materials
Jordan, William; August 25, 2003; 25 pp.; In English
Report No.(s): SE-2003-08-00064-SSC; No Copyright; Avail: CASI; A03, Hardcopy

Six modules were created that can be used in K-12 classes to introduce students to what engineers can do at NASA.The purpose of this project was to create outreach materials for the classroom. To make it appealing to students, many color NASA photographs are used to illustrate NASA applications.Student experiments are described that can be performed to illustrate topics.
Author
NASA Programs; Aerospace Engineering; Aeronautical Engineering; Educational Resources

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040070762 American Inst. of Aeronautics and Astronautics, Washington, DC, USA
America's Space Launch Capabilities
February 1994; 36 pp.; In English; Copyright; Avail: Other Sources

The Clinton Administration has undertaken a wide ranging review of America's national space launch policy and capabilities. To that end, the White House Office of Science and Technology Policy (OSTP) has established an interagency working group, and plans to report its findings and recommendations to the President by the Summer of 1994. Action by the White House on this matter does not take place in an historical policy vacuum. Congress and the Executive Branch have labored with the issue of space launch for a number of years. In addition, a variety of expert advisory panels have studied this question extensively, and have published their findings and recommendations. In anticipation of another round of debate and decision-making concerning our nation's future space launch capabilities, the Public Policy Committee of the AIAA has prepared this information/resource paper. It is designed as a summary of the need to modernize America's space launch capabilities, the basic options for pursuing a policy of modernization, and a compilation of findings and recommendations from expert advisory panels. This paper is not intended to be one more study of the space launch subject, nor does it call for another such report. The experts have done their job. They have achieved a reasonable consensus on the need to move forward. The challenge facing the White House and Congress is to agree on and to implement an integrated plan to modernize our nation's space launch capabilities.
Derived from text
Decision Making; Research and Development; Spacecraft Launching

20040070780 NASA, Washington, DC, USA
NASA's Productivity Improvement and Quality Enhancement Initiatives
[1984]; 36 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The National Aeronautics and Space Administration celebrated its 25th Anniversary in 1983 at the Air and Space Museum in Washington, DC, with President Reagan in attendance. We look back on the accomplishments of these twenty-five years with pride in our missions and our people. NASA captured the world's imagination during the days of the Apollo mission. So much so, that we now talk about the Apollo era. In the l970s, we moved into the Space Transportation business and in the 199Os, we look forward to having a manned Space Station. Each succeeding mission has presented its own challenge in terms

of technology and resources. This is especially true today, when we are being asked to do more with less. To ensure that NASA continues to be a productive and quality conscious agency, one of our highest Agency goals is leadership in the development and application of practices which contribute to high productivity and quality. greatest competitive strength, and this country has a solid scientific and engineering foundation. Traditionally we have spent more money on research and development than Japan and Europe combined, and we are the source of most of this century significant innovations. We should build on this solid base and use it more effectively.
Author
Commerce; Leadership; Procedures; Productivity; Quality Control; Space Transportation

20040070839 NASA, Washington, DC, USA
NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry
[1984]; 248 pp.; In English; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry, 25-26 Sep. 1984, Washington, DC, USA; See also 20040070840 - 20040070869; No Copyright; Avail: CASI; A11, Hardcopy

The purpose of the Symposium is to increase the awareness of productivity and quality issues in the USA, and to foster national initiatives through government and industry executive leadership. The Symposium will provide a forum for discussion of white-collar productivity issues by experienced executives from successful organizations and an opportunity to share information learned through Productivity initiatives in govemment, industry and academic organizations. It will focus on white-collar organizational issues that are common to large companies and technology oriented organizations. The Symposium program will include strategies for improving operations in government and industry and will be responsive to the management issues viewed necessary to increase our nation's productivity growth rate.
Author
Productivity; NASA Programs

20040070840 NASA, Washington, DC, USA
Introduction to NASA Symposium on Productivity and Quality
Braunstein, David; NASA Symposium on Productivityand Quality Strategies for Improving Operations in Government and Industry; [1984], pp. 15-18; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

The discussions will concentrate on white-collar organizational issues common to large organizations. The program will address a number of management issues for improving our nation's productivity and quality, and therefore its competitive position. executives have contributed their time to share /their experience with you. In addition, the American Institute of Astronautics & Aeronautics corporate members have helped to organize the sessions. I am most grateful for this support. The NASA Administrator has set the goal for NASA to become a leader in productivity and quality.
Derived from text
Productivity; Quality

20040070841 NASA, Washington, DC, USA
Committing to Excellence
Beggs, John M.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 19-22; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

We are honored, indeed, that President Reagan has agreed to participate in this symposium to underscore his personal commitment to productivity growth and quality improvement. NASA is proud to take the lead in what is certainly one of the most challenging and most important areas of our national life, the drive for excellence in all we do and all we produce. And we appreciate the cooperation and support of the corporate members of the American Institute for Aeronautics and Astronautics in helping to make this symposium a success.
Derived from text
Quality Control; Productivity

20040070842 Michigan Univ., Ann Arbor, MI, USA
Understanding Changes in the US Competitive Position: International Competitiveness
Cole, Robert E.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 32-37; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

Rather than focus on statistics showing the worsening of the American competitive position, the paper stresses problems

in our competitive position resulting from shortages of and mode of deployment of engineers in American consumer goods industries. Automotive industry is used as a case in point with specific comparisons between Japanese and U.S. firms reported on ratio of engineers to administrative personnel and utilization of engineers. Role of technical support personnel and role of engineers in employee involvement activities is also considered. Policy implications include the need to train more engineers, to train them more broadly, and to deploy them more effectively. Paper concludes with a discussion of the potential contribution of industrial policy and a call for a more pragmatic approach to formulating policies that will contribute to a restoration of American industrial strength.
Author
Consumers; Deployment; Management; Policies; Personnel

20040070843 Hewlett-Packard Co., Palo Alto, CA, USA
Encouraging and Maintaining an Innovative Work Climate
Edmondson, Harold E.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 35-40; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Innovation is not a rare phenomenon that flourishes only in a garage. Creativity can be nurtured within a large 0rganlzation. Those who wish to manage innovation need to do three basic tasks that consist of good management: I) define the role of innovation in terms their overall business strategy; 2) hire and motivate highly skilled and creative people; and 3) create an environment where creativity is encouraged and reward. These three steps leave little room for "gut feel" and "playing it by ear," and they should provide some encouragement for those in large organizations. In short, to encourage creativity, a manager doesn't have to be a psychologist -- just a good businessman.
Author
Creativity; Management Methods

20040070844 Naval Surface Weapons Center, Dahlgren, VA, USA
Building Teams and Maintaining Trust
Hill, Lemmuel; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 51-58; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Perhaps I should begin by giving you a thumbnail sketch of what NSWC is and what we do for the Navy. We are one of nine RDT&E Centers within the Navy' s National Command - which is charged with acquiring all of the physical assets and resources needed to carry out the Navy's mission; that means "everything from beans to bullets " as one Admiral said once in describing the National Command's role. These RDT&E Centers are actively engaged in a wide variety of work in the physical sciences and engineering disciplines to develop new or improved systems and equipment which, in turn, will provide the Navy the capabilities needed in the operation of their forces. The basic role of the Centers is to support the Navy in acquiring these capabilities. The complexities of today's acquisition decisions, which require the application of sound scientific and technical Judgments, require the Navy to maintain a strong Internal competence in all phases of research and development--including early exploratory work as well as integrative and support efforts. This competence both facilitates Navy decision-making and helps assure equitable competition among industrial firms seeking to market their products to the Navy. As you know the Navy is heavily dependent on the production capabilities of the private sector to meet its material needs, and the Centers help to build an effective military-industrial partnership. In short, we assist the Navy in functioning as a smart buyer in a technically sophisticated marketplace.
Derived from text
Competition; Decision Making

20040070845 International Business Machines Corp., Purchase, NY, USA
Quality in Practice at IBM
Jackson, John B.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 59-68; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

This paper discusses the excellence values of IBM and how they were made operational through quality improvement for the decade of the '80s. First, consideration is given to the importance of underlying beliefs of a corporation that brings out the great energies and talents of its people. The most important single factor in corporate success is the faithful adherence to those beliefs. Quality as a productivity driver is examined. The five concepts that IBM uses as a basis for its quality improvement are discussed. Tools and techniques for the removal of "defects" from non-product processes, e.g., accounting, inventory control, distribution, order entry, etc., are reviewed. Specific attention is given to the "job

process" and to complex cross functional processes that every large organization has and must manage in a defect-free manner if it is to be competitive.
Author
Inventory Controls; Productivity; Quality Control

20040070846 Lockheed Missiles and Space Co., Sunnyvale, CA, USA
CAD-CAM Productivity
Oder, F. C. E.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 97-102; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this paper is to present some specific results where productivity has been improved by the application of computer-aided design and manufacturing techniques at the Lockheed Missiles & Space Company (LMSC) in Sunnyvale, California. We have the opportunity to apply these techniques, both to moderate production rate programs such as the Fleet Ballistic Missile Program as well as relatively low or limited production programs such as are common to space programs. In addition to addition to examples from both of these, I will discuss an integrated application of computer-aided design and manufacturing in the production of digital electronic equipment. It is important that productivity activities be viewed from a correct perspective. An important goal of productivity is to reduce actual labor content by improving its effectiveness. For most aerospace products, direct and indirect labor is not only an essential ingredient, but it is a primary element of program cost. At this time, and quite likely in the future, the aerospace industry will not be oversupplied with skilled engineers and technicians, thus emphasizing the need for more labor efficient methods if we are to do programs important to our country. Computer-aided methods of engineering and manufacturing contribute to these efficiencies and, furthermore, are conducive to a better product via improved accuracy. All of this is conducive to maintaining competitive position both within the industry and nationally.
Derived from text
Computer Aided Manufacturing; Computer Aided Design; Productivity; Space Programs; Efficiency; Costs; Technology Transfer

20040070847 Sony Corp. of America, New York, NY, USA
Sony Keeps High Quality and Productivity in the USA
Wada, Sadami; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 127-132; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents a discussion about the high quality and productivity that has been established at the Sony Corporation of America. The topics include: 1) Quality and Productivity Depend upon the Management; 2) People's Dedication is Most Important; 3) Our Experiences at San Diego and Dothan; 4) San Diego Plant and Dothan Plant; 5) Sony Family; 6) No Layoff; 7) Pride in Quality Rather Than in Volume; and 8) Interested in Job and Morale is High.
CASI
Productivity; United States; Conferences; Project Management

20040070848 Bureau of Land Management, Washington, DC, USA
Labor-Management Cooperative Programs
Stepp, John R.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 211-216; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

The Department of Labor is working to facilitate the development and adoption of innovative forms of labor-management cooperation to foster the welfare of workers, increase productivity and contribute to the development of a mature system of labor-management relations. It's activities include the creation of an information exchange, the support of research, participation in conference and other public forums and the development of training materials. The establishment of new relationships between workers and employers will he a critical component of the reorganization of work necessitated by new technology. The change toward mere cooperative forms of employer-employee interaction will in many cases require a concomitant change in an organization's cultural framework and will transcend traditional blue-white collar lines. The paper discusses some prerequisites of cooperative programs at the firm level as well as some institutional changes at the national level that may be necessary. National level changes include a reconsideration of some current labor laws and the provision of incentives for employers and employees to solve their own problems with less regulation. The Federal Government must

also work to foster increased trust between business and labor by finding ways to reward cooperative behavior and establishing itself as a model employer.
Author
Employee Relations; Unionization; Personnel Management

20040070849 Department of Agriculture, Washington, DC, USA
Productivity Initiatives at USDA
Franke, John J., Jr.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 219-224; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Current popular literature would have us believe that all business practices are good and that government practices are bad. But the world of government is substantially different than the private sector and works the way it does for a reason. The appropriate business principles should be applied and specific strengths of the government system identified and capitalized on. To get away from the occasional, fragmented and simplified management improvement and productivity solutions as cure-alls that haven't seen results in the past, a comprehensive multi-front program has to be devised that gets at the systems that are hampering morale and productivity of the employees. Efforts at the U. S. Department of Agriculture are centering on streamlining the maze of systems that have built up over the years plus identifying employees concerns and developing targeted long and short-term initiatives to make the necessary improvements. Personnel and personnel-related activities are the most noted topics for improvement and new life and emphasis is being sparked into old practices that need to change as we move into a new era in handling the increasing expectations of our workforce.
Author
Personnel Management; Governments; Management Methods

20040070850 Amalgamated Clothing and Textile Workers Union, New York, NY, USA
Union and Management Joining Forces
Sheinkman, Jack; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 239-244; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

During the first surge of industrialization, most unions found themselves in adversarial, often bitterly hostile, situations. In the 1930's, the National Labor Relations Act guaranteed the right of Workers to unionize, but, even then, unions sometimes ran into great opposition. There were a few exceptions, such as the men's tailored clothing industry. On the whole, though, until fairly recently, mass production industries, such as auto and steel, have come to the bargaining table only when unions had the strength to get them there. When the survival of whole industries was threatened by foreign competition and the collapse of markets in 1980-82, the necessity for cooperation became evident. On the other hand, under the Reagan Administration, anti-unionism has been sanctioned and encouraged. Yet, the future of our economy, the revitalization of our industries, and the restoration of our competitiveness in world markets require that every effort he made to increase labor-management cooperation. One area in which work has been done is that of worker participation programs, which are intended to improve the quality of work life while enhancing the effectiveness of the company. Attitudes toward such programs have been mixed, and a recent study has found, in 1980, that 75 percent of such projects that had been operating at least five years ware no longer functioning. Yet, I believe that worker participation programs can make a positive contribution if managements and unions approach the task in good faith. Unions and managements must view each other as equal partners in planning and carrying out a program. All company policies that may affect the viability of the operation must be subjected to joint discussion. The company must share information on its plans for investment, procurement, product development, marketing, and the location of production.
Author (revised)
Employee Relations; Unionization; Management

20040070851 TRW Space Technology Labs., Redondo Beach, CA, USA
Applying Productivity Principles to New R and D Programs: NASA/TRW GRO Project
Walquist, Robert L.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 79-82; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

TRW seeks to adhere to the highest standards in the conduct of its business. We have always placed a special emphasis on high quality products and services, with a special focus on employee relations. The TRW challenges for the l980's are to: Become more cost effective. Maintain our high technology and quality objectives. Continue the high quality output of our work force. Raise employee efficiency and morale, through team building, individual recognition and incentive plans. To meet

these challenges, we intent to support our customers in the "war on cost" by achieving significant productivity improvements in our internal operations, without sacrificing the high technological performance and quality of our products and services. Our past performance on government space system contracts shows that while constantly on the cutting edge of technology, our systems meet their required orbital performance goals for periods well in excess of contractual lifetime requirements. Ninety percent of the spacecraft we have built and launched for the government over the past twenty years have outlived their design lifetimes.
Derived from text
Productivity; Cutting; Employee Relations; Morale

20040070852 Office of the Assistant Deputy Under Secretary of Defense for Research and Engineering (Production Support), Washington, DC, USA
Productivity Improvement in the Acquisition Environment
Mittino, John A.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 83-94; In English; See also 20040070839; No Copyright; Avail: CASI; A03, Hardcopy

This paper discusses DoD efforts to improve defense contractor productivity as a way to reduce acquisition costs. It provides a perspective on the magnitude of the challenge and examines the unique aspects of the environment that exists. The paper surveys and describes the broad range of initiatives, program, and activities under way aimed at fostering productivity improvement in the acquisition environment.
Author
Productivity; Cost Reduction; Armed Forces; Acquisition

20040070854 Mead Corp., Dayton, OH, USA
Making the "Z" Concept Work
Joiner, Charles W.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 119-125; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

There are no magic machines, no secret formulas for success. Excellence in any business enterprise simply requires the cooperative effort of many people through organized activity. Today I cannot offer you any startling new discoveries, but I can tell you how I made the proven theories work. Leading change in an organization to achieve excellence is not complicated; it is lncredibly simple.The basic principles of Tl_ory Z are as follows: Long term employment; Relatively slow process of evaluation and promotion;Broad career paths; Consensus decision asking; Implicit controls with explicit measurements; High levels of trust and egalitarianism; and Wholisttc concern for people.
Author
Management; Incentive Techniques

20040070855 Detroit Diesel Allison, Indianapolis, IN, USA
Are Incentives Right for US White Collar Organizations?
Wallace, F. Blake; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 191-194; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

In response to the workshop's objective - to explore challenges and problems which may impede white collar productivity - attention is directed to the effectiveness of white collar efforts and the creative results which they achieve. Tendencies in our current management systems may place undesired incentives of short- vs long-term emphasis on strategies and investments, or may stifle risk taking, creativity, and entrepreneurship. These management practices are discussed, as are avenues for continuing the progress currently being made in U.S. organizations.
Author
Industrial Management; Management Methods; Incentives

20040070856 Federal Express Corp., Memphis, TN, USA
Getting Organizations to Accept New Ideas/Technology "The Federal Express Experience"
Manske, F. A., Jr.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 143-155; In English; See also 20040070839; No Copyright; Avail: CASI; A03, Hardcopy

There are two types of change which occur within an organization. The first is 'social change,' which relates to how the people affected by a change think it will alter their established relationships in an organization. An example would be reassigning employees to new work groups away from their friends or close associates. For many employees, the enjoyment

of interacting with others while working is a primary need. The second type of change is 'technical.' It involves making measurable modifications to the phystcal routines of a job. Federal Express Corporation's recent experiences in introducing massive technical change is the subject of this presentation. The principal focus will be on the actions taken by the Company's management to ensure acceptance of new technology which significantly affected the day-to-day activities of its 12,000 courier workforce.
Author
Social Factors; Upgrading; Industrial Management; Technologies

20040070857 Matsushita Industrial Corp., Fraklin Park, IL, USA
Japanese Management in US
Kraft, Richard A.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 187-190; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

Japanese manufacturers are gaining worldwide recognition for their outstanding quality and productivity achievement in many industries. Japanese management techniques have frequently been identified as a main contributor to this accomplishment. Matsushita has achieved a notable result in the reconstruction of a television manufacturing operation which it purchased in 1974, located in Franklin Park, Illinois. This company today is a profitable, high quality producer of television products and microwave ovens, after a history of losses prior to its acquisition. Certain Japanese management practices have been identified as making a significant contribution to this improvement including: I. Management focus on product, rather than on other business activities designed to show short term gains without substantive contribution to improve the product, process or people. 2. Management patience to accept and support long term plans. 3. Management focus on cooperation, rather than on confrontation, to facilitate smooth operations and smooth relationships between all participants in the business system. 4. Management attention to detail, but not inundation in detail. Much mere analysis and study is carried on by the employees to clarify the meaning of the detail. 5. Management's will to study and learn, from all available sources, and to apply or adapt the information in a disciplined system. 6. Conduct of managerial activities under the guidance of clearly defined and consistent corporate philosophy.
Author
Management Methods; Japan

20040070858 General Dynamics Corp., Fort Worth, TX, USA
Modernization in Aerospace
Rogers, Herbert F.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 43-48; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

It is a pleasure to have this opportunity to describe the General Dynamics Fort Worth Division's efforts in the areas of Productivity and Quality Improvement. At Fort Worth, Productivity and quality are never separated. On the F-16 program, our efforts in these areas will save the DOD more than $1 billion by the end of 1981.
Derived from text
Quality Control; Productivity

20040070859 Minnesota Mining and Mfg. Co., Saint Paul, MN, USA
Renewing Large Organizations
Lehr, L. W.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 71-77; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

I say this, even though my subject today-renewing large organizations - is one that has puzzled both public and private sector managers for a long, long time. It's an old story. Most organizations begin with a small group of people - people who have a strong drive for success. They build a team. There is no motivation problem, no communication problem. People deal with each other face--to-face. But than if it's successful, if it fulfills its mission, the organization begins to grow. Gradually, things change. Informal give-and-take becomes a preoccupation with policy and control. New challenges and new ideas are walled off into separate compartments and surrounded by specialists . . . almost as if they were some kind of dangerous infection.
Derived from text
Motivation; Policies

20040070860 Digital Equipment Corp., Maynard, MA, USA

Counteracting the Stipling Effects of a Large Organization

Weiss, Harvey; Hill, Richard L.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 103-109; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

In recent years, organizational behaviorists have written literally millions of words concerning the "large " organization, its behavior, and techniques to manage and renew its effectiveness. This paper carries a basic premise: that organizations, whatever their size, should exist and be configured to enhance the effectiveness of the individuals in that organization. Three specific concepts are explored, with actual examples shown, and a call to action in each area is defined: 1. Think differently; the way you did it last Year may not be the best way to do it this year. 2. Invest in people; capital invested in "people" may produce larger returns than you ever thought possible. 3. Keep focus on the mission; we may mistakenly encourage people to stray from the desired "mission" of the enterprise through the structure, the measurement system or the reward system we put in place.

Author

Organizations; Effectiveness; Management Methods

20040070861 Dana Corp., Toledo, OH, USA

The Dana Style: Participation Builds the Climate for Productivity

Hirsch, Carl H.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 135-141; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

The Dana Corporation is a manufacturer of traditional vehicular and industrial products. Yet Dana is also widely recognized as having one of the most innovative programs in American business for building productivity through people. Called "The Dana Style," this program emphasizes that any person is the best authority on how to do his or her job. Two key elements of The Dana Style are productivity through people, and autonomy & entrepreneurship. The former works through an employee stock purchase plan, quality circles, productivity gain sharing activities, continuous communication, and similar efforts to tap the skills of all Dana people as the company's most productive resource. The latter defines an organization in which management is reduced through regionalization, task forces, councils, and committees. Each element is intended to remove the management barriers to the productivity gains of which every person is capable.

Author

Commerce; Productivity; Autonomy; Industrial Management

20040070862 Honeywell, Inc., Minneapolis, MN, USA

Why Wrestle with Jellyfish?

Boyle, Richard J.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 179-184; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Based on experience with stimulating organizational change, the author suggests that executives should make sure they are devoting their attention to the right things -- culture, quality and management systems. Eight pitfalls that accompany dealing with change are noted, and eight corollary lessons are offered.

Author

Productivity; Organizations; Project Management; Economics

20040070863 NASA Johnson Space Center, Houston, TX, USA

Contractor and Government: Teamwork and Commitment

Griffin, Gerald D.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 23-29; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

The assigned topic, "Contractor and Government: Teamwork and Commitment," is a subject about vitally interested. The successes of the U.S. space program were built on such teamwork and commitment. It seems only a short time ago that man's role in space was an unknown quantity. In rapid succession, however, the flights of Shepard, Glenn, and Armstrong demonstrated man's capability to live and travel in space. Consequently, we no longer live with the same awe of space. The success of these joint industry-NASA efforts in achieving our Nation's space goals testifies to the validity of our team's past commitment, management expertise, communications techniques, and teamwork over a period of 25 years. Today, however, We are at the beginning of a new era in space.

Derived from text

Contractors; Management Methods; Governments

20040070865 Ford Motor Co., Dearborn, MI, USA

Quality and Cost Competitiveness

Manoogian, J. A.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984]; 6 pp.; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

A discussion is presented by the Executive Director of Product Assurance for North American Automotive Operations at Ford Motor Co.The topics include interrelationships of quality, productivity, and cost and need for improvements, and the approach Ford has used to achieve dramatic quality improvements.

Derived from text

Productivity; Industrial Management; Production Management

20040070867 Citibank North America, New York, NY, USA

Balancing Risk Taking and Encouraging Entrepreneurism

Seegers, George E.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 203-209; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

Must there be a conflict between risk-taking and entrepreneurism in large organizations? Not necessarily, says this paper by a Citibank executive. The way to encourage entrepreneurism is by making prudent risk-taking not just possible, but potentially rewarding as well. 'Give people enough rope, then see whether they build a swing or a noose,' the author says, the result might be a better mousetrap - benefiting the entire organization.

Author

Industrial Management; Management Methods

20040070868 McCormick and Co., Inc., Hunt Valley, MD, USA

Step Back into The Future: The History of Multiple Management

Felton, John W.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 227-233; In English; See also 20040070839; No Copyright; Avail: CASI; A02, Hardcopy

An employee participation program call_ 'Multiple Management' is cited as one of the reasons McCormick & Company, the international spice firm, is included in the recent best seller, 'The 100 Best Companies to Work for in America.' Multiple Management is a multifaceted program which not only stimulates employees' innovative ideas for new products and improved procedures but also offers in-house training for future leaders of the Company. Unlike the popular quality circles, which limit participation to employees in one specific area of production, Multiple Management crosses all corporate areas, levels and disciplines. It is based on the premise that 'the employee on the job is often best able to say how that job ought to be done.' McCormick says: 'Few organizations realize that making people feel they are an important part of the enterprise is the key to enthusiastic participation, to teamwork, to innovation and to pride in products and in the workplace. 'Unlike many businesses, we're not as interested in ideas about managing people as we are in peoples' ideas about managing the business.'

Author

Personnel Management; Management Methods; Employee Relations

20040070869 Avon Products, Inc., Rye, NY, USA

Paperless Office at Work

Giannantonio, Frank; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984], pp. 235-238; In English; See also 20040070839; No Copyright; Avail: CASI; A01, Hardcopy

In today's world where technology is changing so rapidly, the implementation of office automation becomes a process rather than a project. As a company deciding to automate its office, the process would begin as a series of projects that would continue over time. To give you a better perspective on an automated office, I would like to share with you our experience at Avon. Since 1978, we have followed the technological advancements of several vendors' hardware and software. We were convinced two years ago that an automated office with 'paperless intentions' could begin to be achieved. We had decided to evaluate several vendors, of which we selected one to do a pilot. The pilot was to be conducted over a 6-month period with the key objectives to measure effectiveness, justification and organizational implications. In that same time we had established that our universal work station would be a personal computer.

Derived from text

Office Automation; Management Methods

20040071103 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Summary Report of the Seventh Annual NASA/Contractors Conference on Quality and Productivity: "Total Quality Leadership"

April 1991; ISSN 1049-667X; 68 pp.; In English; Seventh Annual NASA/Contractors Conference on Quality and Productivity: "Total Quality Leadership, 24-25 Oct. 1990, Grenelefe, FL, USA; No Copyright; Avail: CASI; A04, Hardcopy

More than 750 NASA, government, contractor, and academic representatives attended the Seventh Annual NASA/ Contractors Conference on Quality and Productivity on October 12-13, 1990, in Grenelefe, Florida. The panel presentations and keynote speeches revolving around the theme of 'Total Quality Leadership" provided a solid base of understanding of the importance, benefits, and principles of total quality management. The implementation of these strategies is critical if we are to effectively pursue our mission of continuous quality improvement and reliability in our products, processes, and services. The annual NASA/contractors conferences serve as catalysts for achieving success in this mission.

Author

Total Quality Management; Productivity; Reliability

20040071104 National Academy of Public Administration, Washington, DC, USA

Summary Report of the NASA Management Study Group: Recommendations to the Administrator, National Aeronautics and Space Administration

Phillips, Samuel C.; December 30, 1986; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Management Study Group (NMSG) was established under the auspices of the National Acedamy of Public Administration at the request of the Administrator of NASA to assess NASA's management practices and to evaluate the effectiveness of the NASA organization. This report summarizes the conclusions and recommendations of the NMSG on the overall management and organization of NASA.

Author

NASA Programs; Management

20040071106 NASA Ames Research Center, Moffett Field, CA, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA, NASA Johnson Space Center, Houston, TX, USA, NASA Lewis Research Center, Cleveland, OH, USA

Improving Organizational Productivity in NASA, Volume 2

April 1986; 45 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Recognizing that NASA has traditionally been in the forefront of technological change, the NASA Administrator challenged the Agency in 1982 to also become a leader in developing and applying advanced technology and management practices to increase productivity. One of the activities undertaken by the Agency to support this ambitious productivity goal was participation in a 2-year experimental action research project devoted to learning more about improving and assessing the performance of professional organizations. Participating with a dozen private sector organizations, NASA explored the usefulness of a productivity improvement process that addressed all aspects of organizational performance. This experience has given NASA valuable insight into the enhancement of professional productivity. More importantly, it has provided the Agency with a specific management approach that managers and supervisors can effectively use to emphasize and implement continuous improvement. This report documents the experiences of the five different NASA installations participating in the project, describes the improvement process that was applied and refined, and offers recommendations for expanded application of that process. Of particular interest is the conclusion that measuring white collar productivity may be possible, and at a minimum, the measurement process itself is beneficial to management. Volume I of the report provides a project overview, significant findings, and recommendations. Volume II presents individual case studies of the NASA pilot projects that were part of the action research effort.

Author

Organizations; Productivity; NASA Programs; Project Management; Technology Utilization

20040074191 NASA, Washington, DC, USA

University Program Management Information System

Gans, Gary, Technical Monitor; [2004]; 687 pp.; In English

Report No.(s): NASA/TM-2004-212986; No Copyright; Avail: CASI; A99, Hardcopy

As basic policy, NASA believes that colleges and universities should be encouraged to participate in the nation's space and aeronautics program to the maximum extent practicable. Indeed, universities are considered as partners with government

and industry in the nation's aerospace program. NASA's objective is to have them bring their scientific, engineering, and social research competence to bear on aerospace problems and on the broader social, economic, and international implications of NASA's technical and scientific programs. It is expected that, in so doing, universities will strengthen both their research and their educational capabilities to contribute more effectively to the national well being. This annual report is one means of documenting the NASA-university relationship, frequently denoted, collectively, as NASA's University Program. This report is consistent with agency accounting records, as the data is obtained from NASA's Financial and Contractual Status (FACS) System, operated by the Financial Management Division and the Procurement Office. However, in accordance with interagency agreements, the orientation differs from that required for financial or procurement purposes. Any apparent discrepancies between this report and other NASA procurement or financial reports stem from the selection criteria for the data.

Author

Management Information Systems; University Program; NASA Programs

20040074218 General Accounting Office, Washington, DC, USA

Impact of the Grounding of the Shuttle Fleet

September 2003; 27 pp.; In English

Report No.(s): GAO-03-1107; No Copyright; Avail: CASI; A03, Hardcopy

Although the effects of the Columbia accident on the space station are still being explored, it is clear that the station will cost more, take longer to complete, and have further delay in the achievement of key research objectives. Due to the limited payload capacity of Russia s Soyuz and Progress vehicles - which the program must now rely on to rotate crew and provide logistics support - the station is currently in a survival mode. On-orbit assembly is at a standstill, and the on-board crew has been reduced from three to two members. NASA officials maintain that delays in on-orbit assembly will be at least a "month for month" slip from the previous schedule. However, these delays have presented a number of operational challenges. For example, several key components that were ready for launch when the Columbia accident occurred have been idle at Kennedy Space Center and now require additional maintenance or re-certification before they can be launched. Moreover, certain safety concerns on-board the station cannot be addressed until the shuttle fleet s return to flight. The grounding of the shuttle fleet has also further impeded the advancement of the program s science investigations. Specifically, the limited availability of research facilities and new science materials has constrained on-board research.

Author

Survival; Schedules; Safety; Research Facilities; Payloads; Maintenance

20040074227 Defence Science and Technology Organisation, Edinburgh, Australia

The Prototype Automated Research Management System (ARMS)

Prekop, Paul; Burnett, Mark; Chapman, Chris; February 2004; 34 pp.; In English

Report No.(s): DSTO-TR-0540; DODA-AR-013-011; Copyright; Avail: Other Sources

Automated Research Management System (ARMS) is a knowledge management application designed to address many of the knowledge management problems identified by SmartWays and FASSP's Knowledge Management Review. ARMS supports knowledge management by recording and exposing the knowledge and expertise of E T 0 Staff, providing organization- wide methods for S&T Staff to find and interact with other staff with similar or complementary skills, experiences or interests, and by providing a coherent and organization- wide R&D corporate memory of current and past E T 0 work. This report presents a set of detailed use-cases for the ARMS prototype, and the piloting process that will be used to test and evaluate it.

Author

Automatic Control; Management Systems

20040074267 McDonald Observatory, Austin, TX, USA

Community Perspective on NASA Strategic Planning

Lester, Dan; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 11-17; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The process that leads from a mission concept to flight hardware in space has many dimensions, involving the astronomical community, the Administration, the Congress, and even the private sector. The development of coherent space science policy and the strategic planning needed to follow through with it is a crucial factor in the success of such endeavors. In this contribution, I will try to outline some of these efforts as they apply to space infrared and submillimeter missions, report

on status as it relates to our discipline, and share some thoughts about where we need to go.
Author
Management Planning; Mission Planning; Space Law

20040074305 NASA, Washington, DC, USA
NASA Space Sciences Strategic Planning
Crane, Philippe; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 3-10; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of strategic planning roadmap is to:Fulfill the strategic planning requirements; Provide a guide to the science community in presenting research requests to NASA; Inform and inspire; Focus investments in technology and research for future missions; and Provide the scientific and technical justification for augmentation requests.
Derived from text
Management Planning; Spaceborne Astronomy

20040074312 NASA, Washington, DC, USA
Enabling Telescopes of the Future: Long-Range Technology Investing
Thronson, Harley; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 18-22; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The Office of Space Science at NASA Headquarters has a current staff of about 60 professionals (aka, scientists, engineers, budget analysts) and an annual budget of $2.5 B out of NASA s $15.0 B. About 35 missions or programs in various stages of development or operation are managed by OSS, notable among them are Hubble Space Telescope, Mars Global Surveyor, Mars 2001 Odyssey, Chandra X-ray Observatory, TRACE (solar observatory), Cassini (mission to Saturn), Galileo (mission at Jupiter), and Next Generation Space Telescope. OSS has an annual technology budget of several hundred million dollars. So, what is it that we are doing?
Derived from text
Telescopes; X Ray Astrophysics Facility; X Rays

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*.

20040068166 NASA Ames Research Center, Moffett Field, CA, USA
Knowledge Driven Image Mining with Mixture Density Mercer Kernels
Srivastava, Ashok N.; Oza, Nikunj; 2004; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a new methodology for automatic knowledge driven image mining based on the theory of Mercer Kernels; which are highly nonlinear symmetric positive definite mappings from the original image space to a very high, possibly infinite dimensional feature space. In that high dimensional feature space, linear clustering, prediction, and classification algorithms can be applied and the results can be mapped back down to the original image space. Thus, highly nonlinear structure in the image can be recovered through the use of well-known linear mathematics in the feature space. This process has a number of advantages over traditional methods in that it allows for nonlinear interactions to be modelled with only a marginal increase in computational costs. In this paper, we present the theory of Mercer Kernels, describe its use in image mining, discuss a new method to generate Mercer Kernels directly from data, and compare the results with existing algorithms on data from the MODIS (Moderate Resolution Spectral Radiometer) instrument taken over the Arctic region. We also discuss the potential application of these methods on the Intelligent Archive, a NASA initiative for developing a tagged image data warehouse for the Earth Sciences.
Author
Knowledge Based Systems; Data Mining; Image Analysis; Image Classification

20040068173 NASA Langley Research Center, Hampton, VA, USA

Evaluating the Effectiveness of the 2002-2003 NASA SCIence Files(TM) Program

Pinelli, Thomas E.; Lambert, Matthew A.; Williams, Amy C.; April 2004; 113 pp.; In English

Contract(s)/Grant(s): L-18373

Report No.(s): NASA/TM-2004-213012; No Copyright; Avail: CASI; A06, Hardcopy

NASA SCIence Files (tm) is a research-, inquiry-, and standards-based, integrated mathematics, science, and technology series of 60-minute instructional distance learning (television and web-based) programs for students in grades 3-5. Respondents who evaluated the programs in the 2002-2003 NASA SCIence Files (tm) series reported that (1) they used the programs in the series; (2) the goals and objectives for the series were met; (3) the programs were aligned with the national mathematics, science, and technology standards; (4) the program content was developmentally appropriate for grade level; and (5) the programs in the series enhanced and enriched the teaching of mathematics, science, and technology.

Author

Education; Research and Development; Science; Mathematics

20040068306 Istituto Superiore di Sanita, Rome, Italy

National Workshop Enter-net Italia. Surveillance System of Enteric Infections. Gastrointestinal Infections. Man, Animals, Food and Environment: New Epidemiological Scenarios. III. Istituto Superiore di Sanita. Rome, November 6-7, 2003

Caprioli, A.; Luzzi, I.; Tozzi, A. E.; Lana, S.; Nov. 2003; 82 pp.; In Italian

Report No.(s): PB2004-105431; ISTISAN-C-03/C5; Copyright; Avail: National Technical Information Service (NTIS)

Enter-net is an international network for the surveillance of human gastrointestinal infections, which monitors salmonellosis and Verocytotoxin producing Escherichia coli (VTEC) O157, including their antimicrobial resistance. It involves 19 European countries and is funded by the DG SANCO of the European Commission. The main objectives of Enter-net are the harmonization of typing methods, the establishment of a regularly updated international database including the antimicrobial susceptibility of the isolates, the recognition and investigation of outbreaks involving different countries. The Istituto Superiore di Sanita (ISS, the Italian National Institute of Health) represents Italy in the network and coordinates a national surveillance system (Enter-net Italia) that involves laboratories operating in the medical, veterinary and environmental fields. Starting from 2001, Enter-net Italia activities are presented in an annual workshop held at ISS. This year the workshop is structured as a meeting that, beside presenting Enter-net activities, will provide an updating on the pathogenesis, diagnosis and epidemiology of enteric infections.

NTIS

Gastrointestinal System; Infectious Diseases

20040070779 Management Services, Inc., Huntsville, AL, USA

MSFC Space Station Program Commonly Used Acronyms and Abbreviations Listing

Gates, Thomas G.; December 1988; 27 pp.; In English

Contract(s)/Grant(s): NAS8-35900

Report No.(s): MHR-17; No Copyright; Avail: CASI; A03, Hardcopy

The Marshall Space Flight Center maintains an active history program to assure that the foundation of the Center's history is captured and preserved for current and future generations. As part of that overall effort, the Center began a project in 1987 to capture historical information and documentation on the Marshall Center's roles regarding Space Shuttle and Space Station. This document is MSFC Space Station Program Commonly Used Acronyms and Abbreviations Listing. It contains acronyms and abbreviations used in Space Station documentation and in the Historian Annotated Bibliography of Space Station Program. The information may be used by the researcher as a reference tool.

Derived from text

Abbreviations; Annotations; Bibliographies; Histories

20040070837 NASA Stennis Space Center, Bay Saint Louis, MS, USA

Test Facilities Capability Handbook

Taliancich, Paula, Editor; Bruce, Robert, Editor; November 2001; 158 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/NP-2001-11-00021-SSC/REV; No Copyright; Avail: CASI; A08, Hardcopy

The John C. Stennis Space Center (SSC) is located in Southern Mississippi near the Mississippi-Louisiana state line. SSC

is chartered as the National Aeronautics and Space Administration (NASA) Center of Excellence for large space transportation propulsion system testing. This charter has led to many unique test facilities, capabilities and advanced technologies provided through the supporting infrastructure. SSC has conducted projects in support of such diverse activities as liquid, and hybrid rocket testing and development; material development; non-intrusive plume diagnostics; plume tracking; commercial remote sensing; test technology and more. On May 30, 1996 NASA designated SSC the lead Center for rocket propulsion testing, giving the Center total responsibility for conducting and/or managing all NASA rocket engine testing. Test services are now available not only for NASA but also for the DoD, other government agencies, academia, and industry. This handbook was developed to provide a summary of the capabilities that exist within SSC. It is intended as a primary resource document, which will provide the reader with the top-level capabilities and characteristics of the numerous test facilities, test support facilities, laboratories, and services. Due to the nature of continually evolving programs and test technologies, descriptions of the Center's current capabilities are provided. Periodic updates and revisions of this document will be made to maintain is completeness and accuracy.
Author
Diagnosis; Engine Tests; Handbooks; Large Space Structures; Nonintrusive Measurement; Propulsion; Support Systems; Test Facilities

20040071042 University Transportation Center for Alabama, Tuscaloosa, AL, USA, Alabama Dept. of Transportation, Montgomery, AL, USA
Development of a Statewide Bridge Database and Data Retrieval System
Graettinger, A.; Simmons, S.; May 2003; 30 pp.; In English
Report No.(s): PB2004-105459; UTCA-02403; No Copyright; Avail: CASI; A03, Hardcopy

The Alabama Department of Transportation (ALDOT) has amassed significant quantities of information related to geotechnical subsurface data, construction drawings, and design information for transportation projects. This data is in a paper format that makes it difficult to locate and to use in the design of new projects. This research project developed a pilot-scale agency-specific GIS-based tool for a statewide geotechnical database and data retrieval system that can be expanded to include virtually all of the geotechnical and subsurface structural information from across the State of Alabama. This new geotechnical-GIS (Geo-GIS) application is a tool for storing both graphical and attribute geotechnical data that can be accessed both spatially and through queries. This pilot study collected data from eight projects, which involved 18 bridges across the State of Alabama. The Geo- GIS was designed with four GIS point layers: project, bridge, foundation, and soil boring. All layers are linked to attribute database tables that have six to ten columns of object specific data. The layers are also linked to a HTML page to access pre-construction and construction reports for the projects and bridges respectively. This pilot study also investigated the level of effort and the file storage requirements for extending the scope of this project to the more than 18,000 bridges statewide, with a total estimated cost of $1.15 million.
NTIS
Data Bases; Data Retrieval; Document Markup Languages

20040071056 Texas A&M Univ., College Station, TX
Estimating ITS Benefits: Guidelines for Evaluating ITS Products
Stockton, W. R.; Walton, C. M.; Goodin, G. D.; Turner, S. M.; Martello, M. T.; Mar. 2003; 218 pp.; In English
Report No.(s): PB2004-105024; TTI-0-1790; No Copyright; Avail: CASI; A10, Hardcopy

This report summarizes the results of a multi-year research project that looked into the benefits of deploying intelligent transportation systems (ITS) projects. In this report the researchers: summarize current estimates of the benefits of ITS deployments, and present detailed guidelines for evaluating existing ITS projects and for estimating potential benefits of prospective projects. In addition to describing what ITS is, the report addresses the range of benefits that can be expected from ITS deployments, identifies key sources for updated benefits information in a highly dynamic field, and develops a sound and consistent approach to setting goals and objectives and to measuring the benefits of ITS deployments. Using the detailed evaluation guidelines, the report identifies data collection and evaluation methodologies for 28 of the most commonly deployed market packages. Detailed evaluation 'trees' are presented in an appendix. These trees lead the user through a comprehensive assessment of the goals, objectives, measures of effectiveness, and data requirements for each of the 28 market packages. Additional appendices present detailed recommendations for analytical approaches to specific analyses associated with various measures of effectiveness.
NTIS
Data Acquisition; Estimates; Evaluation; Smart Structures

20040073532 Defense Manpower Data Center, Arlington, VA

May 2003 Status of Forces Survey of Reserve Component Members: Tabulations of Responses

Nov. 2003; 541 pp.; In English

Report No.(s): AD-A418114; DMDC-2003-010; No Copyright; Avail: CASI; A23, Hardcopy

The Status of Forces Surveys (SOFS) is the Web- based component of the Human Resource Strategic Assessment Program (HRSAP) administered by DMDC for the Office of the Under Secretary of Defense for Personnel and Readiness (OUSDP&R). HRSAP is designed to measure the attitudes and opinions of the entire DoD community--Active and Reserve Service members, their families and DoD civilian--on the full range of personnel issues. The focus of this survey was on activation and mobilization issues. In this tabulation volume are an introduction to the survey, cross tabulations of the resulting data on a series of demographic variables of interest to the various policy offices within OUSD(P&R), and a copy of actual survey items. Results are tabulated by Reserve component, paygrade, Reserve program, prior service experience, activated/ deployed status, employment/student status, race/ethnicity, gender, and component further broken out by paygrade.

DTIC

Military Personnel; Psychology; Reserves; Surveys

20040073535 WetStone Technologies, Inc., Cortland, NY

Organically Assured and Survivable Information Systems (OASIS) Technology Transition Assessment (OTTA)

Duren, Mike; Mar. 2004; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-C-0207; Proj-K128

Report No.(s): AD-A422272; AFRL-IF-RS-TR-2004-67; No Copyright; Avail: CASI; A04, Hardcopy

This effort examined a development beneath the Defense Advanced Research Project Agency's (DARPA's) umbrella program, OASIS (Organically Assured and Survivable Information Systems). The focus of this effort was on the identification of promising technology and assessing the readiness, applicability, and maturity of research and technology derived from or created during the research process. Effective and rapid transition of new technology is essential to the nation's security. With advancements in computing and with States worldwide becoming increasingly technologically sophisticated, we must create an environment that not only fosters cutting edge research, but does so in a way that considers how this research can be deployed most effectively and efficiently. Efficiency must always be a consideration in planning and performing research. It is supposed here that, in some cases, an effective transition environment can improve the quality of research, particularly in the output of research projects, and that early assessment is one means to provide feedback to the research processes at a time when important research decisions are being made or need to be made.

DTIC

Information Systems; Oases; Technology Assessment

20040073545 Naval Postgraduate School, Monterey, CA

Computer Network Operations Methodology

Vega, Juan C.; Mar. 2004; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422320; No Copyright; Avail: CASI; A06, Hardcopy

All nations face increasing tension between exploiting Computer Network Operations (CNO) in the military sphere and protecting the global information grid. The USA is moving apace to develop doctrines and capabilities that will allow them to exploit cyberspace for military advantage. Within the broad rubric of Information Operations, there is increasing effort devoted to integrating CNO into routine military planning. At the same time, these nations are becoming increasingly concerned at the dependency of their militaries, governments, economies and societies on the networked information systems that are emerging as the central nervous systems of post-industrial society. The armed forces desire to exploit and use CNO to their advantage is the central argument for this developed concept. This new weapons platform, or CNO, can be clearly identified so that the leaders will have an understanding of terms, limitations and capabilities of cyber operations. A methodology incorporating doctrine can be created to identify the Rules of Engagement (ROE) as well as the CNO components. The CNO area of operations and area of interest reach far beyond the typical battle space. The battle space has evolved and has penetrated every element of military operations that utilize computers and networks.

DTIC

Computer Networks

20040073546 Naval Postgraduate School, Monterey, CA

Cultivating Innovation to Ignite Organizational Transformation

Yu, Warren; Mar. 2004; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422322; No Copyright; Avail: CASI; A05, Hardcopy

Having graduated from the Naval Postgraduate School (NPS) in 1998, I found myself reassigned there two years later only to watch the same frustrating cycle of inefficiency and ineffectiveness. Classes were still being manually scheduled using 3x5 cards, the results transferred into a 1970's mainframe for printout on 15 inch-wide computer paper, and then distributed by hand. Incoming US and international families from any of 50 countries found it difficult to locate timely orientation information. Students, faculty and staff did not have a convenient, consistent method of finding people, places or things on campus. The school's intranet was littered with outdated, irrelevant information. And the crews of 300 warships, positioned worldwide, were hungry for 24/7 distance learning programs. Bureaucracy, fiscal pressure, excruciating oversight, and declining enrollment stifled the school's prospects. A group of us in the technology department launched the school's first Web Operations Group and I modeled NPS's new website after Monterey's weekly open-air farmer's market. I harvested three conclusions: 1) Like the fresh produce sold every Tuesday afternoon, no one wants information that is beyond a week old; 2) The marketplace provides a secure, convenient, consistent forum in which to transact business as well as ideas; 3) The stalls with better marketing and more relevant produce or services gainered more business. I started attending NPS bi- weekly leadership meetings and asking lots of questions. With no budget, I taught myself how to use web-authoring tools, studied the government Web edicts, and leveraged my server privileges to help stakeholders communicate ideas, collaborate on research projects and partner with NPS. After collecting survey data, I pitched the final concept to school leadership, crafted the new website over Christmas break, and went live six weeks later.

DTIC

Cultivation; Data Acquisition; Data Management; Ignition; Information Retrieval; Internets

20040073570 Naval Postgraduate School, Monterey, CA

Analyzing the Feasibility of Using Secure Application Integration Methodology (SAIM) for Integrating DON Enterprise Resource Planning (ERP) applications

Marin, Ramon O.; Mar. 2004; 119 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422388; No Copyright; Avail: CASI; A06, Hardcopy

A thorough examination of the Secure Application Integration Methodology (SAIM) for applicability in the Department of the Navy (DON) would provide useful information about a beneficial methodology. SAIM is analyzed, by accessing its step by step directions, for suitability in the integration of the Enterprise Resource Planning (ERP) projects implemented by the SYSTEMS COMMANDS (SYSCOMS). The Navy Enterprise Convergence Team (NECT) that leads the ERP integration effort could benefit from a sound Enterprise Application Integration methodology. Results do not support SAIM as the sole guiding EAI methodology however it could have some value to the NECT. SAIM has three primary benefits which NECT could employ: 1) It provides a complete walkthrough of the EAI process, 2) It emphasizes the importance of an Enterprise Architecture, and 3) It provides useful management checklists along with other important considerations.

DTIC

Architecture (Computers); Information Systems; Systems Management

20040073620 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Cross-Service Investigation of Geographical Information Systems

Beverly, Matthew H.; Mar. 2004; 236 pp.; In English; Original contains color illustrations

Report No.(s): AD-A422497; AFIT/GEM/ENV/04M-01; No Copyright; Avail: CASI; A11, Hardcopy

This research investigated the armed services current uses of GIS, and asked the question whether or not a joint GIS program could benefit the DOD. An information technology implementation model was presented as a framework to implement a joint GIS program. It was found that all four armed services use GIS for forward deployments. The Army has its Combat Terrain Information System (CTIS). The Navy's digital nautical charts are a GIS. The Marine Corps has created their Geographically Linked Information Display Environment (GLIDE) program, which is similar to a map repository. Finally, the Air Force has its GeoBase program for installation GIS, and GeoReach is the expeditionary deployment base-planning subset. The research methodology combined a case study and a Delphi study. The case study research examined a single Army GIS unit for current GIS implementation methods and uses. The Delphi study asked eight DOD GIS experts their opinions about current GIS uses and the possibility of a joint GIS program. Through the case study and Delphi research,

it was found that information flow between the services is limited and that a joint GIS program may bring improved and new planning and executing capabilities for the DOD.
DTIC
Geographic Information Systems

20040073653 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
Internet Tools for Sharing Unmanned Vehicle Information
Gage, Douglas W.; May 1994; 9 pp.; In English
Report No.(s): AD-A422537; No Copyright; Avail: CASI; A02, Hardcopy

Using Mosaic and other emerging Internet toots, a user at a workstation or personal computer attached to the Internet can find and access multi-media information hosted on server systems anywhere in the world, using an intuitive "point and shoot" interface in a windowed environment. The power of these systems derives from clever structuring of the databases, so that any server can "point" to data hosted by any other server. This presentation provides a brief introduction to the terminology and user interface paradigms of the World Wide Web, and conveys a feeling of how simple it is to "publish" (as well as access) information in these modes. Evolving DTIC/IAC and other WWW/Gopher resources in robotics and related fields are identified, and the possible roles and implications for the Unmanned Vehicle community of these decentralized, highly distributed public information sharing tools are discussed.
DTIC
Internets; Robotics

20040073664 North Carolina State Univ., Raleigh, NC
A Data Mining approach for building cost-sensitive and light intrusion detection models
Mar. 2004; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-1-0603; Proj-K357
Report No.(s): AD-A422555; AFRL-IF-RS-TR-2004-84; No Copyright; Avail: CASI; A03, Hardcopy

The report provides a summary of the intrusion detection research completed for this effort. The research studied how to build cost-sensitive and light weight intrusion detection models. The main technical components of the research are: 1) Automatic feature construction by analyzing the patterns of normal and intrusion activities computed from large amounts of audit data. 2) Using cost-sensitive machine learning algorithms to construct intrusion detection models that achieve optimal performance on the given (often site- specific) cost metrics, cluster attack signatures and normal profiles and accordingly construct one light model of each cluster to maximize the utility of each model. 3) Dynamic (re-) configuration of the light models to make an IDS effective and efficient, and resilient to IDS-related attacks. Algorithms and prototype systems were developed and extensive experiment using DARPA datasets and other real-world datasets were conducted. The results showed that the technologies developed in this project are more advanced and better than today's state-of-the-art.
DTIC
Cost Analysis; Data Mining; Detection; Information Retrieval; Sensitivity; Warning Systems

20040073710 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Study of Information Exchange Between USA Air Force Bases and Their Surrounding Communities
Clewett, Andrew C.; Mar. 2004; 147 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422614; AFIT/GEM/ENV/04M-06; No Copyright; Avail: CASI; A07, Hardcopy

Data, information, and knowledge are exchanged daily from USA Air Force (USAF) bases to surrounding communities. The purpose of this research is to aid managers and commanders in gaining a better understanding of their information flow and bettering their information management practices. The research specifically seeks answers to the questions of where information is exchanged, why information is exchanged, and to whom information is exchanged with.
DTIC
Data Management; Military Air Facilities; Resources Management; United States

20040073716 Aerospace Medical Research Labs., Wright-Patterson AFB, OH
An Annotated Bibliography of USA Air Force Engineering Anthropometry - 1946 to 1983
Robinette, Kathleen M.; May 1983; 103 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A422628; AFAMRL-TR-83-045; No Copyright; Avail: CASI; A06, Hardcopy

This report contains the titles, authors, publication/source information, and the abstracts of 202 technical reports and articles published by the Air Force Aerospace Medical Research Laboratory from 1946 to 1983. It is a detailed document of the scope of the effort of the Air Force in the field of engineering anthropometry to provide the information on human body size and bio- mechanical characteristics of Air Force personnel required for the development and evaluation of Air Force systems, personal protective equipment, and clothing.
DTIC
Annotations; Anthropometry; Bibliographies; United States

20040073761 Naval War Coll., Newport, RI
Afghanistan: Security Integration and Organization
Monroe, Joseph F.; Feb. 9, 2004; 22 pp.; In English
Report No.(s): AD-A422691; No Copyright; Avail: CASI; A03, Hardcopy

This paper will examine the interaction of security with economic and political development by analyzing the goal of security and the complexity of creating a comprehensive security strategy that is flexible and lends itself to an integrated reconstruction plan. Secondly, the paper will analyze the US marines Combined Action Program (CAP) from Vietnam to garner lessons that are applicable to the security mission in Afghanistan. Finally the paper will make a few recommendations for changes to the PRT model.
DTIC
Afghanistan; Economic Development; Security

20040073780 Naval War Coll., Newport, RI
Network Centric Warfare - A Tool or Hindrance to the Operational Commander
Villa, Jiancarlo; Feb. 9, 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422740; No Copyright; Avail: CASI; A03, Hardcopy

Network Centric Warfare has been identified as the manner in which the Joint Force will operate in the 21st Century. Six years after VADM Arthur Cebrowski proposed the road to a netted force, we are able to examine the progress toward the attainment of that goal. To achieve its goals of speed of command and self-synchronization of the forces, NCW integrates three grids into a combined picture aimed at simplifying the planning and execution processes. The information of these grids is merged into a common operating picture which is to be a coherent picture of the battlefield. Independent production and development of networks by the various branches of the military service has caused the COP to receive its information from systems which have been produced in a stove pipe' and don't truly integrate into the COP. The current challenge for the Joint Force is to achieve the ordered objectives with a smaller force while increasing speed and effectiveness of mission accomplishment. Network Centric Warfare must facilitate the Joint Force Commander's achievement of the Joint Vision 2020 mandate of full spectrum dominance and enable his expediency of command which is integral in the effective conduct of operations across the military spectrum. NCW architects are successfully proceeding to develop the tenets of speed of command and self synchronization by providing technologically advanced sensors and systems. However, they must not lose sight of the fact that NCW technology must enable operational art and aid in the commander's ability to synchronize fires and maneuver along with the available instruments of National Power to achieve the objective.
DTIC
Command and Control; Constraints; Information Systems; Military Operations; Warfare

20040073785 Naval War Coll., Newport, RI
Information Operations and the Global War on Terror: The Joint Force Commander's Fight for Hearts and Minds in the 21st Century
Mackin, Patrick B.; Feb. 9, 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422766; No Copyright; Avail: CASI; A03, Hardcopy

Information Operations offers the Joint Force Commander with an alternative to using traditional military force when objectives are abstract or intangible. General Charles Holland, USA Special Operations Command, identifies the Muslim population as the Center of Gravity in our current War on Terror. Information operations may be the tool necessary to target this Center of Gravity. The successful Australian Defense Force (ADF) experience with Information Operations in two recent conflicts offer the USA valuable strategies in fighting the Global War on Terror. Examining the ADF IC methods and techniques offer today's Joint Force Commander (JFC) with approaches worthy of consideration in a conflict that is religiously and ideologically charged. Analysis of current U.S. efforts in Afghanistan and Iraq are explored and recommendations are

provided for consideration in the struggle to win the Hearts and Souls of the greater Muslim population.
DTIC
Heart; Military Operations; Warfare

20040073798 Naval War Coll., Newport, RI
Ulysses Bow or Achilles Heel for the Combatant Commander?
Cox, Sonya; Feb. 9, 2004; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422802; No Copyright; Avail: CASI; A03, Hardcopy

Just as the advent of precision-guided weapons has significantly reduced and limited collateral damage in modern technological warfare, so the emergence of cyber technology may produce a shift in the very way in which war is conceived in the twenty-first century, reducing the amount of collateral damage and the number of combatant casualties to the point it may be possible to subdue the enemy without bloodshed. The first line of attack In warfare has always been the adversary's ability to wage war through the destruction of his military and industrial infrastructure. In the rapidly evolving Age of cyber war, this might be accomplished with a minimum o physical destruction and human casualties. Today's Combatant Commanders can and should take advantage of the new capabilities that cyber warfare offers, while maintaining a secure defensive posture in order to protect them where they are most vulnerable.
DTIC
Information Systems; Ulysses Mission; Warfare

20040074215 NASA Langley Research Center, Hampton, VA, USA
Results of a Telephone Survey of Television Station Managers Concerning the NASA SCI Files(TM) and NASA CONNECT(TM)
Pinelli, Thomas E.; Perry, Jeannine; May 2004; 47 pp.; In English
Contract(s)/Grant(s): WU 23-090-20-09
Report No.(s): NASA/TM-2004-213029; L-18376; No Copyright; Avail: CASI; A03, Hardcopy

A telephone survey of television station managers concerning 2 instructional television programs, the NASA SCI Files(TM) and NASA CONNECT(TM), offered by the NASA Langley Center for Distance Learning (CDL) was conducted. Using a 4-point scale, with 4 being very satisfied, survey participants reported that they were either very satisfied (77.1 percent) or satisfied (19.9 percent) with the overall (educational and technical) quality of the NASA SCI Files(TM). Using a 4-point scale, with 4 being very satisfied, survey participants reported that they were either very satisfied (77.9 percent) or satisfied (19.1 percent) with the overall (educational and technical) quality of NASA CONNECT(TM) .
Author
Surveys; Evaluation

20040074326 Defence Science and Technology Organisation, Edinburgh, Australia
An Automatic Transcriber of Meetings Utilising Speech Recognition Technology
Graham, Steve; Sladek, Jarrah; March 2004; 59 pp.; In English
Report No.(s): DSTO-CR-0355; DODA-AR-013-054; Copyright; Avail: Other Sources

Conducting meetings is an important part of the Australian Defence Organization (ADO) activities. Meetings span a broad range of knowledge sharing and collaborative activities; examples are interviews, informal discussions, brain-storming sessions, video-conferences and presentations. Thus, looking at ways to improve the capture of information from these meetings is of interest to the ADO. This report presents progress towards the application of speech recognition technology to automatically produce text transcriptions of collaborative meetings. The report reviews the literature on automatic transcription systems and describes the progress on the research and development of a concept demonstrator named AuTM (Automatic Transcriber of Meetings).
Author
Speech Recognition; Utilization; Video Conferencing

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040070722 Saint Luke's Hospital, Cleveland, OH, USA
Eye Surgery Light
Spinoff 1978; January 1978, pp. 105; In English; No Copyright; Avail: CASI; A06, Hardcopy

During eye surgery, the surgeon uses an illuminating instrument called an opthalmoscope for close examination of the retina or the interior of the eye. Ordinarily, electric power for the head-mounted light is supplied through a cord from an overhead swivel arm or a floor pedestal. Within limits of cord length and swivel arm movement, the surgeon has considerable freedom of motion. But when more than one opthalmoscope is involved, tangling and interference of the power cords becomes a problem. St. Luke's Hospital, Cleveland, Ohio asked Lewis Research Center for assistance in finding a solution. Lewis responded with a battery-powered system that totally frees the surgeon of attached cords and swivels. Borrowing from space technology, Lewis used small, lightweight nickel-cadmium batteries that can deliver high intensity light for an hour and can be recharged overnight. The Opthalmoscope Powerpack consists of eight batteries in three containers affixed to a webbed belt, and a novel on-off switch equipped with a spring-loaded plexiglass 'flapper.' The belt pack is worn underneath the surgical gown and the flapper permits the doctor to activate the switch by elbow pressure. Lewis built five units and they have been in service at St. Luke's Hospital for a year. Used for routine examinations as well as for surgery, they have demonstrated excellent reliability.
Author
Aerospace Technology Transfer; Medical Electronics; Ophthalmology; Surgery

20040070724 Protective Products, Grand Prairie, TX, USA
Shock Absorbing Helmets
Spinoff 1978; January 1978, pp. 100-101; In English; No Copyright; Avail: CASI; A05, Hardcopy

This paper presents a description of helmets used by football players that offer three times the shock-absorbing capacity of earlier types. An interior padding for the helmets, composed of Temper Foam, first used by NASA's Ames Research Center in the design of aircraft seats is described.
CASI
Helmets; Shock Absorbers; Aerospace Technology Transfer

20040071000 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Mississippi Company Using NASA Software Program to Provide Unique Imaging Service: DATASTAR Success Story
September 20, 2001; 6 pp.; In English; Original contains black and white illustrations
Report No.(s): SE-2001-09-00052-SSC; No Copyright; Avail: CASI; A02, Hardcopy

DATASTAR, Inc., of Picayune, Miss., has taken NASA's award-winning Earth Resources Laboratory Applications (ELAS) software program and evolved it to the point that the company is now providing a unique, spatial imagery service over the Internet. ELAS was developed in the early 80's to process satellite and airborne sensor imagery data of the Earth's surface into readable and useable information. While there are several software packages on the market that allow the manipulation of spatial data into useable products, this is usually a laborious task. The new program, called the DATASTAR Image Processing Exploitation, or DIPX, Delivery Service, is a subscription service available over the Internet that takes the work out of the equation and provides normalized geo-spatial data in the form of decision products.
Author
Satellite Imagery; Applications Programs (Computers); Internet Resources

20040071086 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
NASA Involvement in National Priority Support for Disasters
McGregor, Lloyd; February 13, 2002; 85 pp.; In English; 18th Anual Louisiana Remote Sensing and GIS Workshop, 9-11 Apr. 2002, Baton Rouge, LA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-02-00007-SSC; No Copyright; Avail: CASI; A05, Hardcopy

This viewgraph presentation provides an overview of the role NASA remote sensing played in planning recovery operations in the aftermath of the September 11, 2001 terrorist attacks on the World Trade Center and the Pentagon. The presentation includes AVIRIS and satellite imagery of the attack sites, and photographs taken on the ground after the attacks. One page of the presentation addresses NASA's role in disaster management of the 2002 Winter Olympics.
CASI
Technology Utilization; Security; Terrorism

20040071140 Owens-Corning Fiberglas Corp., Toledo, OH, USA, Du Pont de Nemours (E. I.) and Co., Wilmington, DE, USA, Chemical Fabrics, Inc., Bennington, VT, USA, Birdair Structures, Inc., Buffalo, NY, USA
A Roof for the Lions' House
Spinoff 1978; January 1978, pp. 36-39; In English; No Copyright; Avail: CASI; A03, Hardcopy

Fans of the National Football League s Detroit Lions don't worry about game day weather. Their magnificent new Pontiac Stadium has a domed, air-supported, fabric roof that admits light but protects the playing field and patrons from the elements. The 80,000-seat Silverdome is the world s largest fabric-covered structure-and aerospace technology played an important part in its construction. The key to economical construction of the Silverdome--and many other types of buildings--is a spinoff of fiber glass Beta yarn coated with Teflon TFE fluorocarbon resin. The big advance it offers is permanency.The team of DuPont, Chemical Fabrics and Birdair have collaborated on a number of fabric structures. Some are supported by air pressure, others by cables alone. Most of the structures are in the recreational category. With conventional construction costs still on the upswing, you're likely to see a great many more permanent facilities enclosed by the aerospace spinoff fabric.
Derived from text
Technology Utilization; Roofs; Materials Selection

20040074171 University of Southern Mississippi, MS, USA
Success Continues: NASA-Developed Plant Health Measurement Technology is Becoming Big Business for Illinois Company
November 21, 2003; 2 pp.; In English
Report No.(s): NASA/NP-2003-11-00047-SSC; No Copyright; Avail: CASI; A01, Hardcopy

Originally produced in 2001, sales of Spectrum Technologies' CM 1000 chlorophyll meter have now topped $290,000 on 140 units. Up-to-date sales figures for 2003 have shown an almost 50% increase over the combined sales totals of 2001 and 2002. The CM 1000 chlorophyll meter identifies the failing health of a plant based on the chlorophyll content of the plant up to 16 days before it is physically detectable by the human eye. Poor health, 'stress' in a plant, is a result of unfavorable growing conditions; lack of nutrients, insufficient water, disease or insect damage.
Author
Instruments; Plant Stress; Chlorophylls; Product Development

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*.

20040068195 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Thermopile Detector Arrays for Space Science Applications
Foote, M. C.; Kenyon, M.; Krueger, T. R.; McCann, T. A.; Chacon, R.; Jones, E. W.; Dickie, M. R.; Schofield, J. T.; McCleese, D. J.; Gaalema, S., et al.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 2-16 - 2-20; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

Thermopile detectors are widely used in uncooled applications where small numbers of detectors are required, particularly in low-cost commercial applications or applications requiring accurate radiometry. Arrays of thermopile detectors, however, have not been developed to the extent of uncooled bolometer and pyroelectric/ferroelectric arrays. Efforts at JPL seek to remedy this deficiency by developing high performance thin-film thermopile detectors in both linear and two-dimensional formats. The linear thermopile arrays are produced by bulk micromachining and wire bonded to separate CMOS readout electronic chips. Such arrays are currently being fabricated for the Mars Climate Sounder instrument, scheduled for launch

in 2005. Progress is also described towards realizing a two-dimensional thermopile array built over CMOS readout circuitry in the substrate.
Author
Thermopiles; Bolometers; Detectors; Pyroelectricity; Radiometers; Linear Arrays

20040068216 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Large Format Narrow-Band, Multi-Band, and Broad-Band LWIR QWIP Focal Planes for Space and Earth Science Applications
Gunapala, S. D.; Bandara, S. V.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 7-12 - 7-15; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A 640x512 pixel, long-wavelength cutoff, narrow-band (delta(lambda)/approx. 10%) quantum well infrared photodetector (QWIP) focal plane array (FPA), a four-band QWIP FPA in the 4-16 m spectral region, and a broad-band (delta(lambda)/approx. 42%) QWIP FPA having 15.4 m cutoff have been demonstrated.
Author
Narrowband; Broadband; Focal Plane Devices; Infrared Radiation; M Region; Spectral Bands

20040068390 NASA Marshall Space Flight Center, Huntsville, AL, USA
Spaceflight Operations Services Grid (SOSG)
Bradford, Robert N.; Thigpen, William W.; [2004]; 3 pp.; In English; Ground Systems Architecture Workshop 2004, 30 Mar. - 1 Apr. 2004, Manhatten Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In an effort to adapt existing space flight operations services to new emerging Grid technologies we are developing a Grid-based prototype space flight operations Grid. This prototype is based on the operational services being provided to the International Space Station's Payload operations located at the Marshall Space Flight Center, Alabama. The prototype services will be Grid or Web enabled and provided to four user communities through portal technology. Users will have the opportunity to assess the value and feasibility of Grid technologies to their specific areas or disciplines. In this presentation descriptions of the prototype development, User-based services, Grid-based services and status of the project will be presented. Expected benefits, findings and observations (if any) to date will also be discussed. The focus of the presentation will be on the project in general, status to date and future plans. The End-use services to be included in the prototype are voice, video, telemetry, commanding, collaboration tools and visualization among others. Security is addressed throughout the project and is being designed into the Grid technologies and standards development. The project is divided into three phases. Phase One establishes the baseline User-based services required for space flight operations listed above. Phase Two involves applying Gridlweb technologies to the User-based services and development of portals for access by users. Phase Three will allow NASA and end users to evaluate the services and determine the future of the technology as applied to space flight operational services. Although, Phase One, which includes the development of the quasi-operational User-based services of the prototype, development will be completed by March 2004, the application of Grid technologies to these services will have just begun. We will provide status of the Grid technologies to the individual User-based services. This effort will result in an extensible environment that incorporates existing and new spaceflight services into a standards-based framework providing current and future NASA programs with cost savings and new and evolvable methods to conduct science. This project will demonstrate how the use of new programming paradigms such as web and grid services can provide three significant benefits to the cost-effective delivery of spaceflight services. They will enable applications to operate more efficiently by being able to utilize pooled resources. They will also permit the reuse of common services to rapidly construct new and more powerful applications. Finally they will permit easy and secure access to services via a combination of grid and portal technology by a distributed user community consisting of NASA operations centers, scientists, the educational community and even the general population as outreach. The approach will be to deploy existing mission support applications such as the Telescience Resource Kit (TReK) and new applications under development, such as the Grid Video Distribution System (GViDS), together with existing grid applications and services such as high-performance computing and visualization services provided by NASA s Information Power Grid (IPG) in the MSFC s Payload Operations Integration Center (POIC) HOSC Annex. Once the initial applications have been moved to the grid, a process will begin to apply the new programming paradigms to integrate them where possible. For example, with GViDS, instead of viewing the Distribution service as an application that must run on a single node, the new approach is to build it such that it can be dispatched across a pool of resources in response to dynamic loads. To make this a reality, reusable services will be critical, such as a brokering service to locate appropriate resource within the pool. This brokering service can then be used by other applications such as the TReK. To expand further, if the GViDS application is constructed using a services-based mel, then other applications such as the Video Auditorium can then use GViDS as a service to easily incorporate these video streams into a collaborative conference. Finally, as these

applications are re-factored into this new services-based paradigm, the construction of portals to integrate them will be a simple process. As a result, portals can be tailored to meet the requirements of specific user communities.
Derived from text
Flight Operations; Grid Computing (Computer Networks); Space Flight; Conferences

20040073491 NASA Marshall Space Flight Center, Huntsville, AL, USA
Uses of Computed Tomography for Characterizing Materials Grown Terrestrially and in Microgravity
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 16; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Tomography (CT) has proved to be of inestimable use in providing a rapid evaluation of a variety of samples from Mechanics of Granular Materials (MGM) to electronic materials (Ge-Si alloys) to space grown materials such as meteorites. The system at Kennedy Space Center (KSC), because of its convenient geographical location, is ideal for examining samples before launch and immediately after returning to Earth. It also has the advantage of the choice of fluxes, and in particular the use of a radioactive cobalt source, which is basically monochromatic. This permits a reasonable measurement of density to be made from which chemical composition can be determined. Due to the current dearth of long duration space grown materials, the CT instrument has been used: (1) to characterize materials in preparation for flight, (2) to determine thermal expansion values, and (3) to examine long duration space grown materials, i.e. meteorites. This work will first describe the establishment of the protocol for obtaining the optimum density readings for any material. Included will be the effects of the hardware or instrumental parameters that can be controlled, and the techniques used to process the CT data. Examples will be given of the compositional variation along a single crystal of Ge-Si alloy. Density variation with temperature has been measured in preparation for future materials science experiments; this involved the fabrication at MSFC and installation of a single zone furnace at KSC incorporating a heat pipe to ensure high temperature uniformity. At the time of writing the thermal expansion of lead (Pb) has been measured from room temperature to 900 C. Three methods are available. Digital radiography enables length changes to be determined. Prior to melting the sample is smaller than the container and the diameter change can be measured. Most critical, however, is the density change in solid, through the melting region, and in the liquid state. These data are needed for engineering purposes to aid in the design of containment cartridges, and for enabling fluid flow calculations. A second sample, with the Pb alloyed with Sb is ready for scanning. This corresponds to the planned composition of Dr. Poirier s flight experiment. Other materials pertinent to NASA programs such as Al-Cu (Trivedi), CdTe (Banish), HgCdTe (Lehoczky) will be examined below and above the melting point. Finally, three-dimensional results will be shown of the structure of a two-phase metallic meteorite of metal and sulfide, in which the Fe-Ni phase has coarsened during slow cooling over hundreds of millions of years.
Author
Aluminum Alloys; Cadmium Tellurides; Copper Alloys; Mercury Cadmium Tellurides; Microgravity; Crystal Growth

20040073503 NASA Marshall Space Flight Center, Huntsville, AL, USA
Basic and Applied Materials Science Research Efforts at MSFC Germane to NASA Goals
Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 6; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Presently, a number of investigations are ongoing that blend basic research with engineering applications in support of NASA goals. These include (1) "Pore Formation and Mobility (PFMI) " An ISS Glovebox Investigation" NASA Selected Project - 400-34-3D; (2) "Interactions Between Rotating Bodies" Center Director's Discretionary Fund (CDDF) Project - 279-62-00-16; (3) "Molybdenum - Rhenium (Mo-Re) Alloys for Nuclear Fuel Containment" TD Collaboration - 800-11-02; (4) "Fabrication of Alumina - Metal Composites for Propulsion Components" ED Collaboration - 090-50-10; (5) "Radiation Shielding for Deep-Space Missions" SD Effort; (6) "Other Research". In brief, "Pore Formation and Mobility" is an experiment to be conducted in the ISS Microgravity Science Glovebox that will systematically investigate the development, movement, and interactions of bubbles (porosity) during the controlled directional solidification of a transparent material. In addition to promoting our general knowledge of porosity physics, this work will serve as a guide to future ISS experiments utilizing metal alloys. "Interactions Between Rotating Bodies" is a CDDF sponsored project that is critically examining, through theory and experiment, claims of "new" physics relating to gravity modification and electric field effects. "Molybdenum - Rhenium Alloys for Nuclear Fuel Containment" is a TD collaboration in support of nuclear propulsion. Mo-Re alloys are being evaluated and developed for nuclear fuel containment. "Fabrication of Alumina - Metal Composites for Propulsion Components" is an ED collaboration with the intent of increasing strength and decreasing weight of metal engine components through the incorporation of nanometer-sized alumina fibers. "Radiation

Shielding for Deep-Space Missions" is an SD effort aimed at minimizing the health risk from radiation to human space voyagers; work to date has been primarily programmatic but experiments to develop hydrogen-rich materials for shielding are planned. "Other Research" includes: BUNDLE (Bridgman Unidirectional Dendrite in a Liquid Experiment) activities (primarily crucible development), vibrational float-zone processing (with Vanderbilt University), use of ultrasonics in materials processing (with UAH), rotational effects on microstructural development, and application of magnetic fields for mixing.
Author
Rhenium Alloys; Nuclear Fuels; Aluminum Oxides; Directional Solidification (Crystals); Nuclear Propulsion

20040074232 Massachusetts Inst. of Tech., Cambridge, MA, USA
Physical Characterization of the Near-Earth Object Population
Binzel, Richard P.; 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12355; No Copyright; Avail: CASI; A01, Hardcopy

Many pieces of the puzzle must be brought together in order to have a clear picture of the near-Earth object (NEO) population. Four of the pieces that can be described include: i) the taxonomic distribution of the population as measured by observational sampling, ii) the determination of albedos that can be associated with the taxonomic distribution, iii) discovery statistics for the NE0 population, and iv) the debiasing of the discovery statistics using the taxonomic and albedo information. Support from this grant enables us to address three of these four pieces. Binzel et al. (2004, submitted) presents the first piece, detailing the observations and observed characteristics of the NE0 and Mars-crossing (MC) population. For the second piece, a complementary program of albedo measurements is pursued at the Keck Observatory (Binzel, P. I.) with first results published in Delbo et al. (2003). For the third piece, the most extensive NE0 discovery statistics are provided by the LINEAR survey. Binzel has supervised the MIT Ph. D. thesis work of Stuart (2003) to bring the fourth piece, submitted for publication by Stuart and Binzel (2004). Our results provide new constraints for the NE0 population and progress for the Spaceguard Survey, illuminate asteroid and comet source regions for the NEOs, and provide new evidence for space weathering processes linking asteroids and meteorites. Further, we are identifying top priority near-Earth spacecraft mission candidates based on their spectral properties and inferred compositions.
Author
Taxonomy; Asteroids; Meteorites; Space Weathering; Comets

20040074233 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Computational Physics for Space Flight Applications
Reed, Robert A.; 2004; 57 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

This paper presents viewgraphs on computational physics for space flight applications. The topics include: 1) Introduction to space radiation effects in microelectronics; 2) Using applied physics to help NASA meet mission objectives; 3) Example of applied computational physics; and 4) Future directions in applied computational physics.
CASI
Space Flight; Physics; Computation; Extraterrestrial Radiation; Aerospace Environments

20040074234 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Calibration of TOMS Radiances From Ground Observations
Bojkov, B. R.; Kowalewski, M.; Wellemeyer, C.; Labow, G.; Hilsenrath, E.; Bhartia, P. K.; Ahmad, Z.; [2003]; 1 pp.; In English; Fall AGU 2003, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Verification of a stratospheric ozone recovery remains a high priority for environmental research and policy definition. Models predict an ozone recovery at a much lower rate than the measured depletion rate observed to date. Therefore improved precision of the satellite and ground ozone observing systems are required over the long term to verify its recovery. We show that validation of radiances from the ground can be a very effective means for correcting long term drifts of backscatter type satellite measurements and can be used to cross calibrate all BUV instruments in orbit (TOMS, SBUV/2, GOME, SCIAMACHY, OMI, GOME-2, OMPS). This method bypasses the retrieval algorithms used to derive ozone products from both satellite and ground based measurements that are normally used to validate the satellite data. Radiance comparisons employ forward models, but they are inherently more accurate than the retrieval This method employs very accurate comparisons between ground based zenith sicy radiances and satellite nadir radiances and employs two well established capabilities at the Goddard Space Flight Center, 1) the SSBUV calibration facilities and 2) the radiative transfer codes used for the TOMS and SBUV/2 algorithms and their subsequent refinements. The zenith sky observations are made by the SSBUV

where its calibration is maintained to a high degree of accuracy and precision. Radiative transfer calculations show that ground based zenith sky and satellite nadir backscatter ultraviolet comparisons can be made very accurately under certain viewing conditions. Initial ground observations taken from Goddard Space Flight Center compared with radiative transfer calculations has indicated the feasibility of this method. The effect of aerosols and varying ozone amounts are considered in the model simulations and the theoretical comparisons. The radiative transfer simulations show that the ground and satellite radiance comparisons can be made with an uncertainty of less than l\% without the knowledge of the amount ozone viewed by either instrument on ground or in space. algorithms.
Derived from text
Environment Management; Atmospheric Composition; Radiative Transfer; Ultraviolet Radiation; Ozone; Radiance

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040068128 Hawaii Univ., Honolulu, HI, USA
FUSE Observations of LMC and SMC 03-4 Stars: Physical Parameters of the Hottest Stars
Kudrtizki, Rolf-Peter; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11938; No Copyright; Avail: CASI; A01, Hardcopy

The goal of the project is to analyze the spectra of the most massive stars in our neighbor Galaxies, to determine the physical parameters of temperature, mass, gravity, and Luminosity, together with the stellar wind properties. For this purpose, FUSE spectra, HST spectra (uv and optical) and high quality optical spectra obtained with ground-based telescopes need to be analyzed wing modern NLTE model atmosphere techniques. The combination of the use of spectra from different wavelength regions is a fundamental aspect of the project. Each spectral domain adds complementary important to the process of the spectral analysis. In this way the comparison of stellar properties between galaxies of different metallicity will become more significant.
Derived from text
Hot Stars; Massive Stars; Galaxies; Astronomy; Physical Properties

20040068129 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Studying X-Ray Binaries with High Frequency Quasi-Periodic Oscillations
Oliversen, Ronald, Technical Monitor; Kaaret, Philip; March 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-7405; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this investigation is to further our understanding of the dynamics of accreting neutron stars and black holes in the hope of using these systems as probes of the physics of strong gravitational fields. The main focus of this work has been a multi-year program of millisecond X-ray timing and spectral observations of accreting compact objects. include imaging of X-ray jets from binaries and the study of extragalactic X-ray binaries. past year. Nine papers were accepted and/or published, as listed below. Seven of these are new since our previous annual report. With the advent of Chandra, we have extended our work to Significant progress was made over the The presentation of several talks and posters at astronomical meetings were supported by this grant. The PI was the lead organizer of "X-Ray Timing 2003: Rossi and Beyond", a major conference held in Cambridge, MA, in November, 2003. A t the conference we reviewed the accomplishments of the Rossi X-Ray Timing Explorer and developed the scientific motivation for a future X-ray timing mission. This conference was well attended and generated a significant amount of interest.
Author
X Ray Binaries; High Frequencies; Oscillations; Time Measurement; Neutron Stars

20040068253 Lawrence Livermore National Lab., Livermore, CA
Science and Technology Review: Riding the Waves of High-Power Computing
Jun. 2003; In English
Report No.(s): DE2003-15004365; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Livermore's Three-Pronged Strategy for High-Performance Computing; Riding the Waves of Supercomputing Technology; Chromosome 19 and Lawrence Livermore Form a Long-Lasting Bond; A New Way

to Measure the Mass of Stars; Flexibly Fueled Storage Tank Brings Hydrogen-Powered Cars Closers to Reality; The Laboratory in the News; Patents and Awards and Abstracts.
NTIS
Research and Development; Supercomputers; Chromosomes

20040068308 National Centers for Environmental Prediction, Silver Spring, MD
Intense Space Weather Storms, October 19-November 07, 2003: Service Assessment
Mar. 2004; In English
Report No.(s): PB2004-105255; No Copyright; Avail: National Technical Information Service (NTIS)

The October-November 2003 solar storms rank as one of the largest outbreaks of solar activity in recent history. The global effects were wide-ranging, impacting power grids, airline flights, spacecraft operations, and much more. Media interest and public awareness of this activity was at the highest levels ever. Due to the magnitude of this space weather event, a service assessment team was formed to examine the space environment warning and forecast services provided by the NOAA Space Environment Center. Service assessments provide a valuable contribution to our ongoing efforts to improve the quality and timelessness of our products and services for the protection of life and property. Findings and recommendations from this assessment will help to improve techniques, products, services, and the information provided to the American public and citizens around the world.
NTIS
Aerospace Environments; Meteorological Services; Space Weather

20040068393 NASA Ames Research Center, Moffett Field, CA, USA
Disk Dispersal Around Young Stars
Hollenbach, David; [2004]; 1 pp.; In English; Modeling the Structure, Chemistry and Appearance of Protopnaetary Disks, 13-17 Apr. 2004, Bavaria, Germany
Contract(s)/Grant(s): 21-344-53-00; No Copyright; Avail: Other Sources; Abstract Only

We first review the evidence pertaining to the lifetimes of planet-forming disks of gas and dust around young stars and discuss possible disk dispersal mechanisms: 1) viscous accretion of material onto the central source, 2) close stellar encounters, 3) stellar winds, and 4) photoevaporation caused by the heating of the disk surface by ultraviolet radiation. Photoevaporation is likely the most important dispersal mechanism for the outer regions of disks, and this talk focuses on the evaporation caused by the presence of a nearby, luminous star rather than the central star itself. We also focus on disks around low-mass stars like the Sun rather than high-mass stars, which we have treated previously. Stars often form in clusters and the ultraviolet flux from the most luminous star in the cluster can have a dramatic effect on the disk orbiting a nearby low-mass star. We apply our theoretical models to the evaporating protoplanetary disks (or "proplyds") in the Trapezium cluster in Orion, to the formation of gas giant planets like Jupiter around Sun-like stars in the Galaxy, and to the formation of Kuiper belts around low mass stars. We find a possible explanation for the differences between Neptune and Jupiter, and make a prediction concerning recent searches for giant planets in large clusters. We discuss recent models of the infrared spectra from gaseous disks around young stars.
Author
Planetary Evolution; Protoplanetary Disks; Gas Giant Planets; Dispersing; Dust; Radiant Heating

20040068394 NASA Ames Research Center, Moffett Field, CA, USA
A Technical Overview and Description of SOFIA (Stratospheric Observatory for Infrared Astronomy)
Kunz, Nans; November 23, 2003; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

This paper provides a technical overview of SOFIA, a unique airborne observatory, from an engineering perspective. It will do this by describing several of the systems of this observatory that are common with mountain top ground based observatories but mostly emphasize those more unique features and systems that are required to facilitate world class astronomy from a highly modified Boeing 747-SP flying at Mach 0.84 in the Stratosphere. This paper provides a technical overview of SOFIA by reviewing each of the performance specifications (the level one requirements for development) and describing some of the technical advancements for the telescope as well as the platform required to achieve these performance specifications. The technical advancements involved include mirror technologies, control system features, the telescope suspension system, and the aircraft open port cavity with associated cavity door that opens in flight and tracks the telescope elevation angle. For background this paper will provide a brief programmatic overview of the SOFIA project including the joint project arrangement between the US and Germany (NASA and DLR). Additionally, this paper will describe the up to date

status of the development of SOFIA as the Observatory nears the date of the first test flight in the summer of 2004.
Author
Elevation Angle; Functional Design Specifications; Stratosphere

20040070913 NASA Marshall Space Flight Center, Huntsville, AL, USA
Revealing the X-Ray Emission Processes of Old Rotation-Powered Pulsars: XMM-Newton Observations of PSR B0950+08, PSR B0823+26 and PSR J2043+2740
Becker, Werner; Weisskopf, Martin C.; Tenant, Allyn F.; Jessmer, Axel; Zhang, Shiang N.; 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We have completed part of a program to study the X-ray emission properties of old rotation-powered pulsars with XMM-Newton in order to probe and identify the origin of their X radiation. The X-ray emission from these old pulsars is largely dominated by non-thermal processes. None of the observed spectra required adding a thermal component consisting of either a hot polar cap or surface cooling emission to model the data. The energy spectrum of PSR B0950+08 is best described by a single power law of photon-index alpha = 1.93(sup +0.14)(sub -0.12). Three-sigma temperature upper limits for possible contributions from a heated polar cap or the whole neutron star surface are T(sup infinity)(sub pc) < 0.87 x 10(exp 6) K and T(sup infinity)(sub s) < 0.48 x 10(exp 6) K, respectively. We also find that the X-ray emission from PSR B0950+08 is pulsed with two peaks per rotation period. The phase separation between the two X-ray peaks is approx. 144 deg (maximum to maximum) which is similar to the pulse peak separation observed in the radio band at 1.4 GHz. The fraction of X-ray pulsed photons is approx. 30%. A phase resolved spectral analysis confirms the nonthermal nature of the pulsed emission and finds power law slopes of alpha = 2.4(sup +0.52)(sub -0.42) and alpha = 1.93(sup +0.29)(sub -0.24) for the pulse peaks P1 and P2, respectively. The spectral emission properties observed for PSR B0823+26 are similar to those of PSR B0950+08. Its energy spectrum is very well described by a single power law with photon-index alpha = 2.5(sup +0.52)(sub -0.24. Three-sigma temperature upper limits for thermal contributions from a hot polar cap or from the entire neutron star surface are T(sup infinity)(sub pc) < 1.17 x 10(exp 6) K and T(sup infinity)(sub s) < 0.5 x 10(exp 6) K, respectively. There is evidence for pulsed X-ray emission at the - 97% confidence level with a pulsed fraction of 49 +/- 22%. For PSR 52043+2740 we report the first detection of X-ray emission. A power law spectrum, or a combination of a thermal and a power law spectrum all yield acceptable descriptions of its X-ray spectrum. No X-ray pulses are detected from PSR J2043+2740 but the sensitivity is low - the 2-sigma pulsed fraction upper limit is 57% assuming a sinusoidal pulse profile.
Author
X Ray Astronomy; Pulsars; Spectral Emission

20040071009 NASA Marshall Space Flight Center, Huntsville, AL, USA
On the Nature of the Bright Short-Period X-Ray Source in the Circinus Galaxy Field
Weisskopf, Martin C.; Wu, Kinwah; Tennant, Allyn F.; Swartz, Douglas A.; Ghosh, Kajal K.; The Astrophysical Journal; 10 Apr. 2004; Vol. 605, pp. 360-367; In English; Copyright; Avail: Other Sources

The spectrum and light curve of the bright X-ray source CG X-1 in the field of the Circinus galaxy are reexamined. Previous analyses have concluded that the source is an accreting black hole of mass > or approx. 50 solar masses although it has been noted that the light curve resembles that of an AM Herculis system. Here we show that the short period and an assumed main-sequence companion constrain the mass of the companion to less than 1 solar mass. Furthermore, a possible eclipse seen during one of the Chandra observations and a subsequent XMM-Newton observation constrain the mass of the compact object to less than 60 solar masses. If such a system lies in the Circinus galaxy, then the accreting object must either radiate anisotropically or strongly violate the Eddington limit. Even if the emission is beamed, then the companion star that intercepts this flux during eclipse will be driven out of thermal equilibrium and evaporate within approx. 10(exp 3) yr. We find that the observations cannot rule out an AM Herculis system in the Milky Way and that such a system can account for the variations seen in the light curve.
Author
X Ray Binaries; Black Holes (Astronomy); Emission Spectra; X Ray Astronomy

20040071107 California Inst. of Tech., Pasadena, CA, USA
A XMM Survey for Compact Objects in Supernova Remnants
Kulkarni, Shrinivas R.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12925
Report No.(s): CIT-SRK.00049-1-NASA.000147; No Copyright; Avail: CASI; A01, Hardcopy

The goal of the project is to identify candidate neutron stars in Galactic supernova remnants (SNRs) through their X-ray emission. With XMM we observed the SNRs and typically find 10 - 50 X-ray sources. Almost all are either background galaxies or foreground stars. Therefore we must also pursue detailed optical/infrared follow-up observations to find counterparts for these X-ray sources and classify them. At the depth of the XMM observations, practically all confusing X-ray sources should have identifiable optical/IR counterparts. We have done a preliminary analysis of the XMM data and identified likely counterparts to the X-ray sources from available surveys(DSS, 2MASS). We then obtained wide-field optical/IR data from Palomar to get counterparts for the remaining sources. This analysis is underway: while often a single bright source is in the XMM error circle and can be considered a counterpart, in a number of cases we must do more detailed studies and evaluate several fainter optical/lR sources. We hope to have the final analysis of the XMM + Palomar data done this Fall. It is possible that additional, deeper optical/IR data may be necessary. We expect to publish our results by the end of this year. Author

Neutron Stars; Supernova Remnants; Surveys; Visual Observation

20040071147 Alabama Univ., Huntsville, AL, USA

Studying the Warm Layer and the Hardening Factor in Cygnus X-1

Yao, Yangsen; Zhang, Shuangnan; Zhang, Xiaoling; Feng, Yuxin; April 2002; 1 pp.; In English

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

As the first dynamically determined black hole X-ray binary system, Cygnus X-1 has been studied extensively. However, its broadband spectrum observed with BeppoSax is still not well understood. Besides the soft excess described by the multi-color disk model (MCD), the power-law hard component and a broad excess feature above 10 keV (a disk reflection component), there is also an additional soft component around 1 keV, whose origin is not known currently. Here we propose that the additional soft component is due to the thermal Comptonization between the soft disk photons and a warm plasma cloud just above the disk, i.e., a warm layer. We use the Monte-Carlo technique to simulate this Compton scattering process and build a table model based on our simulation results. With this table model, we study the disk structure and estimate the hardening factor to the MCD component in Cygnus X-1.

Author

X Ray Binaries; X Ray Astronomy; Plasma Clouds

20040071149 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Constellation X-Ray Mission and Support

Grady, Jean, Technical Monitor; Tananbaum, H.; April 2004; 14 pp.; In English

Contract(s)/Grant(s): NCC5-368; No Copyright; Avail: CASI; A03, Hardcopy

This Fifth Annual Report summarizes work performed by the Smithsonian Astrophysical Observatory (SAO) for NASA Goddard Space Flight Center (GSFC) under Cooperative Agreement NCC5-368. The Agreement is entitled 'Constellation X-ray Mission Study and Support.' This report covers the period from October 1, 2002 through September 30,2003. The report summarizes the main areas of SAO activity. Most of the work has been done jointly with personnel from GSFC and Marshall Space Flight Center (MSFC). We describe SAO participation in these efforts. In spite of the work being mainly a level of effort, a significant amount of work was accomplished. Under the Agreement, SAO performed work in eight major areas of activity. These areas related to: 1) Constellation X-ray Mission Facility Definition Team and Study Management; 2) Science Support; 3) Spectroscopy X-ray Telescope (SXT); 4) Systems Engineering; 5) Travel in Support of the Work Effort; 6) In-house Management and Coordination; 7) Technical Readiness and Implementation Plan (TRIP) Report and Follow-up; 8) Industry Liaison and Study Preparation.

Author

X Ray Telescopes; Astronomical Observatories; Spaceborne Telescopes; Contract Management

20040071151 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evidence for Doppler-Shifted Iron Emission Lines in Black Hole Candidate 4U 1630-47

Cui, Wei; Chen, Wan; Zhang, Shuang Nan; Astrophysical Journal; Feb. 2000; Volume 529, Issue 2, pp. 952-960; In English

Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

We report the first detection of a pair of correlated the X-ray spectrum of black hole candidate 4U 1630-47 outburst, based on Rossi X-Ray Timing Explorer (RXTE) emission lines in during its 1996 observations of the source. At the peak plateau of the outburst, the emission lines are detected, centered mostly at approx. 5.7 and approx. 7.7 keV, respectively, while the line energies exhibit random variability approx. 5%. Interestingly, the lines move in a concerted manner to keep their

separation roughly constant. The lines also vary greatly in strength, but with the lower energy line always much stronger than the higher energy one. The measured equivalent width ranges from approx. 50 to approx. 270 eV for the former, and from insignificant detection to approx. 140 eV for the latter; the two are reasonably correlated. The correlation between the lines implies a causal connection; perhaps they share a common origin. Both lines may arise from a single K & alpha; line of highly ionized iron that is Doppler shifted either in a Keplerian accretion disk or in a bipolar outflow or even both. In both scenarios, a change in the line energy might simply reflect a change in the ionization state of line-emitting matter. We discuss the implication of the results and also raise some questions about such interpretations.
Author
X Ray Astronomy; Black Holes (Astronomy); Line Spectra; Iron

20040073166 NASA Marshall Space Flight Center, Huntsville, AL, USA
Spectroscopy of Cyg X-1 the High State with HETG/Chandra
Feng, Y. X.; Tennant, A.; Zhang, S. N.; Bulletin of the American Astronomical Society; 2002; Volume 34, pp. 1206; In English; 201st AAS Meeting
Contract(s)/Grant(s): NAG5-7927
Report No.(s): AAS-57.02; No Copyright; Avail: Other Sources; Abstract Only

Cyg X-1 was observed in the high state around orbital phase 0 with HETG/Chandra. Significant absorption lines of highly ionized species were detected, such as Fe XXV, Fe XXIV, Fe XXIII, S XIV, S XVI, Ne X, etc. The observed absorption lines are found to be blue-shifted (z approx. -0.002) from those observed in the low and transition states. In the high state each absorption line was composed of a blue-shifted absorption line and a un-shifted absorption line which similar to that observed in the low state. The broad line feature of Fe K(sub alpha;) at 6.4 keV was detected with a significance of Delta chi(Sup 2) approx. 40, although precise measurements are hindered by uncertainties in the calibration. The implications of these results on the configuration of the accretion flow of Cyg X-1 in the high state are discussed.
Author
Spectroscopy; Calibrating; Cygnus Constellation

20040073171 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Three-Layered Atmospheric Structure in Accretion Disks Around Stellar-Mass Black Holes
Zhang, S. N.; Cui, Wei; Chen, Wan; Yao, Yangsen; Zhang, Xiaoling; Sun, Xuejun; Wu, Xue-Bing; Xu, Haiguang; Science; 2000; Volume 287, Issue 5456, pp. 1239-1241; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

Modeling of the x-ray spectra of the Galactic superluminal jet sources GRS 1915+105 and GRO J1655-40 reveals a three-layered atmospheric structure in the inner region of the inner accretion disks. Above the cold and optically thick disk with a temperature of 0.2 to 0.5 kiloelectron volts, there is a warm layer with a temperature of 1.0 to 1.5 kiloelectron volts and an optical depth around 10. Sometimes there is also a much hotter, optically thin corona above the warm layer, with a temperature of 100 kiloelectron volts or higher and an optical depth around unity. The structural similarity between the accretion disks and the solar atmosphere suggests that similar physical processes may be operating in these different systems.
Author
Accretion Disks; Stellar Mass; Black Holes (Astronomy); X Ray Spectra; Stellar Structure

20040074122 Arizona Univ., Tucson, AZ, USA
Production of Star-Grazing and Star-Impacting Planetestimals via Orbital Migration of Extrasolar Planets
Quillen, A. C.; Holman, M.; The Astronomical Journal; 2000; Volume 119, pp. 397-402; In English
Contract(s)/Grant(s): NAG5-10365; Copyright; Avail: Other Sources; Abstract Only

During the orbital migration of a giant extrasolar planet via ejection of planetesimals (as studied by Murray et al. in 1998), inner mean-motion resonances can be strong enough to cause planetesimals to graze or impact the star. We integrate numerically the motions of particles which pass through the 3:1 or 4:1 mean-motion resonances of a migrating Jupiter-mass planet. We find that many particles can be trapped in the 3:1 or 4:1 resonances and pumped to high enough eccentricities that they impact the star. This implies that for a planet migrating a substantial fraction of its semimajor axis, a fraction of its mass in planetesimals could impact the star. This process may be capable of enriching the metallicity of the star at a time when the star is no longer fully convective. Upon close approaches to the star, the surfaces of these planetesimals will be sublimated. Orbital migration should cause continuing production of evaporating bodies, suggesting that this process should be detectable with searches for transient absorption lines in young stars. The remainder of the particles will not impact the star but can be

ejected subsequently by the planet as it migrates further inward. This allows the planet to migrate a substantial fraction of its initial semimajor axis by ejecting planetesimals.
Author
Extrasolar Planets; Protoplanets; Planetary Orbits; Orbital Mechanics

20040074152 Naval Observatory, Washington, DC, USA, National Radio Astronomy Observatory, Socorro, NM, USA
Ground-State SiO Maser Emission Toward Evolved Stars
Boboltz, D. A.; Claussen, M. J.; Feb. 20, 2004; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A422690; No Copyright; Avail: CASI; A03, Hardcopy

We have made the first unambiguous detection of vibrational ground-state maser emission from 28SiO toward six evolved stars. Using the Very Large Array, we simultaneously observed the v = 0,J = 1-0, 43.4-GHz, groundstate and the v = 1,J = 1-0, 43.1-GHz, first excited-state transitions of 28SiO toward the oxygen-rich evolved stars IRC+10011, o Ceti, W Hya, RX Boo, NML Cyg, and R Cas and the S-type star chi Cyg. We detected at least one v = 0 SiO maser feature from six of the seven stars observed, with peak maser brightness temperatures ranging from 10000 K to 108800 K. In fact, four of the seven v = 0 spectra show multiple maser peaks, a phenomenon which has not been previously observed. Ground-state thermal emission was detected for one of the stars, RX Boo, with a peak brightness temperature of 200 K. Comparing the v = 0 and the v = 1 transitions, we find that the ground-state masers are much weaker with spectral characteristics different from those of the first excited-state masers. For four of the seven stars the velocity dispersion is smaller for the v = 0 emission than for the v = 1 emission, for one star the dispersions are roughly equivalent, and for two stars (one of which is RX Boo) the velocity spread of the v = 0 emission is larger. In most cases, the peak flux density in the v = 0 emission spectrum does not coincide with the v = 1 maser peak. Although the angular resolution of these VLA observations were insufficient to completely resolve the spatial structure of the SiO emission, the SiO spot maps produced from the interferometric image cubes suggest that the v = 0 masers are more extended than their v = 1 counterparts.
DTIC
Ground State; Interferometry; Masers; Radio Astronomy

20040074164 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Long-Term Stability of Planets in Binary Systems
Holman, Matthew J.; Wiegert, Paul A.; The Astronomical Journal; 1′999; Volume 117, pp. 621-628; In English
Contract(s)/Grant(s): NAG5-10365; No Copyright; Avail: Other Sources; Abstract Only

A simple question of celestial mechanics is investigated: in what regions of phase space near a binary system can planets persist for long times? The planets are taken to be test particles moving in the field of an eccentric binary system. A range of values of the binary eccentricity and mass ratio is studied, and both the case of planets orbiting close to one of the stars, and that of planets outside the binary orbiting the systems center of mass, are examined. From the results, empirical expressions are developed for both (1) the largest orbit around each of the stars and (2) the smallest orbit around the binary system as a whole, in which test particles survive the length of the integration (10A4 binary periods). The empirical expressions developed, which are roughly linear in both the mass ratio mu and the binary eccentricity e, are determined for the range 0.0=e=0.7-0.8 and 0.1=mu=0.9 in both regions and can be used to guide searches for planets in binary systems. After considering the case of a single low-mass planet in binary systems, the stability of a mutually interacting system of planets orbiting one star of a binary system is examined, though in less detail.
Author
Planets; Center of Mass; Eccentricity; Celestial Mechanics; Systems Stability

20040074165 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
On the Origin of Chaos in the Asteroid Belt
Murray, N.; Holman, M.; Potter, M.; The Astronomical Journal; 1998; Volume 116, pp. 2583-2589; In English
Contract(s)/Grant(s): NAG5-10365; No Copyright; Avail: Other Sources; Abstract Only

We consider the effect of gravitational perturbations from Jupiter on the dynamics of asteroids, when Jupiter is itself perturbed by Saturn. The presence of Saturn introduces a number of additional frequencies into Jupiters orbit. These frequencies in turn produce chaos in narrow regions on either side of the chaotic zones associated with the mean motion resonances between the asteroids and Jupiter. The resonant arguments of these three-body resonances contain the longitudes of Jupiter and the asteroid together with either the secular frequency 9-6, or the longitude of Saturn. Resonances involving the longitude of Saturn are analogs of the Laplace resonance in the Jovian satellite system. We show that many three-body

resonances involving the longitude of Saturn are chaotic. We give simple expressions for the width of the chaotic region and the associated Lyapunov time. In some cases the chaos can produce a diffusive growth in the 4 eccentricity of the asteroid that leads to ejection of the asteroid on times shorter than the age of the solar system. We give simple estimates for the diffusion time. Finally, we present the results of numerical integrations testing the theory.
Author
Asteroid Belts; Chaos; Eccentricity; Diffusivity; Jupiter (Planet); Perturbation

20040074167 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
The Geometry of Resonant Signatures in Debris Disks with Planets
Kuchner, Marc J.; Holman, Matthew J.; The Astrophysical Journal; [2002]; Volume 588, pp. 1110-1120; In English
Contract(s)/Grant(s): NAG5-10365; No Copyright; Avail: Other Sources; Abstract Only

Using simple geometrical arguments, we paint an overview of the variety of resonant structures a single planet with moderate eccentricity (e<approx.0.6) can create in a dynamically cold, optically thin dust disk. This overview may serve as a key for interpreting images of perturbed debris disks and inferring the dynamical properties of the planets responsible for the perturbations. We compare the resonant geometries found in the solar system dust cloud with observations of dust clouds around Vega, Epsilon Eridani, and Fomalhaut.
Author
Signatures; Perturbation; Eccentricity; Dust; Dwarf Stars; Clouds

20040074169 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Dynamical Influence of a Planet at Semimajor Axis 3.4 A on the Dust around Epsilon Eridani
Moran, Sean M.; Kuchner, Marc J.; Holman, Matthew J.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-10365
Report No.(s): astro-ph/0310813; No Copyright; Avail: Other Sources

No abstract available
Extrasolar Planets; Accretion Disks; Gravitational Effects

20040074177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Finding our Origins with the Hubble and James Webb Space Telescopes
Gardner, Jonathan P.; [2004]; 1 pp.; In English; Salisbury State University Astronomy Night, Salisbury Univ. and Optical Society Dinner, 18 May 2004, Greenbelt,MD, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA s Origins program is a series of space telescopes designed to study the origins of galaxies, stars, planets and life in the universe. In this talk, I will concentrate on the origin and evolution of galaxies, beginning with the Big Bang and tracing what we have learned with the Hubble Space Telescope through to the present day. I will introduce several of the tools that astronomers use to measure distances, measure velocities, and look backwards in time. I will show that results from studies with Hubble have led to plans for its successor, the James Webb Space Telescope, which is designed to find the first galaxies that formed in the distant past. I will finish with a short discussion of other missions in the Origins theme, including the Terrestrial Planet Finder.
Author
Galactic Evolution; Galaxies; Spaceborne Telescopes; Terrestrial Planets; Universe

20040074178 Stanford Univ., Stanford, CA, USA
Analysis of RXTE data on Clusters of Galaxies
Petrosian, Vahe; May 17, 2004; 1 pp.; In English
Contract(s)/Grant(s): NAG5-13031; No Copyright; Avail: Other Sources; Abstract Only

This grant provided support for the reduction, analysis and interpretation of of hard X-ray (HXR, for short) observations of the cluster of galaxies RXJO658--5557 scheduled for the week of August 23, 2002 under the RXTE Cycle 7 program (PI Vahe Petrosian, Obs. ID 70165). The goal of the observation was to search for and characterize the shape of the HXR component beyond the well established thermal soft X-ray (SXR) component. Such hard components have been detected in several nearby clusters. distant cluster would provide information on the characteristics of this radiation at a different epoch in the evolution of the imiverse and shed light on its origin. We (Petrosian, 2001) have argued that thermal bremsstrahlung, as proposed earlier, cannot be the mechanism for the production of the HXRs and that the most likely mechanism is Compton upscattering of the cosmic microwave radiation by relativistic electrons which are known to be present in the clusters and be

responsible for the observed radio emission. Based on this picture we estimated that this cluster, in spite of its relatively large distance, will have HXR signal comparable to the other nearby ones. The planned observation of a relatively The proposed RXTE observations were carried out and the data have been analyzed. We detect a hard X-ray tail in the spectrum of this cluster with a flux very nearly equal to our predicted value. This has strengthen the case for the Compton scattering model. We intend the data obtained via this observation to be a part of a larger data set. We have identified other clusters of galaxies (in archival RXTE and other instrument data sets) with sufficiently high quality data where we can search for and measure (or at least put meaningful limits) on the strength of the hard component. With these studies we expect to clarify the mechanism for acceleration of particles in the intercluster medium and provide guidance for future observations of this intriguing phenomenon by instrument on GLAST. The details of the nonthermal particle population has important implications for the theories of cluster formation, mergers and evolution. The results of this work were first presented at the High Energy Division meeting of the American astronomical Society at Mt. Tremblene, Canada (Petrosian et al. 2003). and in an invited review talk at the General Assembly of the International Astronomical Union at Sydney, Australia (Petrosian, 2003). A paper describe the observations, the data analysis and its implication is being prepared for publication in the Astrophysical Journal. Author

Astrophysics; Galactic Clusters; X Ray Timing Explorer; Data Processing

20040074198 Alabama Univ., Huntsville, AL, USA

Chandra Observations of Cygnus X-1 at Different Spectral States and Different Orbital Phases

Feng, Yixin; Zhang, Shuang Nan; Cui, Wei; Schultz, N. S.; Apr. 23, 2002; 1 pp.; In English; American Physical Society Meeting, Apr. 23, 2002, Albuquerque, NM, USA

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

Cygnus X-1 has been observed in different spectral states and at different orbit phases with the Chandra High Energy Transmission Grating Spectrometer. The observed absorption line and edge features are different in these observations. These differences may be caused by the variations of the column density at different orbit phases in a photoionized-wind accretion system. The variations of the absorption features observed in different states may also provide information about changes in the configuration of the corona and accretion disk around the black hole. We present results of our data analysis and discuss the physical implications of these results.

Author

X Ray Astronomy; X Ray Sources; X Ray Spectra

20040074200 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Earth Occultation Technique with the Burst and Transient Source Experiment

Wilson, C. A.; Harmon, B. A.; McCollough, M. L.; Fishman, M. L.; Zhang, S. N.; Paciesas, W. S.; Astronomical Data Analysis Software and Systems IX; 2000; Volume 216, pp. 587; In English

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

The Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (CGRO) is successfully being used as an all-sky hard X-ray monitor. The experiment consists of a set of eight uncollimated detectors sensitive to photons in the 20 keV to 2 MeV range. Since CGRO orbits the Earth at an altitude of about 450 km, about 33% of the sky, as viewed with BATSE, is covered by the Earth at any given time. The entire sky is subject to Earth occultation for some portion of CGRO's 52 day precession period. When a source sets below or rises above the Earth's limb, atmospheric attenuation produces step-like features in the BATSE data. The observed change in count rate in several energy bands provides a measurement of the source intensity and spectrum without sophisticated background models. These occultation features are used to locate and monitor astrophysical sources with BATSE when the source signal can be separated from the detector background. Examples of step searches, spectra, light curves, and transform imaging are presented.

Author

Earth Limb; Occultation; X Ray Astronomy

20040074205 Boston Univ., Boston, MA, USA

International Conference: Milky Way Surveys: The Structure and Evolution of Our Galaxy

Clemens, Dan; May 24, 2004; 9 pp.; In English; Milky Way Surveys: The Structure and Evolution of Our Galaxy, 15-17 Jun. 2003, Boston, MA, USA

Contract(s)/Grant(s): NAG5-13223; No Copyright; Avail: CASI; A02, Hardcopy

We were granted NASA support for partial sponsorship of an international conference on Galactic science, held June

15-17, 2003 and hosted by the Institute for Astrophysical Research at Boston University. This conference, entitled 'Milky Way Surveys: The Structure and Evolution of Our Galaxy' drew some 125 scientific experts, researchers, and graduate students to Boston to: (1) Present large area survey plans and findings; (2) Discuss important remaining questions and puzzles in Galactic science; and (3) To inform and excite students and researchers about the potential for using large area survey databases to address key Galactic science questions. An international Scientific Organizing Committee for this conference crafted a tightly packed two-day conference designed to highlight many recent and upcoming large area surveys (including 2MASS, SDSS, MSX, VLA-HI, GRS, and SIRTF/GLIMPSE) and current theoretical understandings and questions. By bringing together experts in the conduct of Galactic surveys and leading theorists, new ways of attacking long-standing scientific questions were encouraged. The titles of most of the talks and posters presented are attached to the end of this report.
Author
Milky Way Galaxy; Sky Surveys (Astronomy); Conferences

20040074260 NASA Goddard Space Flight Center, Greenbelt, MD, USA
New Concepts for Far-Infrared and Submillimeter Space Astronomy
Benford, Dominic J., Editor; Leisawitz, David T., Editor; April 2004; 535 pp.; In English; Second Workshop on New Concepts for Far-Infrared and Submillimeter Space Astronomy, 7-8 Mar. 2002, College Park, MD, USA; See also 20040074261 - 20040074321
Report No.(s): NASA/CP-2003-212233; Rept-2003-03082-0; No Copyright; Avail: CASI; A23, Hardcopy

The Second Workshop on New Concepts for Far-Infrared and Submillimeter Space Astronomy aimed to highlight the groundbreaking opportunities available for astronomical investigations in the far-infrared to submillimeter using advanced, space-based telescopes. Held at the University of Maryland on March 7-8, 2002, the Workshop was attended by 130 participants from 50 institutions, and represented scientists and engineers from many countries and with a wide variety of experience. The technical content featured 17 invited talks and 44 contributed posters, complemented by two sixperson panels to address questions of astronomy and technology.
Author
Spaceborne Astronomy; Far Infrared Radiation; Submillimeter Waves

20040074261 Space Telescope Science Inst., Baltimore, MD, USA
Star Formation in Local Galaxies from the UV to the Far-IR
Calzetti, D.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 69-78; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The star formation rates and histories of galaxies are gauged via a variety of indicators, from the direct stellar light (e.g., UV luminosity) to the dust-reprocessed light (far infrared luminosity). Yet, despite all the advances brought by a number of missions, including infrared ones like IRAS and ISO, the cross calibration between indicators at di.erent wavelengths is still incomplete. The largely unknown physical connection between stellar populations (the heaters) and the surrounding ISM (the emitters) in the vast zoo of extragalactic environments is the main culprit. Addressing this issue is a crucial step for understanding the nature of high redshift galaxies and galaxy evolution in general, but it is currently hampered by the angular resolution mismatch between UV/optical and far infrared/submillimeter telescopes. Far-IR/sub-mm missions with arcsec angular resolution or better are the obligatory course of action to solve this conundrum.
Author
Far Infrared Radiation; Star Formation Rate; Galaxies; Ultraviolet Radiation; Galactic Evolution

20040074262 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Observing Star and Planet Formation in the Submillimeter and Far Infrared
Yorke, Harold W.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 79-85; In English; See also 20040074260
Contract(s)/Grant(s): NRA-99-01-ATP-065; No Copyright; Avail: CASI; A02, Hardcopy

Stars from in the densest parts of cold interstellar clouds which-due to presence of obscuring dust-cannot be observed with optical telescopes. Recent rapid progress in understanding how stars and planets are formed has gone hand in hand with our ability to observe extremely young systems in the infrared and (submillimeter) spectral regimes. The detections and silhouetted imaging of disks around young objects in the visible and NIR have demonstrated the common occurrence of circumstellar disks and their associated jets and outflows in star forming regions. However, in order to obtain quantitative information pertaining to even earlier evolutionary phases, studies at longer wavelengths are necessary. From spectro-photometric imaging

at all wavelengths we learn about the temperature and density structure of the young stellar environment. From narrow band imaging in the far infrared and submillimeter spectral regimes we can learn much about the velocity structure and the chemical makeup (pre-biotic material) of the planet-forming regions.
Author
Far Infrared Radiation; Star Formation; Submillimeter Waves; Photometry; Planetary Evolution

20040074268 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Surveying Galaxy Evolution in the Far-Infrared: A Far-Infrared All-Sky Survey Concept
Benford, D. J.; Amato, M. J.; Dwek, E.; Freund, M. M.; Gardner, J. P.; Kashlinsky, A.; Leisawitz, D. T.; Mather, J. C.; Moseley, S. H.; Shafer, R. A., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 188-193; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

Half of the total luminosity in the Universe is emitted at rest wavelengths approximately 80-100 microns. At the highest known galaxy redshifts (z greater than or equal to 6) this energy is redshifted to approximately 600 microns. Quantifying the evolution of galaxies at these wavelengths is crucial to our understanding of the formation of structure in the Universe following the big bang. Surveying the whole sky will find the rare and unique objects, enabling follow-up observations. SIRCE, the Survey of Infrared Cosmic Evolution, is such a mission concept under study at NASA's Goddard Space Flight Center. A helium-cooled telescope with ultrasensitive detectors can image the whole sky to the confusion limit in 6 months. Multiple wavelength bands permit the extraction of photometric redshifts, while a large telescope yields a low confusion limit. We discuss the implications of such a survey for galaxy formation and evolution, large-scale structure, star formation, and the structure of interstellar dust.
Author
Galactic Evolution; Far Infrared Radiation; Sky Surveys (Astronomy); Spaceborne Astronomy

20040074269 Centre National de la Recherche Scientifique, Orsay, France
H2EX: A Space Mission Dedicated to the Observation of Molecular Hydrogen
Boulanger, Francois; Falgarone, Edith; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 194-204; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

We present a proposal for a space mission, H2EX, that would be dedicated to the mapping of H2 emission in its four lowest rotational transitions, at 28.2, 17.0, 12.3 and 9.7 micron with a spectral resolution approximately 10(exp 4) sufficient to provide kinematical distances in galaxies. The proposed instrument will be extremely sensitive to H2 with temperatures higher than 80 K. Colder H2, which may contribute most of the baryonic dark matter in galaxies, will be traced by the emission of the warm H2 heated, throughout the medium, by the dissipation of omnipresent turbulence. The main scientific objectives are to (i) directly measure the mass and temperature distribution of the warm H2, far from star forming regions, in particular in low metallicity environments where the traditional tracers of H2 (CO, dust emission) fail (ii) trace the dissipation of turbulence in the perspective of building a global view of the star formation process in galaxies and (iii) provide mass constraints on baryonic dark matter in the form of H2 in a large sample of galaxies along the Hubble sequence.
Author
Space Missions; Hydrogen; Molecular Gases; Spaceborne Astronomy

20040074270 Wales Univ. Inst. of Science and Technology, Cardiff, UK
Future Far-IR Mission and Submillimeter Space Missions: The European Perspective
Griffin, Matt; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 241-246; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The European astronomy and instrumentation community has a long history of participation in far-IR space astronomy satellites including IRAS, ISO, Herschel and Planck. While there are no specific far-IR/submillimetre missions in ESA's current long-term plan after Herschel and Planck, technology and design studies are currently underway, in connection with the IRSI-DARWIN infrared interferometer mission, which are relevant to any future FIR space observatory. In addition, following work on the Herschel, Planck, and NGST satellites, as well as many ground-based, balloon-borne and air-borne instruments, the European instrumentation community will have much to contribute at an international level to the next generation of far-IR/submillimetre missions. This includes the design and construction of large cryogenic focal plane units, optical design and stray light control, filter and quasi-optical component technology, cryogenic mechanisms, and large-format detector arrays for imaging and spectroscopy. Instrumentation heritage and expertise will be complemented by a strong

scientific enthusiasm amongst European astronomers to exploit the great astronomical potential of the far-IR and submillimetre range.
Author
Far Infrared Radiation; Submillimeter Waves; Space Missions; Europe; Spaceborne Astronomy; Observatories

20040074271 Institute of Space and Astronautical Science, Sagamihara, Japan
Future Far-IR and Submm Missions: Japanese Perspective
Nakagawa, Takao; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 237-240; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

We present the concept of the SPICA (Space Infrared Telescope for Cosmology and Astrophysics) mission, which incorporates a 3.5 m telescope cooled to 4.5 K. SPICA will focus on high-resolution mid-to far-infrared observations with unprecedented sensitivity. It will make great contributions to our understanding of important astronomical questions, such as the history of star-formation in the universe, the birth and evolution of AGN, the formation of planets in extrasolar systems, and the history of our solar system. In order to reduce the total weight dramatically, we propose a "warm launch" cooled telescope concept; the telescope is to be launched at ambient temperature and is to be cooled in orbit to 4.5 K by a modest mechanical cooler system with the assistance of effective radiative cooling. SPICA is proposed to be launched into a halo orbit around S-E L2 in 2010.
Author
Far Infrared Radiation; Submillimeter Waves; Space Missions; Spaceborne Telescopes; Cosmology; Japan; Astrophysics

20040074272 National Radio Astronomy Observatory, Charlottesville, VA, USA
The Atacama Millimeter Array (ALMA): Imaging Cosmic Dawn at Near-THz Frequencies
Wootten, Alwyn; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 247-255; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The Atacama Large Millimeter Array, or ALMA, is an international telescope project which will be built over the coming decade in Northern Chile. With over 7000 square meters of collecting area comprised of 64 12m antennas arrayed over baselines up to 14 kilometers in extent, ALMA will provide images of unprecedented clarity and detail. One revolutionary feature of ALMA will be its ability to combine interferometric and single telescope data, providing complete flux recovery. ALMA will cover a spectral wavelength range from 7 mm to 0.3 mm or shorter wavelengths, providing astronomy with its first detailed look at the structures which emit Terahertz and subTerahertz photons, the most abundant photons in the Universe.
Author
Imaging Techniques; Telescopes; Cosmology; Spaceborne Astronomy; Frequency Ranges; Antenna Arrays

20040074277 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Science Questions for the Post-SIRTF and Herschel Era
Werner, Michael; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 23-36; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

The contents include the following: 1. SIRTF. Long wavelength surveys planned for SIRTF. Galaxy Discovery Rates for Future Missions. Impact of SIRTF s Improved Resolution at 160um: Resolving the Background. 2. Polarimetry. Submillimeter Polarimetry - The State of Play. Magnetic Vectors Across the Orion Molecular Cloud Core. Neutral and Ionized Molecular Spectral Lines. Variation of Polarization With Wavelength. The Polarization Spectrum. Submillimeter Polarimetry - Looking Ahead. 3.Confusion. Confusion at 500, 600 micron. 4. Extragalactic Science. Do Massive Black Holes and Galaxy Bulges form Together? 5. Galactic Science. Can We See the First Generations of Stars and Metal Formation? The Birth of Planets and the Origins of Life. Spatial Resolution at 100 microns. Far-ir/Sub-mm Transitions of Linear Carbon Clusters. Predicted Spectra of Glycine.
Derived from text
Biological Evolution; Black Holes (Astronomy); Line Spectra; Molecular Clouds; Spatial Resolution

20040074278 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
The Herschel Mission
Pilbratt, Goeran; deGraauw, Thijs; Griffin, Matt; Poglitsch, Albrecht; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 256-258; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The Herschel Space Observatory (formerly known as FIRST) is the fourth cornerstone mission in the European Space

Agency (ESA) science programme. It will perform imaging photometry and spectroscopy in the far infrared and submillimetre part of the spectrum, covering approximately the 60-670 micron range. The key science objectives emphasize current questions connected to the formation of galaxies and stars, however, having unique capabilities in several ways, Herschel will be a facility available to the entire astronomical community. The three Herschel payload instruments and their capabilities are briefly described.
Author
Space Missions; Astronomical Observatories; Spectrometers; Spaceborne Telescopes; European Space Agency

20040074280 NASA Goddard Space Flight Center, Greenbelt, MD, USA
COSMOG: Cosmology Oriented Sub-mm Modeling of Galactic Foregrounds
Kashlinsky, A.; Leisawitz, D.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 271-277; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

With upcoming missions in mid- and far-Infrared there is a need for software packages to reliably simulate the planned observations. This would help in both planning the observation and scanning strategy and in developing the concepts of the far-off missions. As this workshop demonstrated, many of the new missions are to be in the far-IR range of the electromagnetic spectrum and at the same time will map the sky with a sub-arcsec angular resolution. We present here a computer package for simulating foreground maps for the planned sub-mm and far-IR missions. such as SPECS. The package allows to study confusion limits and simulate cosmological observations for specified sky location interactively and in real time. Most of the emission at wavelengths long-ward of approximately 50 microns is dominated by Galactic cirrus and Zodiacal dust emission. Stellar emission at these wavelengths is weak and is for now neglected. Cosmological sources (distant and not-so-distant) galaxies for specified cosmologies will be added. Briefly, the steps that the algorithm goes through is described.
Derived from text
Cosmology; Submillimeter Waves; Mathematical Models; Galaxies; Applications Programs (Computers)

20040074281 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Maximizing Science Capability for Far-Infrared Space Missions
Benford, Dominic; Leisawitz, Dave; Moseley, Harvey; Staguhn, Johannes; Voellmer, George; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 278-282; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The far-infrared and submillimeter region (20 microns-800 microns) has perhaps the greatest potential of all wavelengths for advancement in astronomy. When viewed in terms of the cosmic backgrounds, the far-IR is extremely important: half of the total luminosity in the Universe is emitted at rest wavelengths approximately 80-100 microns. At the highest known galaxy redshifts (z approximately equal to 6) this energy is redshifted to approximately 600 microns. Existing and planned missions have a broad range of capabilities, defined in terms of their spectral coverage, spectral resolution, angular resolution, mapping speed, and sensitivity. In this 5-dimensional parameter space, the far-IR is substantially be-hind most other wavelength bands. The opportunity for future missions with great discovery potential is evident. Such missions will be well-suited to answering fundamental questions about the history of energy release in the Universe, the formation and evolution of galaxies, and formation of stellar and protoplanetary systems. We discuss the parameter space that can be filled by a few well-chosen space missions, specifically a submillimeter all-sky survey and a far-IR to submillimeter observatory. Ultimately, a long baseline submillimeter interferometer is necessary to provide sensitivity and angular resolution.
Author
Far Infrared Radiation; Space Missions; Submillimeter Waves; Sky Surveys (Astronomy); Spaceborne Astronomy

20040074284 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
WaFIRS, a Waveguide Far-IR Spectrometer: Enabling Space-Borne Spectroscopy of High-z Galaxies in the Far-IR and Submm
Bradford, C. M.; Bock, J. J.; Dragovan, M.; Earle, L.; Glenn, J.; Naylor, B.; Nguyen, H.; Zmuidzinas, J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 285-294; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The discovery of galaxies beyond z approximately equal to 1 which emit the bulk of their luminosity at long wavelengths has demonstrated the need for high sensitivity, broadband spectroscopy in the far-IR/submm/mm bands. Because many of these sources are not detectable in the optical, long wavelength spectroscopy is key to measuring their redshifts and ISM conditions. The continuum source list will increase in the next decade with new ground-based instruments (SCUBA2,

Bolocam, MAMBO) and the surveys of HSO and SIRTF. Yet the planned spectroscopic capabilities lag behind, primarily due to the difficulty in scaling existing IR spectrograph designs to longer wavelengths. To overcome these limitations, we are developing WaFIRS, a novel concept for long-wavelength spectroscopy which utilizes a parallel-plate waveguide and a curved diffraction grating. WaFIRS provides the large (approximately 60%) instantaneous bandwidth and high throughput of a conventional grating system, but offers a dramatic reduction in volume and mass. WaFIRS requires no space overheads for extra optical elements beyond the diffraction grating itself, and is two-dimensional because the propagation is confined between two parallel plates. Thus several modules could be stacked to multiplex either spatially or in different frequency bands. The size and mass savings provide opportunities for spectroscopy from space-borne observatories which would be impractical with conventional spectrographs. With background-limited detectors and a cooled 3.5 telescope, the line sensitivity would be better than that of ALMA, with instantaneous broad-band coverage. We have built and tested a WaFIRS prototype for 1-1.6 mm, and are currently constructing Z-Spec, a 100 mK model to be used as a ground-based lambda/DELTAlambda approximately equal to 350 submillimeter galaxy redshift machine.
Author
Galaxies; Spectroscopy; Submillimeter Waves; Far Infrared Radiation; Waveguides; Spaceborne Astronomy; Spectrometers

20040074286 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Universe at Infrared and Submillimeter Wavelengths
Dwek, E.; Arendt, R. G.; Benford, D. J.; Mather, J. C.; Moseley, S. H.; Shafer, R. A.; Staguhn, J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 90-97; In English; See also 20040074260
Contract(s)/Grant(s): NRA-99-OSS-01; No Copyright; Avail: CASI; A02, Hardcopy

Far infrared and submillimeter surveys offer unique information on the early stages of galaxy formation and evolution, and the cosmic history of star formation and metal enrichment. This paper presents various model results that can be used in the interpretation of far-IR and submm surveys with different diameter telescopes.
Author
Far Infrared Radiation; Submillimeter Waves; Universe; Telescopes

20040074287 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
The Far Infrared Lines of OH as Molecular Cloud Diagnostics
Smith, Howard A.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 98-108; In English; See also 20040074260
Contract(s)/Grant(s): NAG5-10659; No Copyright; Avail: CASI; A03, Hardcopy

Future IR missions should give some priority to high resolution spectroscopic observations of the set of far-IR transitions of OH. There are 15 far-IR lines arising between the lowest eight rotational levels of OH, and ISO detected nine of them. Furthermore, ISO found the OH lines, sometimes in emission and sometimes in absorption, in a wide variety of galactic and extragalactic objects ranging from AGB stars to molecular clouds to active galactic nuclei and ultra-luminous IR galaxies. The ISO/LWS Fabry-Perot resolved the 119 m doublet line in a few of the strong sources. This set of OH lines provides a uniquely important diagnostic for many reasons: the lines span a wide wavelength range (28.9 m to 163.2 m); the transitions have fast radiative rates; the abundance of the species is relatively high; the IR continuum plays an important role as a pump; the contribution from shocks is relatively minor; and, not least, the powerful centimeter-wave radiation from OH allows comparison with radio and VLBI datasets. The problem is that the large number of sensitive free parameters, and the large optical depths of the strongest lines, make modeling the full set a difficult job. The SWAS montecarlo radiative transfer code has been used to analyze the ISO/LWS spectra of a number of objects with good success, including in both the lines and the FIR continuum; the DUSTY radiative transfer code was used to insure a self-consistent continuum. Other far IR lines including those from H2O, CO, and [OI] are also in the code. The OH lines all show features which future FIR spectrometers should be able to resolve, and which will enable further refinements in the details of each cloud's structure. Some examples are given, including the case of S140, for which independent SWAS data found evidence for bulk flows.
Author
Far Infrared Radiation; Molecular Clouds; Hydroxides; Detection; Line Spectra

20040074288 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Probing the Invisible Universe: The Case for Far-IR/Submillimeter Interferometry
Leisawitz, D.; Armstrong, T.; Benford, D. J.; Blain, A.; Borne, K.; Danchi, W.; Evans, N.; Gardner, J.; Gezari, D.; Harwit, M., et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 167-177; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

The question "How did we get here and what will the future bring?"captures the human imagination and the attention of the National Academy of Science's Astronomy and Astrophysics Survey Committee (AASC). Fulfillment of this fundamental goal requires astronomers to have sensitive, high angular and spectral resolution observations in the far-infrared/submillimeter (far- IR/sub-mm) spectral region. With half the luminosity of the universe and vital information about galaxy, star and planet formation, observations in this spectral region require capabilities similar to those currently available or planned at shorter wavelengths. In this paper we summarize the scientific motivation, some mission concepts and technology requirements for far-IR/sub-mm space interferometers that can be developed in the 2010-2020 timeframe.
Author
Infrared Interferometers; Cosmic Dust; Astronomical Observatories

20040074289 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Case for Space-Borne Far-Infrared Line Surveys
Bock, J. J.; Bradford, C. M.; Dragovan, M.; Earle, L.; Glenn, J.; Naylor, B.; Nguyen, H. T.; Zmuidzinas, J.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 205-213; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The combination of sensitive direct detectors and a cooled aperture promises orders of magnitude improvement in the sensitivity and survey time for far-infrared and submillimeter spectroscopy compared to existing or planned capabilities. Continuing advances in direct detector technology enable spectroscopy that approaches the background limit available only from space at these wavelengths. Because the spectral confusion limit is significantly lower than the more familiar spatial confusion limit encountered in imaging applications, spectroscopy can be carried out to comparable depth with a significantly smaller aperture. We are developing a novel waveguide-coupled grating spectrometer that disperses radiation into a wide instantaneous bandwidth with moderate resolution (R ~ 1000) in a compact 2-dimensional format. A line survey instrument coupled to a modest cooled single aperture provides an attractive scientific application for spectroscopy with direct detectors. Using a suite of waveguide spectrometers, we can obtain complete coverage over the entire far-infrared and sub-millimeter. This concept requires no moving parts to modulate the optical signal. Such an instrument would be able to conduct a far-infrared line survey 10 6 times faster than planned capabilities, assuming existing detector technology. However, if historical improvements in bolometer sensitivity continue, so that photon-limited sensitivity is obtained, the integration time can be further reduced by 2 to 4 orders of magnitude, depending on wavelength. The line flux sensitivity would be comparable to ALMA, but at shorter wavelengths and with the continuous coverage needed to extract line fluxes for sources at unknown redshifts. For example, this capability would break the current spectroscopic bottleneck in the study of far-infrared galaxies, the recently discovered, rapidly evolving objects abundant at cosmological distances.
Author
Infrared Telescopes; Sensitivity; Infrared Spectrometers

20040074292 Naval Research Lab., Washington, DC, USA
IR Fine-Structure Line Signatures of Central Dust-Bounded Nebulae in Luminous Infrared Galaxies
Fischer, J.; Allen, R.; Dudley, C. C.; Satyapal, S.; Luhman, M.; Wolfire, M.; Smith, H. A.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 109-116; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

To date, the only far-infrared spectroscopic observations of ultraluminous infrared galaxies have been obtained with the European Space Agency s Infrared Space Observatory Long Wavelength Spectrometer. The spectra of these galaxies are characterized by molecular absorption lines and weak emission lines from photodissociation regions (PDRs), but no far-infrared (greater than 40 microns) lines from ionized regions have been detected. ESA s Herschel Space Observatory, slated for launch in 2007, will likely be able to detect these lines in samples of local and moderate redshift ultra luminous galaxies and to enable measurement of the ionization parameters, the slope of the ionizing continuum, and densities present in the ionized regions of these galaxies. The higher spatial resolution of proposed observatories discussed in this workshop will enable isolation of the central regions of local galaxies and detection of these lines in high-redshift galaxies for study of the evolution of galaxies. Here we discuss evidence for the e.ects of absorption by dust within ionized regions and present the spectroscopic signatures predicted by photoionization modeling of dust-bounded regions.
Author
Cosmic Dust; Fine Structure; Galactic Evolution; Infrared Radiation; Luminosity; Nebulae

20040074293 Naval Research Lab., Washington, DC, USA

Far-Infrared and Submillimeter Spectroscopy of Low to Moderate Redshift Normal and Active Galaxies

Fischer, Jacqueline; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 145-148; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

Broadband surveys with planned observatories such as SIRTF, ASTRO-F, NGST, Herschel, SMA, and ALMA will provide large samples of dust-enshrouded galaxies undergoing varying proportions of star formation and accretion onto supermassive black holes. Recent evidence suggests that the mass of supermassive central black holes are proportional to central velocity dispersions of their host galaxy bulges, but it is not yet known how these properties are evolutionarily connected. To trace the evolution of these components during the important luminous, dusty merger episodes as a function of redshift, sensitive mid- to far-infrared spectroscopic diagnostic observations from space will be necessary. The high sensitivity and spatial resolution of a large aperture, natural background limited far-infrared/submillimeter telescope such as SAFAIR will allow detection and identification of the far-infrared/submillimeter components of galaxies and of a multitude of rest-frame mid- to far-infrared recombination, fine-structure, and molecular lines toward dusty galactic nuclei. The line diagnostics beginning to be developed from ISO work will help determine important parameters such as the intrinsic spectral energy distribution, ionization parameters, metallicities, densities, extinction to the embedded energy sources, and ultimately the star-formation and accretion rates in these galaxies. Ultimately, the higher spatial resolution provided by a cold, far-infrared submillimeter interferometer is needed to view the distribution of structure in galaxies in order to unravel the as yet untold story of the evolution of galaxies over the lifetime of the Universe.

Author

Active Galaxies; Black Holes (Astronomy); Infrared Telescopes; Spatial Resolution

20040074294 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Charting the Winds that Change the Universe, II: The Single Aperture Far Infrared Observatory (SAFIR)

Rieke, G. H.; Benford, D. J.; Harvey, P. M.; Lawrence, C. R.; Leisawitz, D. T.; Lester, D. F.; Mather, J. C.; Stacey, G. J.; Werner, M. W.; Yorke, H. W.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 157-166; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

SAFIR will study the birth and evolution of stars and planetary systems so young that they are invisible to optical and near-infrared telescopes such as NGST. Not only does the far-infrared radiation penetrate the obscuring dust clouds that surround these systems, but the protoplanetary disks also emit much of their radiation in the far infrared. Furthermore, the dust reprocesses much of the optical emission from the newly forming stars into this wavelength band. Similarly, the obscured central regions of galaxies, which harbor massive black holes and huge bursts of star formation, can be seen and analyzed in the far infrared. SAFIR will have the sensitivity to see the first dusty galaxies in the universe. For studies of both star-forming regions in our galaxy and dusty galaxies at high redshifts, SAFIR will be essential in tying together information that NGST will obtain on these systems at shorter wavelengths and that ALMA will obtain at longer wavelengths.

Author

Black Holes (Astronomy); Astronomical Observatories; Infrared Astronomy

20040074299 Consiglio Nazionale delle Ricerche, Rome, Italy

Star Formation with Herschel

Saraceno, Paolo; Molinari, Sergio; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 117-124; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

We briefly discuss two of the major programmes that could be carried out with the Herschel satellite in the field of star formation: the photometric and spectroscopic imaging of the nearby star forming regions and the survey of the Galactic plane.

Author

Star Formation; Spaceborne Astronomy; Satellite-Borne Instruments; Galaxies

20040074300 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

An Overview of the StarLight Mission

Lay, Oliver; Blackwood, Gary; Dubovitsky, Serge; Duren, Riley; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 224-234; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

An overview of the Starlight Mission is presented. Mission summary: June 2006 launch to heliocentric orbit; Nominal 6 month mission with option of additional 6 month extension; Validate autonomous formation flying system: range control to 10 cm bearing, control to 4 arcmin; Demonstrate formation flying optical interferometry.The original 3 spacecraft design did

not fit the budget. 2 spacecraft concept demonstrates all key areas of formation flying interferometry. Collector flown on the surface of a virtual paraboloid, with combiner at the focus. It Gives a baseline of 125 m with a fixed delay of only 14 m.
Derived from text
Spacecraft Design; Trajectory Control; Astronomical Interferometry

20040074301 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Technology Needs for Far-Infrared, Submillimeter, and Millimeter Missions
Moseley, S. Harvey; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 37-58; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

SAFIR will: Study the important and relatively unexplored region of the spectrum between 30 and 300 m; Enable the study of galaxy formation and the earliest stage of star formation by revealing regions too enshrouded by dust to be studied by NGST; Be more than 100 times as sensitive as SIRTF or the European [Herschel] mission.SAFIR is projected to cost around $600M total. The decadal review committee recommends that $100M be allocated in this decade to start the SAFIR project, and that additional technology developments be funded separately: Far-Infrared Array Development ($10M) Refrigerators ($50M) Large, Lightweight Optics ($80M). Current developments are also described.
Derived from text
Infrared Telescopes; Resource Allocation; Design Optimization

20040074302 Paris-Sud Univ., France
Star and Galaxy Formation at High Redshifts: What is to be learned from Future Far-Infrared and Submillimeter Observations
Puget, J. L.; Lagache, G.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 61-68; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The observations relevant to the problem of star and galaxy formation at high redshift available at present are of three types: the cosmic infrared background of radiation from all generations of stars and galaxies (see. Hauser & Dwek 2001 for a review); deep number counts of extragalactic sources from mid infrared to millimeter wavelengths (e.g. Elbaz et al. 2002, Dole et al. 2001, Serjeant et al. 2001, Scott et al. 2002 and references therein); power spectra of the unresolved background in the far infrared (Lagache & Puget 2000, Miville-Desch nes et al. 2002). Identifications and detailed studies of individual sources at long wavelengths are coming very slowly. Partial redshift distribution starts to be available.
Author
Galactic Evolution; Star Formation; Red Shift

20040074304 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Community Plan for Far-Infrared/Submillimeter Space Astronomy
Ade, Peter; Akeson, Rachel; Ali, Shafinaz; Amato, Michael; Arendt, Richard; Baker, Charles; Benford, Dominic; Blain, Andrew; Bock, James; Borne, Kirk, et al.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. XV-XXVI; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

This paper represents the consensus view of the 124 participants in the Second Workshop on New Concepts for Far-Infrared/Submillimeter Space Astronomy.We recommend that NASA pursue the vision for far-IR astronomy outlined in the NAS Decadal Survey, which said: A rational coordinated program for space optical and infrared astronomy would build on the experience gained with NGST1 to construct [a JWST-scale filled-aperture far-IR telescope SAFIR, and then ultimately, in the decade 2010 to 2020, build on the SAFIR, TPF, and SIM experience to assemble a space-based, far-infrared interferometer. SAFIR will study star formation in the young universe, the buildup of elements heavier than hydrogen over cosmic history, the process of galaxy formation, and the early phases of star formation, which occur behind a veil of dust that precludes detection at mid IR and shorter wavelengths. The far-infrared interferometer will resolve distant galaxies to study protogalaxy interactions and mergers and the processes that led to enhanced star formation activity and the formation of Active Galactic Nuclei, and will resolve protostars and debris disks in our Galaxy to study how stars and planetary systems form.
Derived from text
Spaceborne Astronomy; Infrared Interferometers; Infrared Astronomy

20040074306 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
SAFIR and Interstellar Medium Studies
Melnick, Gary; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 149-154; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The questions of greatest scientific interest addressable at far-infrared and submillimeter wavelengths at the time SAFIR would fly will have been shaped by the results from the Space Infrared Telescope Facility (SIRTF) and the Herschel Space Observatory (HSO) as well as ongoing studies using the Stratospheric Observatory for Infrared Astronomy (SOFIA) and the Atacama Large Millimeter Array (ALMA). In light of these other efforts, SAFIR must offer unique and compelling capabilities.
Author
Spatial Resolution; Astronomical Observatories

20040074307 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Complementarity of NGST, ALMA, and Far IR Space Observatories
Mather, John C.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 178-187; In English; See also 20040074260; No Copyright; Avail: CASI; A02, Hardcopy

The Next Generation Space Telescope (NGST) and the Atacama Large Millimeter Array (ALMA) will both start operations long before a new far IR observatory to follow SIRTF into space can be launched. What will be unknown even after they are operational, and what will a far IR space observatory be able to add? I will compare the telescope design concepts and capabilities and the advertised scientific programs for the projects and attempt to forecast the research topics that will be at the forefront in 2010.
Author
Spaceborne Telescopes; Infrared Space Observatory (Iso)

20040074308 New South Wales Univ., Sydney, Australia
Antarctica as a Stepping Stone to Space
Storey, J. W. V.; Burton, M. G.; Ashley, M. C. B.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 264-268; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The high Antarctic plateau offers a unique observing environment that is in many ways intermediate between earth and space. In the infrared, for example, the sky brightness is typically 10 to 100 times darker than at "temperate" observatories. The sub-mm transmission is superior to that measured anywhere else on earth. However, perhaps the most important feature of Antarctica is the extraordinary stability of the upper atmosphere, which dramatically reduces scintillation and offers large gains in astrometric precision. In this presentation we will discuss the site-testing results to date, the science that can be best be done, and the technology demonstrators that can best be tested in Antarctica.
Author
Antarctic Regions; Astrometry; Aerospace Environments; Spaceborne Astronomy

20040074313 California Inst. of Tech., Pasadena, CA, USA
Star and Early planet Formation and the Far-Infrared/Submillimeter Regime
Akeson, Rachel; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 125-128; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

This contribution was presented during the science panel discussion. The goal of this presentation is to describe why observations in the far-infrared and submillimeter are crucial to the study of star formation and the early stages of planet formation and to propose some specific areas that could be address by observations at these wavelengths.
Author
Star Formation; Planetary Evolution; Cosmic Dust

20040074315 Naval Research Lab., Washington, DC, USA
C+ in ULIRGs and the Cosmos
Dudley, C. C.; Fischer, J.; Luhman, M.; Wolfire, M.; Satyapal, S.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 134-144; In English; See also 20040074260; No Copyright; Avail: CASI; A03, Hardcopy

The recently discovered and now confirmed C (sup)+ deficit in ULIGRs may indicate a quite sharp break in luminosity space, which, if stable, suggests a potentially useful standard candle for future far infrared and submillimeter observatories of sufficient sensitivity such as SAFIR.
Derived from text
Galaxies; Spaceborne Astronomy

20040074316 Universities Space Research Association, Moffett field, CA, USA
SOFIA: Current Performance and Future Instrument Upgrades
Sandell, Goeran; Wolf, Juergen; Davidson, Jacqueline; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 269-270; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

The joint U.S. and German SOFIA project to develop and operate a 2.5-meter infrared airborne telescope in a Boeing 747-SP is now well into development. First science flights will begin in late 2004. Once fully operational the observatory will do 960 observing hours/year, with an expected lifetime of over 20 years. The advantages and drawbacks of an airborne observatory relative to space missions are briefly discussed, and the sensitivity, characteristics and science instrument complement are presented. SOFIA will take advantage of new technology development, which allows the observatory to upgrade or replace instruments when new technology, for example more sensitive detectors or larger arrays become available. Some examples of possible future instruments are discussed.
Author
Sofia (Airborne Observatory); Infrared Telescopes; Space Missions; Spacecraft Instruments

20040074320 California Inst. of Tech., Pasadena, CA, USA
Future Developments in Far-IR and Submm Space Observations
Blain, Andrew W.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 86-89; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

Recent observations have highlighted the importance of mid-and far-infrared surveys for studying galaxy evolution. A crucial step forward will be provided by moving to resolve galaxies at these wavelengths, and providing resolution better than 10 arcsec in order to reduce the effects of source confusion.
Author
Far Infrared Radiation; Submillimeter Waves; Galactic Evolution; Spaceborne Astronomy

20040074333 Pittsburgh Univ., Pittsburgh, PA, USA
X-Ray Spectral Variations of X-Ray Nova XTE J1550-564 During the Rising Phase of the 1998 Outburst
Wu, Xuebing; Zhang, S. N.; Yao, Yangsen; Su, Xuejun; Cui, Wei; Chen, Wan; Stellar Astrophysics, Proceedings of the Pacific; January 2000, pp. 267; In English; No Copyright; Avail: Other Sources

No abstract available
Black Holes (Astronomy); X Ray Spectra

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040068124 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Magnetic Field in the Outer Heliosphere
Suess, S. T.; 2004; 1 pp.; In English; Arcetri Astrophysical Observatory Presentation, 29 Apr. 2004, Florence, Italy; No Copyright; Avail: Other Sources; Abstract Only

One of the great achievements of Parker was the prediction that the solar magnetic field would be drawn into Archimedian spirals as it is carried away from the Sun by the solar wind. This prediction has been amply confirmed by many in situ measurements in the intervening four decades. But, Parker made his prediction for a solar wind that expands into infinite space while we now know that the local interstellar medium (LISM) is far from empty and, in fact, confines the solar wind to a finite volume, known as the heliosphere, that extends to approximately 100 AU in the upstream direction (the solar system is moving through the LISM). Voyagers 1/2, presently at -80 AU, are approaching the upstream boundaries of the heliosphere and returning data on the properties of the magnetic field. This is important for understanding how galactic cosmic rays (GCRs) reach the Earth. Voyagers show that the IMF at 10-80 AU behaves much as Parker predicted - with two important exceptions. This is not surprising since the field is essentially passively advected by the solar wind out to 80 AU. But, new models say that nearer the heliosphere boundaries the field plays a major role in the solar wind-LISM interaction. However, of the many physical ingredients that constitute the outer heliosphere, the magnetic field poses some of the most interesting and difficult numerical modeling problems. Presently, only a few results have been published and much remains to be done. Here I will summarize the expected and measured behavior of the magnetic field at 80 AU. Then I will describe modeling predictions beyond 80 AU: magnetic "tornadoes", polarity envelopes, the Axford-Cranfill effect, inner and outer magnetic

walls and more. I will also list what I believe to be important new modeling objectives. Finally, I will speculate on what is happening with the magnetic field near the nose of the heliosphere. My conclusion is that models of GCR modulation rarely incorporate even crudely realistic magnetic fields so it is a wonder that they are as successful as they are and no surprise that there are still important discrepancies between GCR modulation observations and the models.
Author
Heliosphere; Solar Magnetic Field; Magnetic Fields; Sun; Mathematical Models

20040068142 NASA Marshall Space Flight Center, Huntsville, AL, USA
Properties of Longitudinal Flux Tube Waves, III, Wave Propagation in Solar and Stellar Wind Flows
Cuntz, M.; Suess, S. T.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We discuss the analytic properties of longitudinal tube waves taking into account ambient wind flows. This is an extension of the studies of Papers I and II, which assumed a mean flow speed of zero and also dealt with a simplified horizontal pressure balance. Applications include the study of longitudinal flux tube waves in stars with significant mass loss and heating and dynamics of plumes in the solar wind. Slow magnetosonic waves, also called longitudinal waves, have been observed in solar plumes and are likely an important source of heating. We show that the inclusion of ambient wind flows considerably alters the limiting shock strength as well as the energy damping length of waves.
Author
Stellar Winds; Solar Wind; Magnetoacoustic Waves; Wave Propagation; Longitudinal Waves

20040068151 NASA Ames Research Center, Moffett Field, CA, USA
High-Order Simulation of Non-Linear Oscillations and Shocks in the Solar Atmosphere
Bryson, S.; Kosovichev, A.; Levy, D.; 2004; 2 pp.; In English; Presenation at the International Conference on Spectral and High-Order Methods, 21-25 Jun. 2004, Providence, RI, USA
Contract(s)/Grant(s): 704-40-42; No Copyright; Avail: Other Sources; Abstract Only

The solar atmosphere presents a rich source of highly non-linear magneto-hydrodynamic phenomena: strong gradients and forcing terms result in both large shocks and oscillations. The additional requirements of energy balance and initialization in hydrostatic equilibrium compound the challenge of this problem. A wealth of observational data allows us to check the results of our simulations. The problem of simulating the solar atmosphere provides, in addition to an interesting system in its own right, a challenging testbed for high-order shock-capturing methods. We discuss the challenge of simulating solar atmospheric phenomena, concentrating on various high-order central methods ranging from second to fourth order. Our method is based on the central-upwind scheme of Kurganov, Noelle and Petrova, which we extend to high order via various interpolants. We investigate various initial data for our simulations, corresponding to observed conditions in different regions of the solar surface: the normal quiet sun and sunspots. When non-oscillatory using second- and third-order methods, we are able to reproduce non-trivial observational results. In particular we find a correlation between initial data and both the shock speeds and particle oscillation spectra that match observations in the corresponding regions. When using fourth-order WENO interpolants, we find that while the individual shock profiles at any given time appear non-oscillatory, spurious oscillations appear in the fields after long time integrations. The issue of initialization in hydrostatic equilibrium raises difficult issues. Careful treatment of the gravitational source term can reduce violations of hydrostatic equilibrium, but difficulties remain, primarily due to discontinuities in the piecewise-polynomial reconstructions. In the case of the Euler equations in gravity, the use of high-order methods reduces the violation of hydrostatic equilibrium to a sufficiently low level for the above described results to be obtained. Including various energy flux terms in the equations, however, leads to severe instability when hydrostatic balance is violated. We discuss various strategies to address this problem, including adaptive grid methods.
Author
Hydrostatics; Nonlinearity; Oscillations; Solar Atmosphere; Sun; Upwind Schemes (Mathematics); Simulation

20040068269 NASA Marshall Space Flight Center, Huntsville, AL, USA
External and Internal Reconnection in Two Filament-Carrying Magnetic-Cavity Solar Eruptions
Sterling, Alphonse C.; Moore, Ronald L.; [2004]; 3 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We observe two near-limb solar filament eruptions, one of 2000 February 26 and the other of 2002 January 4. For both we use 195 Angstroms Fe XII images from the Extreme-Ultraviolet (EUV) Imaging Telescope (EIT) and magnetograms from the Michelson Doppler Imager (MDI), both on the Solar and Heliospheric Observatory (SOHO) satellite. For the earlier event we also use soft X-ray telescope (SXT), hard X-ray telescope (HXT), and Bragg Crystal Spectrometer (BCS) data from the Yohkoh satellite, and hard X-ray data from the BATSE experiment on the Compton Gamma Ray Observatory (CGRO). Both

events occur in quadrupolar magnetic regions, and both have coronal features that we infer belong to the same magnetic-cavity structures as the filaments. In both cases the cavity and filament first rise slowly at approximately 10 kilometers per second prior to eruption, and then accelerate to approximately 100 kilometers per second during the eruption, although the slow-rise movement for the higher-altitude cavity elements is clearer in the later event. We estimate both filaments and both cavities to contain masses of approximately 10(exp 14-15) g and approximately 10(exp 15-16) g respectively. We consider whether two specific magnetic-reconnection-based models for eruption onset, the tether cutting and the breakout models, are consistent with our observations. In the earlier event soft X-rays from SXT show an intensity increase during the 12-minute interval over whch fast eruption begins, which is consistent with tether-cutting-model predictions. Substantial hard X-rays, however, do not occur until after fast eruption is underway, and so this is a constraint the tether-cutting model must satisfy. During the same 12-minute interval over which fast eruption begins, there are brightenings and topological changes in the corona indicative of high-altitude reconnection early in the eruption, and this is consistent with breakout predictions. In both eruptions, however, the onset of the filament fast-rise phase occurs while overlying cavity-related coronal loops are still evolving from a "closed" state to an "open" state, and our observations of the time evolution of these loops compared to the eruption state in both events are constraints the breakout model must meet. Therefore our findings are consistent with runaway-tether-cutting-type reconnection and fast breakout-type reconnection both occurring early in the fast phase of the February eruption and with both types of reconnection being important in unleashing the explosion, but we are not able to say which, if either, type of reconnection actually triggered the fast phase. We have also found specific constraints that either model, or any other model, must satisfy if correct.
Author
Magnetic Field Reconnection; Solar Limb; Solar Prominences; Astrophysics

20040070827 Smithsonian Astrophysical Observatory, Cambridge, MA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA
Evidence of Spin and Energy Extraction in a Galactic Black Hole Candidate: The XMM-NEWTON/EPIC SPECTRUM of XTE 11650-500
Miller, J. M.; Fabian, A. C.; Wunands, R.; Reynolds, C. S.; Ehle, M.; Freyberg, M. J.; VanDerKlis, M.; Lewin, W. H. G.; Sanchez-Fernandez, C.; Castro-Tirado, A. J.; Astrophysical Journal; May 10, 2002; Volume 570, pp. L69-L73; In English
Contract(s)/Grant(s): NAS8-39073; PF9-10010; Copyright; Avail: Other Sources

We observed the Galactic black hole candidate XTE J1650-500 early in its fall of 2001 outburst with the XMM-Newton European Photon Imaging pn Camera (EPIC-pn). The observed spectrum is consistent with the source having been in the very high state. We h d a broad, skewed Fe Kar emission line that suggests the primary in this system may be a Kerr black hole and that indicates a steep disk emissivity profile that is hard to explain in terms of a standard accretion disk model. These results are quantitatively and qualitatively similar to those from an XMM-Newton observation of the Seyfert galaxy MCG -6-30-15. The steep emissivity in MCG -6-30-15 may be explained by the extraction and dissipation of rotational energy from a black hole with nearly maximal angular momentum or from material in the plunging region via magnetic connections to the inner accretion disk. If this process is at work in both sources, an exotic but fundamental general relativistic prediction may be confirmed across a factor of l0(exp 6) in black hole mass. We discuss these results in terms of the accretion flow geometry in stellar-mass black holes and the variety of enigmatic phenomena often observed in the very high state.
Author
Black Holes (Astronomy); Xmm-Newton Telescope; Astrophysics; Accretion Disks; Energy Dissipation; Imaging Techniques; Photons; Galactic Mass

20040070829 Osservatorio Meteorologico di Brera, Milan, Italy
High-Frequency Quasi-Periodic Oscillations in the Black Hole X-Ray Transient XTE J1650-500
Holman, Jeroen; Klein-Wolt, Marc; Rossi, Sabrina; Miller, Jon M.; Wijnands, Rudy; Belloni, Tomaso; VanDerKlis, Michiel; Lewin, Walter H. G.; Astrophysical Journal; Apr. 1, 2003; Volume 586, pp. 1262-1267; In English
Contract(s)/Grant(s): MM02C71842; Copyright; Avail: Other Sources

We report the detection of high-frequency variability in the black hole X-ray transient XTE 51650-500. A quasi-periodic oscillation (QPO) was found at 250 Hz during a transition from the hard to the soft state. We also detected less coherent variability around 50 Hz that disappeared when the 250 Hz QPO showed up. There are indications that when the energy spectrum hardened the QPO frequency increased from approx. 110 to approx. 270 Hz, although the observed frequencies are also consistent with being 1 : 2 : 3 harmonics of each other. Interpreting the 250 Hz as the orbital frequency at the innermost stable orbit around a Schwarzschild black hole leads to a mass estimate of 8.2 solar mass. The spectral results by Miller et

al., which suggest considerable black hole spin, would imply a higher mass.
Author
High Frequencies; Oscillations; Black Holes (Astronomy); X Rays

20040070918 NASA Marshall Space Flight Center, Huntsville, AL, USA
Laboratory Experiments on Rotation and Alignment of the Analogs of Interstellar Dust Grains by Radiation
Abbas, M. M.; Craven, P. D.; Spann, J. F.; Tankosic, D.; LeClair, A.; Gallagher, D. L.; West, E. A.; Weingartner, J. C.; Witherow, W. K.; Tielens, A. G. G. M.; [2004]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The processes and mechanisms involved in the rotation and alignment of interstellar dust grains have been of great interest in astrophysics ever since the surprising discovery of the polarization of starlight more than half a century ago. Numerous theories, detailed mathematical models and numerical studies of grain rotation and alignment with respect to the Galactic magnetic field have been presented in the literature. In particular, the subject of grain rotation and alignment by radiative torques has been shown to be of particular interest in recent years. However, despite many investigations, a satisfactory theoretical understanding of the processes involved in grain rotation and alignment has not been achieved. As there appears to be no experimental data available on this subject, we have carried out some unique experiments to illuminate the processes involved in rotation of dust grains in the interstellar medium. In this paper we present the results of some preliminary laboratory experiments on the rotation of individual micron/submicron size nonspherical dust grains levitated in an electrodynamic balance evacuated to pressures of approximately 10(exp -3) to 10(exp -5) torr. The particles are illuminated by laser light at 5320 Angstroms, and the grain rotation rates are obtained by analyzing the low frequency (approximately 0-100 kHz) signal of the scattered light detected by a photodiode detector. The rotation rates are compared with simple theoretical models to retrieve some basic rotational parameters. The results are examined in the light of the current theories of alignment.
Author
Alignment; Interstellar Matter; Cosmic Dust; Mathematical Models; Astrophysics; Rotation; Granular Materials; Radiation

20040070943 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Slow Streamer Blowout at the Sun and Ulysses
Seuss, S. T.; Bemporad, A.; Poletto, G.; 2004; ISSN 0094-8276; 1 pp.; In English; Ulysses Science Working Team Meeting, 22-23 Apr. 2004, Noordwijk, Netherlands
Report No.(s): Paper 2003GL018895; No Copyright; Avail: Other Sources; Abstract Only

On 10 June 2000 a streamer on the southeast limb slowly disappeared from LASCO/C2 over approximately 10 hours. A small CME was reported in C2. A substantial interplanetary CME (ICME) was later detected at Ulysses, which was at quadrature with the Sun and SOHO at the time. This detection illustrates the properties of an ICME for a known solar source and demonstrates that the identification can be done even beyond 3 AU. Slow streamer blowouts such as this have long been known but are little studied. We report on the SOHO observation of a coronal mass ejection (CME) on the solar limb and the subsequent in situ detection at Ulysses, which was near quadrature at the time, above the location of the CME. SOHO-Ulysses quadrature was 13 June, when Ulysses was 3.36 AU from the Sun and 58.2 degrees south of the equator off the east limb. The slow streamer blowout was on 10 June, when the SOHO-Sun-Ulysses angle was 87 degrees.
Derived from text
Sun; Coronal Mass Ejection; Soho Mission; Ulysses Mission; Astrophysics

20040071072 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Magnetic Structure of H-alpha Macrospicules in Solar Coronal Holes
Yamauchi, Y.; Moore, R. L.; Suess, S. T.; Wang, H.; Sakurai, T.; The Astrophysical Journal; 10 Apr. 2004; Vol. 605, pp. 511-520; In English; Copyright; Avail: Other Sources

Measurements by Ulysses in the high-speed polar solar wind have shown the wind to carry some fine-scale structures in which the magnetic field reverses direction by having a switchback fold in it. The lateral span of these magnetic switchbacks, translated back to the Sun, is of the scale of the lanes and cells of the magnetic network in which the open magnetic field of the polar coronal hole and polar solar wind are rooted. This suggests that the magnetic switchbacks might be formed from network-scale magnetic loops that erupt into the corona and then undergo reconnection with the open field. This possibility motivated us to undertake the study reported here of the structure of Ha macrospicules observed at the limb in polar coronal holes, to determine whether a significant fraction of these eruptions appear to be erupting loops. From a search of the polar coronal holes in 6 days of image- processed full-disk Ha movies from Big Bear Solar Observatory, we found a total of 35

macrospicules. Nearly all of these (32) were of one or the other of two different forms: 15 were in the form of an erupting loop, and 17 were in the form of a single column spiked jet. The erupting-loop macrospicules are appropriate for producing the magnetic switchbacks in the polar wind. The spiked-jet macrospicules show the appropriate structure and evolution to be driven by reconnection between network-scale closed field (a network bipole) and the open field rooted against the closed field. This evidence for reconnection in a large fraction of our macrospicules (1) suggests that many spicules may be generated by similar but smaller reconnection events and (2) supports the view that coronal heating and solar wind acceleration in coronal holes and in quiet regions are driven by explosive reconnection events in the magnetic network.
Author
Magnetic Field Configurations; Solar Corona; Coronal Holes; H Alpha Line; Spicules

20040071143 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Probing me Reverse Shock in an Oxygen-Rich Supernova Remnant
Gaetz, Terrance; Sonneborn, George, Technical Monitor; May 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12295; No Copyright; Avail: CASI; A01, Hardcopy

The aim of this project is to examine the O VI emission at three positions around the X- ray bright ring of the remnant in order to investigate the relation between the O VI emission, the X-ray O VII and O VIII emission, and the optical [OIII} emission, and how these vary around the rim of the remnant. All three pointings and the background pointing have now been observed; the archive notification for the most recent dataset was Oct 30, 2003. After reprocessing and screening, the net exposure time for the SE exposure is only 54 percent of the approved time (15 kilosec). for the SE exposure, the available statistics are not good enough for analysis. A request for reobservation to make up for the lost time in the SE pointing has been approved. Broad O VI 1032 and O VI 1038 emission is detected with velocity width of at least 800 km/s, and possibly exceeding 1000 km/s. The Flanagan et al. analysis of the Chandra grating data show bulk velocities in the X-ray gas of order +/- 1000 km/s. In the region of the FUSE E0lO2-SE pointing, the Chandra data indicate both blue-shifted and red-shifted emission. Analysis of the velocity structure of the O VI emission will provide additional constraints on the kinematics of the gas: is it emission from a tilted expanding barrel, or a more symmetric expansion? The O VI fluxes are also needed to assess whether the O VI is radiation from recombining O VII or instead fiom cooler gas ionizing toward O VII. The emission is faint, however, which complicates the analysis. Because the lines are so broad, absorption by intervening H2, CII, and foreground OVI must be considered. A number of stars in the SMC have been observed which provide information on foreground OVI absorption. The initial analyses have concentrated on the Li1F channel since the guidance is based on that channel. The Li2F channel is being examined exposure by exposure to see if any of the data can be used to improve the signal to noise in the Li1F data.
Author
Supernova Remnants; Exposure; Light Emission; Hydrogen; Oxygen; X Rays

20040071150 Alabama Univ., Huntsville, AL, USA
Studying the Accretion Disks in Black Hole X-Ray Binaries with Monte-Carlo Simulations
Yao, Y.; Zhang, S. N.; Zhang, X.; AIP Conference Proceedings; 2001; Volume 587, pp. 106; In English; No Copyright; Avail: Other Sources

No abstract available
Accretion Disks; Black Holes (Astronomy); X Ray Binaries; Astronomical Models; X Ray Astronomy

20040071152 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evolution of Iron K Alpha Line Emission in the Black Hole Candidate GX 339-4
Feng, Y. X.; Zhang, S. N.; Sun, X.; Durouchoux, Ph.; Chen, Wan; Cui, Wei; Astrophysical Journal; May 2001; Volume 553, Issue 1, pp. 394-398; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

GX 339-4 was regularly monitored with the Rossi X-Ray Timing Explorer during a period (in 1999) when its X-ray flux decreased significantly (from 4.26 x 10(exp -10) to 7.6 x 10(exp -12) ergs in the 3-20 keV band), as the source settled into the 'off state.' Our spectral analysis revealed the presence of a prominent iron K alpha line in the observed spectrum of the source for all observations. The line shows an interesting evolution: it is centered at approx. 6.4 keV when the measured flux is above 5 x 10(exp -1) ergs per sq cm/s but is shifted to approx. 6.7 keV at lower fluxes. The equivalent width of the line appears to increase significantly toward lower fluxes, although it is likely to be sensitive to calibration uncertainties. While the fluorescent emission of neutral or mildly ionized iron atoms in the accretion disk can perhaps account for the 6.4 keV line,

as is often invoked for black hole candidates, it seems difficult to understand the 6.7 keV line with this mechanism because the disk should be less ionized at lower fluxes (unless its density changes drastically). On the other hand, the 6.7 keV line might be due to a recombination cascade of hydrogen- or helium-like iron ions in an optically thin, highly ionized plasma. We discuss the results in the context of proposed accretion models.
Author
K Lines; Iron; X Ray Astronomy; Black Holes (Astronomy)

20040071153 NASA Marshall Space Flight Center, Huntsville, AL, USA
Relativistic Effects Around Black Holes: Smearing Absorption Edges
Zhang, X. L.; Feng, Y. X.; Zhang, S. N.; Yao, Y.; Bulletin of the American Astronomical Society; December 2002; Volume 34, pp. 1123; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

Broad iron absorption structures have been observed in the X-ray spectra of both AGNs and black hole X-ray binaries (BHXBs). A correctly modeled absorption structure can reveal the physical condition of the source, help to determine the continuum spectra and thus help to estimate other spectral lifes more accurately. The absorption structures are usually thought to be caused by the reflection of X-rays by the accretion disks around the central black holes, and the broadening can be a ttributed to the ionization states of the disk and relativistic effects.
Author
Black Holes (Astronomy); X Ray Spectra

20040071154 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Phase Lag and Coherence Function of X-Ray Emission from Black Hole Candidate XTE J1550-564
Cui, Wei; Zhang, Shuang Nan; Chen, Wan; Astrophysical Journal; March 2000; Volume 531, Issue 1, pp. L45-L48; In English
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

We report the results from measuring the phase lag and coherence function of X-ray emission from black hole candidate XTE J1550-564. These temporal X-ray properties have been recognized to be increasingly important in providing important diagnostics of the dynamics of accretion flows around black holes. For XTE J1550-564, we found significant hard lag-the X-ray variability in high-energy bands lags behind that in low-energy bands-associated both with broadband variability and quasi-periodic oscillation (QPO) . However, the situation is more complicated for the QPO: while hard lag was measured for the first harmonic of the signal, the fundamental component showed significant soft lag. Such behavior is remarkably similar to what was observed of microquasar GRS 1915+105. The phase lag evolved during the initial rising phase of the 1998 outburst. The magnitude of both the soft and hard lags of the QPO increases with X-ray flux, while the Fourier spectrum of the broadband lag varies significantly in shape. The coherence function is relatively high and roughly constant at low frequencies and begins to drop almost right after the first harmonic of the QPO. It is near unity at the beginning and decreases rapidly during the rising phase. Also observed is that the more widely separated the two energy bands are, the less the coherence function between the two. It is interesting that the coherence function increases significantly at the frequencies of the QPO and its harmonics. We discuss the implications of the results on the models proposed for black hole candidates.
Author
Black Holes (Astronomy); Energy Bands

20040071155 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using Monte-Carlo Simulations to Study the Disk Structure in Cygnus X-1
Yao, Y.; Zhang, S. N.; Zhang, X. L.; Feng, Y. X.; Bulletin of the American Astronomical Society; December 2002; Volume 34, pp. 1122; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

As the first dynamically determined black hole X-ray binary system, Cygnus X-1 has been studied extensively. However, its broad-band spectra in hard state with BeppoSAX is still not well understood. Besides the soft excess described by the multi-color disk model (MCD), the power- law component and a broad excess feature above 10 keV (disk reflection component), there is also an additional soft component around 1 keV, whose origin is not known currently.We propose that the additional soft component is due to the thermal Comptonization process between the s oft disk photon and the warm plasma cloud just above the disk.i.e., a warm layer. We use Monte-Carlo technique t o simulate this Compton scattering process and build several table models based on our simulation results.
Author
Black Holes (Astronomy); Compton Effect

20040071156 Alabama Univ., Huntsville, AL, USA

Inclination Angles of Black Hole X-Ray Binaries Manifest Strong Gravity around Black Holes

Zhang, S. N.; Zhang, Xiao-Ling; Yao, Yangsen; April 2002; 1 pp.; In English; American Physical Society April Meeting, 20-23 Apr. 2002, Albuquerque, NM, USA

Contract(s)/Grant(s): NAG5-7927

Report No.(s): N17.083; No Copyright; Avail: Other Sources; Abstract Only

System inclination angles have been determined for about 15 X-ray binaries, in which stellar mass black holes are considered to exist. These inclination angles range between 25 degrees and 80 degrees, but peaked between 60-70 degrees. This peak is not explained in the frame work of Newtonian gravity. However, this peak is reproduced naturally if we model the observed X-ray radiations as being produced in the accretion disks very close to the black hole horizons, where the extremely strong general and special relativistic effects, caused by the extremely strong gravity near the black hole horizons, modify the local radiation significantly as the X-rays propagate to the remote observer. Therefore the peak of the inclination angle distribution provides evidence or strong gravity around stellar mass black holes.

Author

Black Holes (Astronomy); Gravitation; Stellar Mass; X Ray Binaries

20040071157 Alabama Univ., Huntsville, AL, USA

Dominant Gamma-Ray Bursts Production in the Early Universe

Zhang, S. N.; Lin, J. R.; Li, T. P.; March 2003; 1 pp.; In English

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

It has been known that at least some of the observed gamma-ray bursts (GRBs) are produced at cosmological distances and the GRB production rate may follow the star formation rate. Here we report that the lower and upper distance limits to the GRB production are z approx. 0.22 and 8, respectively, as determined from BATSE's GRB fluence distribution. This result suggests that GRBs are no longer produced presently, and that the actual star formation rate peaks at much higher redshift and thus the 'dark ages' of the universe have ended much earlier than believed previously. We have also determined that the GRB opening angles follow an exponential distribution with a mean opening angle of about 0.03 radian. This study is supported in part by the Special Funds for Major State Basic Research Projects and by the National Natural Science Foundation of China. SNZ also acknowledges supports by NASA's Marshall Space Flight Center and through NASA's Long Term Space Astrophysics Program.

Author

Gamma Ray Bursts; Distance; Spatial Distribution; Gamma Ray Astronomy

20040071159 Alabama Univ., Huntsville, AL, USA

RX J1856.5-3754: A Strange Star with Solid Quark Surface?

Zhang, Xiaoling; Xu, Renxin; Zhang, Shuangnan; 2003; 1 pp.; In English; Young Neutron Stars and their Environment, Symposium No. 218, 14-17 Jul. 2003, Sydney, Australia

Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

The featureless spectra of isolated 'neutron stars' may indicate that they are actually bare strange stars but a definitive conclusion on the nature of the compact objects cannot be reached until accurate and theoretically calculated spectra of the bare quark surface are known. However due to the complex nonlinearity of quantum chromodynamics it is almost impossible to present a definitive and accurate calculation of the density-dominated quark-gluon plasma from the first principles. Nevertheless it was suggested that cold quark matter with extremely high baryon density could be in a solid state. Within the realms of this possibility we have fitted the 500ks Chandra LETG/HRC data for the brightest isolated neutron star RX 51856.5-3754 with a phenomenological spectral model and found that electric conductivity of quark matter on the stellar surface is about 1.5 x 10(exp 16)/s.

Author

Neutron Stars; Quarks; Stellar Composition; Stellar Spectra

20040071160 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Timing Evolution of 4U 1630-47 During its Outbursts

Dieters, S. W.; Belloni, T.; Kuulkers, E.; Woods, P.; vanParadijs, J.; Cui, W.; Swank, J. H.; Zhang, S.-N.; Bulletin of the American Astronomical Society; Dec. 1999; Volume 32, pp. 882; In English

Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

We report on the timing analysis of Rossi X-ray Timing Explorer (RXTE) observations of 4U 1630-47 made during its 1998 outburst. In addition we use two BeepoSAX observation on the late decline. 4U1630-47 showed seven distinct types of timing behaviour, most of which show differences with the canonical black hole spectral/timing states. In marked contrast to previous outbursts we find quasi periodic oscillation (QPO) signals during nearly all stages of the outburst. In addition to 2 to 13 Hz QPO slow 0.01Hz QPO are observed. These slow QPO can dominate the light curve as quasi-regular 5 sec, 9--16% deep dips. During these dips we track the behaviour of two QPO's; one remaining constant near 13.5 Hz and the other varying between 7 and 4 Hz. The evolution of the timing and the concurrent spectral changes are mapped using a combination harness-intensity and colour-colour diagrams.
Author
X Ray Timing Explorer; Astrophysics; Black Holes (Astronomy)

20040071162 Beijing Univ., China
An Accretion Model for the Growth of Black Hole in Quasars
Lu, Ye; Cheng, K. S.; Zhang, S. N.; 2003; 1 pp.; In English; Quasar Cores and Jets: 25th Meeting of the IAU, 23-24 Jul. 2003, Sydney, Australia
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

A possible accretion model associated with the ionization instability of quasar disks is proposed to address the growth of the central black hole harbored in the host galaxy. The evolution of quasars in cosmic time is assumed to change from a highly active state to a quiescent state triggered by the S-shaped ionization instability of the quasar accretion disk. For a given external mass transfer rate ionization instability can modify accretion rate in the disk and separates the accretion flows of the disk into three different phases like a S-shape. We suggest that the bright quasars observed today are those quasars with disks in the upper branch of S-shaped instability and the dormant quasars are the system in the lower branch. The disk is assumed to evolve as ADIOS configuration in the lower branch. The mass ratio between black hole and its host galactic bulge is a nature consequence of ADIOS. Our model also demonstrates that a seed black hole 2 x 10(exp 6) solar masses similar to those found in spiral galaxies today is needed to produce a black hole with a final mass 2 x 10(exp 8) solar masses.
Author
Astronomical Models; Black Holes (Astronomy); Quasars; Accretion Disks

20040073167 Institute of Space and Astronautical Science, Sagamihara, Japan
ASCA Observation of the Superluminal Jet Source GRO J1655-40 in the 1997 Outburst
Yamaoka, Kazutaka; Ueda, Yoshihiro; Hajime, Inoue; Nagase, Fumiski; Ebisawa, Ken; Kotani, Taro; Tanaka, Yasuo; Zhang, Shang Nan; Publications of the Astronomical Society of Japan; April 2001; Volume 53, No. 2, pp. 179-188; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

We report on the results of an ASCA observation of the Galactic jet source GRO 51655-40 performed from 1997 February 25 to February 28 covering a full orbital period (2.62 d). The averaged 2-10 keV flux was about 1.1 Crab. An absorption line feature centered at 6.8 keV was detected both in the GIS and SIS spectra. We interpret this as a blend of two resonance-absorption K alpha lines from H-like and He-like iron ions. We can consistently explain both the ASCA spectra and the simultaneous RXTE/PCA spectrum by a combination of K-absorption lines and K-absorption edges of iron ions. The fact that the absorption line is stably present over the whole orbital phase implies that the distribution of the highly ionized plasma is not affected by the companion star, which is consistent with its presence around the black hole. A curve of growth analysis shows that the plasma contains velocity dispersion along the line-of-sight larger than 300 km/s attributed to bulk motions. It is probably a part of a geometrically thick accretion flow in turbulent motions with velocities of 500-1600 km/s at an estimated radius of sim 10(exp 10)/cm.
Author
K Lines; X Ray Astronomy; X Ray Sources

20040073168 Rutgers Univ., Piscataway, NJ, USA
An Accretion Model for the Growth of the Central Black Holes Associated with Ionization Instability in Quasars
Lu, Y.; Cheng, K. S.; Zhang, S. N.; Astrophysical Journal; June 2003; Volume 590, Issue 1, pp. 52-57; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

A possible accretion model associated with the ionization instability of quasar disks is proposed to address the growth of the central black hole (BH) harbored in the host galaxy. The evolution of quasars in cosmic time is assumed to change from a highly active state to a quiescent state triggered by the S-shaped ionization instability of the quasar accretion disk. For a

given external mass transfer rate supplied by the quasar host galaxy, ionization instability can modify the accretion rate in the disk and separate the accretion flows of the disk into three different phases, like an S-shape. We suggest that the bright quasars observed today are those quasars with disks in the upper branch of the S-shaped instability, and the faint or 'dormant' quasars are simply these systems in the lower branch. The middle branch is the transition state, which is unstable. We assume the quasar disk evolves according to the advection-dominated inflow-outflow solution (ADIOS) configuration in the stable lower branch of the S-shaped instability, and the Eddington accretion rate is used to constrain the accretion rate in the highly active phase. The mass ratio between a BH and its host galactic bulge is a natural consequence of an ADIOS. Our model also demonstrates that a seed BH approx. 2 x 10(exp 6) solar masses similar to those found in spiral galaxies today is needed to produce a BH with a final mass of approx. 2 x 10(exp 8) solar masses.
Author (revised)
Astronomical Models; Black Holes (Astronomy); Quasars; Ionization

20040073170 Universities Space Research Association, Greenbelt, MD, USA
RXTE and BATSE Observations of the Recent Outbursts of 2S 1417-624
Finger, M. H.; Heindl, W. A.; Zhang, S. N.; Rossi 2000: Astrophysics with the Rossi X-ray Timing Explorer; 2000, pp. E48; In English; Rossi 2000: Astrophysics with the Rossi X-ray Timing Explorer, 22-24 Mar. 2000, Greenbelt, MD, USA
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

25 1417-624 is a 57 mHz transient Be/X-ray pulsar system first discovered by SAS 3 in 1978. After the discovery outburst it was not seen again until 1994 when BATSE observed an outburst that peaked at 40 Srab (pulsed flux, 20-50 keV) and lasted 110 days, followed by a series of 5 shorter, 10-15 mCrab outbursts occurring every 42 days. Pulse timing analysis showed that these smaller outbursts began a few days after periastron passage of the system's eccentric, 42 day period orbit. Renewed activity from the source was detected by BATSE beginning in 1999 November. BATSE monitoring shows a 10 mCrab peak flux outburst lasting 10 days, followed in the next orbit by a 30 mCrab peak flux outburst, which to date has lasted 56 days. Regular monitoring with RXTE began during the 1999 November outburst and has continued in to the current outburst. The data provides good coverage of the low flux state between BATSE detections, which includes the periastron passage. Pulses are detected through this interval, showing that the source did not enter the propeller regime. The PCA monitoring from the lowest flux level, which occurs shortly before periastron, until the peak of the current outburst, show a continuous evolution of the pulse profile. These profiles contain a narrow notch feature which allow us to present a phase aligned history of this pulse evolution. We present a timing analysis of the PCA and BATSE observations that provide corrections to the binary orbit, and measurements of the torque during the observations. From the observed torque and flux we show that disc accretion is occurring in the current outburst, most probably was also occurring in the smaller outburst.
Author
Gamma Ray Bursts; Gamma Ray Observatory; Pulsars; X Ray Timing Explorer

20040073172 NASA Marshall Space Flight Center, Huntsville, AL, USA
Does the Inner Disk Boundary of a Black Hole X-Ray Binary move During an Outburst?
Zhang, S. N.; Cui, W.; Chen, W.; Harmon, B. A.; Robinson, C. R.; Robinson, C. R.; Sun, X.; Yao, Y.; Zhang, X.; Rossi2000: Astrophysics with the Rossi X-ray Timing Explorer; 2000, pp. E112; In English; Rossi2000: Astrophysics with the Rossi X-ray Timing Explorer, 22-24 Mar. 2000, Greenbelt, MD, USA
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

Comptonization in the corona of an X-ray binary may reduce significantly the flux in the observed soft component of its X-ray spectrum. There fore the apparent inner disk radius inferred from the observed soft component may change in accordance to the fraction of the disk emission scattered into the hard component. We have developed a simple numerical model for carrying out the radiative transfer correction, in order to determine the original disk emission before the Comptonization in the hot corona. Applying this model to the extensive monitoring data of several black hole X-ray binaries with RXTE, we have found that most of the previous 1 y reported inner disk radius variations may be explained as due to this radiative transfer effect in the corona. We thus conclude that there is currently no evidence for significant inner disk boundary movement during the outbursts of these black hole X-ray binaries we have studied with the RXTE data.: GROJ1655-40, XTEJ1550-564, XTEJ1748-288 and XTEJ2012+381.
Author
Black Holes (Astronomy); X Ray Binaries

20040073174 NASA Marshall Space Flight Center, Huntsville, AL, USA, Maryland Univ., MD, USA, NASA Goddard

Space Flight Center, Greenbelt, MD, USA, , Huntsville, AL, USA
Evolution of the Iron K-Alpha Emission Line in the Black Hole Candidate GX339-4 During and Outburst Decay Phase
Feng, Y.; Zhang, S.-N.; Chen, W.; Cui, Wei; Bulletin of the American Astronomical Society; December 1999; Volume 31, pp. 1556; In English; 195th AAS Meeting
Contract(s)/Grant(s): NAG5-7927
Report No.(s): AAS-126.05; Copyright; Avail: Other Sources; Abstract Only

The evolution of the iron K-alpha line emission feature was found from the black hole candidate GX339-4 when its X-ray flux (2 to 10 keV) decreased significantly. With RXTE observations, a broad line emission feature around 7 keV was detected in its quiescent and low flux state; while in the high flux state, an emission line feature around 6.4 keV was detected. A similar 6.4 keV line feature was also detected with previous ASCA observations in a high flux state. We consider that the evolution could be the evidence of the variations in the geometric structure and the physical properties of the accretion flow when the accretion rate changed. This is because that the 7 keV line feature can be produced by the radiative recombination cascade, collisional excitation, and fluorescence of Fe XXVI and Fe XXV, which can exist in a very high temperature plasma; while the 6.4 keV line feature can be produced by fluorescent K-alpha line emission of neutral iron atoms in the cold accretion disk. (copyright) 1999 American Astronomical Society. All rights reserved.
Author (revised)
K Lines; Iron; Black Holes (Astronomy); X Ray Astronomy

20040073455 California Univ., Berkeley, CA, USA
Modelling the Soft X-Ray and EUV Emission in Classical Novae: EUVE and ROSAT Observations of V1974 Cygni
Stringfellow, Guy S.; Bowyer, Stuart; Astrophysics in the Extreme Ultraviolet; [1996], pp. 401-405; In English
Contract(s)/Grant(s): NAS5-30180; NAG5-3394; Copyright; Avail: Other Sources

We have conducted an extensive analysis of the observability of Classical Novae with the EUVE Lex/B and Al/Ti/C detectors. Predicted count rates have been computed using optically thin, isothermal plasma models for solar and metal-rich compositions, and hot ONeMg white dwarf model atmospheres. We find EUVE to be quite sensitive to both the EUV and soft X-ray emission emitted by the underlying hot white dwarf during novae outbursts, except for the coolest temperatures with very high intervening hydrogen column density. These results are used to interpret the emission detected during the EUVE all-sky survey of Nova Cygni 1992 (approx. = V1974 Cyg), 279-290 days after visual maximum. We find the best fit to the observed emission from V1974 Cyg arises from a hot ONeMg white dwarf with surface temperature approx. 4 x l0(exp 5) K and a mas of approx. 1.2 solar mass, and derive an interstellar hydrogen column density of approx. 3 x 10(exp 21)/sq cm. Virtually all this emission arises from supersoft X-rays rather than the EUV. We also report the detection of V1974 Cyg with the EUVE Deep Survey detector at 549 days after visual maximum. This observation is compatible with the above properties, indicating that the mechanism responsible for the soft X-ray emission, connected with the underlying white dwarf, had not yet entirely turned off. We also present analysis of a ROSAT PSPC observation which is contemporaneous with the EUVE survey observations; this independently confirms the high column density we derived from the EUVE survey observation. Light curves for the EUVE and ROSAT observations are presented. Statistical tests for variability show that all of these observations are indeed highly variable over various time scales. The EUVE survey data shows one day variations, the EUVE DS data show approx. 30 minute fluctuations, while the ROSAT data vary rapidly on time scales of seconds. The EUVE data shows no periodic variability on any time scale. The implications of the rapid variability are briefly discussed.
Author
X Rays; Models; Extreme Ultraviolet Radiation; Emission; Interstellar Gas

20040073467 Pennsylvania State Univ., University Park, PA, USA
The Flare and Quiescent States of M-dwarf Coronae
Stringfellow, Guy S.; ASP Conference Series; April 22, 2004; Volume 109, pp. 293-294; In English; Cool Stars, Stellar Systems, and the Sun: 9th Cambridge Workshop
Contract(s)/Grant(s): NAG5-3394; NAG5-2981; Copyright; Avail: Other Sources

As part of an ongoing program searching for and analyzing X-ray variable sources in the ROSAT PSPC archive, the lightcurves and spectral analysis for two M- dwarf flare stars are presented; AD Leo and VB 8.
Author
Coronas; Dwarf Stars; Flare Stars; Spectrum Analysis; M Stars

20040073502 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effect of Viscosity on the Crystallization of Undercooled Liquids

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 5; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There have been numerous studies of glasses indicating that low-gravity processing enhances glass formation. NASA PI s are investigating the effect of low-g processing on the nucleation and crystal growth rates. Dr. Ethridge is investigating a potential mechanism for glass crystallization involving shear thinning of liquids in 1-g. For shear thinning liquids, low-g (low convection) processing will enhance glass formation. The study of the viscosity of glass forming substances at low shear rates is important to understand these new crystallization mechanisms. The temperature dependence of the viscosity of undercooled liquids is also very important for NASA s containerless processing studies. In general, the viscosity of undercooled liquids is not known, yet knowledge of viscosity is required for crystallization calculations. Many researchers have used the Turnbull equation in error. Subsequent nucleation and crystallization calculations can be in error by many orders of magnitude. This demonstrates the requirement for better methods for interpolating and extrapolating the viscosity of undercooled liquids. This is also true for undercooled water. Since amorphous water ice is the predominant form of water in the universe, astrophysicists have modeled the crystallization of amorphous water ice with viscosity relations that may be in error by five orders-of-magnitude.

Author

Crystal Growth; Glass; Crystallization; Temperature Dependence; Microgravity; Viscosity

20040073528 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

Chaos in the Solar System

Lecar, Myron; Franklin, Fred A.; Holman, Matthew J.; Murray, Norman J.; Annual review of Astronomy and Astrophysics; 2001; Volume 39, pp. 581-631; In English

Contract(s)/Grant(s): NAG5-10365; Copyright; Avail: Other Sources; Abstract Only

The physical basis of chaos in the solar system is now better understood: In all cases investigated so far, chaotic orbits result from overlapping resonances. Perhaps the clearest examples are found in the asteroid belt. Overlapping resonances account for its kirkwood gaps and were used to predict and find evidence for very narrow gaps in the outer belt. Further afield, about one new "short-peroid" comet is discovered each year. They are believed to come from the "Kuiper Belt" (at 40 AU or more) via chaotic orbits produced by mean-motion and secular resonances with Neptune. Finally, the planetary system itself is not immune from chaos. In the inner solar system, overlapping secular resonances have been identified as the possible source of chaos. For example, Mercury in 1012 years, may suffer a close encounter with Venus or plunge into the Sun. In the outer solar system, three-body resonances have been identified as a source of chaos, but on an even longer time scale of 109 times the age of the solar system. On the human time scale, the planets do follow their orbits in a stately procession, and we can predict their trajectories for hundreds of thousands of years. That is because the mavericks, with shorter instability times, have long since been ejected. The solar system is not stable; it is just old!

Author

Chaos; Solar System; Gas Giant Planets; Astrophysics

20040073612 Naval Research Lab., Washington, DC

SKA Hybrids Involving the US LNSD COncept

Lazio, Joseph; Apr. 5, 2004; 12 pp.; In English

Report No.(s): AD-A422485; NRL/MR/7210--04-8768; No Copyright; Avail: CASI; A03, Hardcopy

The likely Key Projects for the SKA demand both a large frequency range (potentially 0.06-24 GHz) and a large range of fields of view (potentially less than 1 deg(2) at higher frequencies to as much as 200 deg(2) below 1 GHz). The US SKA Consortium has proposed the Large Number/Small-Diameter (LNSD) concept, which generally covers the frequency ranges and fields of view required by the Key Projects. Opportunities do exist, however, to enhance the design of this concept and provide access to larger ranges of frequency and field of view. We describe a number of "hybrid" arrays, involving the LNSD concept, that are designed to increase the probability that most of the SKA Key Projects can be conducted. There are two broad classes of hybrids, those that combine concepts and those that combine technological aspects from the different international groups. We consider how the US LNSD concept could form the basis of both kinds of hydrids. We focus on two "strawman hybrids." The first is an SKA composed of high- and low-frequency sub-arrays, with the LNSD concept forming the high-frequency sub-array.

DTIC

Interferometry; Radio Astronomy

20040073754 Air Force Research Lab., Hanscom AFB, MA

Narrow Coronal Holes in Yohkoh Soft X-Ray Images and the Slow Solar Wind

Arge, C. N.; Harvey, K. L.; Hudson, H. S.; Kahler, S. W.; Jan. 2004; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A422678; AFRL-VS-HA-TR-2004-1064; No Copyright; Avail: CASI; A01, Hardcopy

Soft X-ray images of the solar corona sometimes show narrow dark features not obviously present in HE I 10830A images. We term these "narrow coronal holes" (NCHs). A prototype for this type of structure crossed solar central meridian on October 29, 2001. Standard source-surface models showed open magnetic field lines in this feature, tending to confirm its identification as a coronal hole. The magnetic field in this example is relatively strong (above 100 G in the low-resolution Kin Peak magnetograms), and the boundaries of the open-field domain fall within the unipolar area as expected. We have surveyed the Yohkoh SXT data for other examples of this phenomenon, and have found several candidates. From observations of the associated solar wind, and from modeling, we find these regions to be sources of slow solar wind.

DTIC

Coronal Holes; Solar Corona; Solar Wind; X Rays

20040073758 Air Force Research Lab., Hanscom AFB, MA

Parameterizing the Wind 3DP Heat Flux Electron Data

Kahler, S. W.; Crooker, N. U.; Larson, D. E.; Jan. 2004; 5 pp.; In English

Contract(s)/Grant(s): Proj-2311

Report No.(s): AD-A422682; AFRL-VS-HA-TR-2004-1063; No Copyright; Avail: CASI; A01, Hardcopy

Solar wind heat flux (HF) electrons are valuable as tracers of the interplanetary magnetic field (IMF) topology, distinguishing positive from negative solar polarities and indicating the presence of magnetically closed CMEs when the flows are counterstreaming. All past applications of heat fluxes to determine field topologies have been based on visual inspection of color spectrograms of electron pitch angle distributions (PADs). However, HF PADs can take a range of shapes and amplitudes, which challenges the visual analysis. We now take a quantitative approach to HF analysis by parameterizing the HF PADs of the UC Berkeley 3DP data with a Fourier harmonic analysis. We have calculated the harmonic cosine coefficients Ao through A4 for a five-year period of the Wind 3DP data set with a lO-min time resolution. With these data we intend to derive quantitative criteria for unidirectional and bi-directional flows and other possible diagnostics of interplanetary field dynamics or configurations. Some initial considerations and results of the 3DP parameterization are presented.

DTIC

Heat Flux; Solar Wind

20040073765 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

Structure in the Dusty Debris around Vega

Wilner, D. J.; Holman, M.; Kuchner, M. J.; Ho, P. T. P.; The Astrophysical Journal; [2002]; Volume 569, pp. L115-L119; In English

Contract(s)/Grant(s): NAG5-10365; Copyright; Avail: Other Sources; Abstract Only

We present images of the Vega system obtained with the IRAM Plateau de Bure interferometer at a 1.3 millimeter wavelength with submillijansky sensitivity and approximately 2.5 inches resolution (about 20 AU). These observations clearly detect the stellar photosphere and two dust emission peaks offset from the star by 9.5 inches and 8.0 inches to the northeast and southwest, respectively. These offset emission peaks are consistent with the barely resolved structure visible in previous submillimeter images, and they account for a large fraction of the dust emission. The presence of two dust concentrations at the observed locations is plausible explained by the dynamical influence of an unseen planet of a few Jupiter masses in a highly eccentric orbit that traps dust in Principal mean motion resonances. Based on observations carried out with the IRAM Plateau de Bure Interferometer.

Author

Dust; Astrophysics; Terrestrial Planets; Solar System; Planetary Structure

20040074130 Naval Observatory, Washington, DC, USA

Gauge Freedom in the N-body Problem of Celestial Mechanics

Efroimsky, M.; Goidreich, P.; Oct. 22, 2003; 14 pp.; In English

Report No.(s): AD-A422861; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this paper is to demonstrate how the internal symmetry of the N-body celestial-mechanics problem can be

exploited in orbit calculation. We start with summarizing research reported in (Efroimsky 2002, 2003; Newman & Efroimsky 2003; Efroimsky & Goldreich 2003) and develop its application to planetary equations in non-inertial frames. This class of problems is treated by the variations of- constraints method. As explained in the previous publications, Whenever a standard system of six planetary equations (in the Lagrange Delaunay, or other form) is employed for N objects, the trajectory resides on a 9(N-1)-1 dimensional submanifold of the 12(N-1)-dimensional space spanned by the orbital elements and their time derivatives. The freedom in choosing this submanifold reveals an internal symmetry inherent in the description of the trajectory by orbital elements. This freedom is analogous to the gauge invariance of electrodynamics. In traditional derivations of the planetary equations this freedom is removed by hand through the introduction of the Lagrange constraint, either explicitly (in the variation-of-constraints methods or implicitly (in the Hamilton-Jacobi approach). This constraint imposes the condition (called osculation condition") that both the instantaneous position and velocity be fit by a Keplerlan ellipse (or hyperbola), i.e. that the instantaneous Keplerian ellipse (or hyperbola) be tangential to the trajectory. Imposition of any supplementary constraint different from that of Lagrange (but compatible with the equations of motion) would alter the mathematical form of the planetary equations without affecting the physical trajectory. However, for coordinate-dependent perturbations, any gauge different from that of Lagrange makes the Delaunay system non-canonical.
DTIC
Celestial Mechanics; Many Body Problem; Measuring Instruments

20040074162 Alabama Univ., Huntsville, AL, USA
Relativistic Effects on X-Ray Emission from Accretion Disk around Black Holes
Zhang, X.; Zhang, S. N.; Yao, Y.; AIP Conference Proceedings; 200; Volume 587, pp. 101; In English
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources
No abstract available
X Ray Astronomy; Black Holes (Astronomy); Relativistic Effects; Accretion Disks

20040074163
The Temporal and Spectral Properties of Cyg X-1 During a Large X-Ray Flare
Cui, W.; Zhang, S. N.; Feng, Y. X.; AIP Conference Proceedings; 2001; Volume 587, pp. 76; In English; Gamma 1002: Gamma-Ray Astrophysics, 4-6 Apr. 2001, Baltimore, MD, USA
Contract(s)/Grant(s): NAG5-2927; No Copyright; Avail: Other Sources
No abstract available
X Ray Astronomy; X Ray Sources; Bursts

20040074166 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Eccentricity Evolution of Migrating Planets
Murray, N.; Paskowitz, M.; Holman, M.; The Astrophysical Journal; [2002]; Volume 565, No. 1, pp. 608-620; In English
Contract(s)/Grant(s): NAG5-10365; No Copyright; Avail: Other Sources; Abstract Only
We examine the eccentricity evolution of a system of two planets locked in a mean motion resonance, in which either the outer or both planets lose energy and angular momentum. The sink of energy and angular momentum could be a gas or planetesimal disk. We analytically calculate the eccentricity damping rate in the case of a single planet migrating through a planetesimal disk. When the planetesimal disk is cold (the average eccentricity is much less than 1), the circularization time is comparable to the inward migration time, as previous calculations have found for the case of a gas disk. If the planetesimal disk is hot, the migration time can be an order of magnitude shorter. We show that the eccentricity of both planetary bodies can grow to large values, particularly if the inner body does not directly exchange energy or angular momentum with the disk. We present the results of numerical integrations of two migrating resonant planets showing rapid growth of eccentricity. We also present integrations in which a Jupiter-mass planet is forced to migrate inward through a system of 5-10 roughly Earth-mass planets. The migrating planets can eject or accrete the smaller bodies; roughly 5% of the mass (averaged over all the integrations) accretes onto the central star. The results are discussed in the context of the currently known extrasolar planetary systems.
Author
Eccentricity; Orbital Mechanics; Planetary Orbits; Extrasolar Planets

20040074190 Beijing Univ., China
The Growth of Central Black Hole and the Ionization Instability of Quasar Disk
Lu, Ye; Cheng, K. S.; Zhang, S. N.; American Astronomical Society, HEAD Meeting #35; March 2003; 1 pp.; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

A possible accretion model associated with the ionization instability of quasar disks is proposed to address the growth of the central black hole harbored in the host galaxy. The evolution of quasars in cosmic time is assumed to change from a highly active state to a quiescent state triggered by the S-shaped ionization instability of the quasar accretion disk. For a given external mass transfer rate supplied by the quasar host galaxy, ionization instability can modify accretion rate in the disk and separates the accretion flows of the disk into three different phases, like a S-shape. We suggest that the bright quasars observed today are those quasars with disks in the upper branch of S-shaped instability, and the faint or 'dormant' quasars are simply the system in the lower branch. The middle branch is the transition state which is unstable. We assume the quasar disk evolves according to the advection-dominated inflow-outflow solutions (ADIOS) configuration in the stable lower branch of S-shaped instability, and Eddington accretion rate is used to constrain the accretion rate in each phase. The mass ratio between black hole and its host galactic bulge is a nature consequence of ADIOS. Our model also demonstrates that a seed black hole (BH) similar to those found in spiral galaxies today is needed to produce a BH with a final mass 2 x 10(exp 8) solar mases.
Author
Galactic Nuclei; Quasars; Black Holes (Astronomy); Astronomical Models; Ionization

20040074194 Alabama Univ., Huntsville, AL, USA
Dominant Gamma-Ray Bursts Production in the Early Universe
Zhang, S. N.; Lin, J. R.; Li, T. P.; December 2002; 1 pp.; In English
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

It has been known that at least some of the observed gamma-ray bursts (GRBs) are produced at cosmological distances and the GRB production rate may follow the star formation rate. Here we report that the lower and upper distance limits to the GRB production are z approx. 0.24 and z approx. 10, respectively. This result suggests that GRBs are no longer produced presently, and that the actual star formation rate peaks at much higher redshift and thus the 'dark ages' of the universe have ended much earlier than believed previously. This study is supported in part by the Special Funds for Major State Basic Research Projects and by the National Natural Science Foundation of China. SNZ also acknowledges supports by NASA's Marshall Space Flight Center and through NASA's Long Term Space Astrophysics Program.
Author
Gamma Ray Astronomy; Gamma Ray Bursts

20040074197 Katholieke Univ. te Leuven, Belgium
How Do The Relativistic Effects Effect the Appearance of a Clothed Black Hole?
Zhang, Xiaoling; Zhang, S. N.; Feng, Yuxin; Yao, Yangsen; April 23, 2002; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

For an accretion disk around a black hole, the strong relativistic effects affect every aspect of the radiation from the disk, including the spectrum, the light-curve, and the image. If the disk is in high inclination angle (nearly edge-on), the image will be greatly distorted; the farther side of the disk will appear to bend toward the observer, photons from the other side of the disk can reach the observer (if they are not blocked by the disk) to form a ghost image. This work differs mainly from previous work by taking into account the temperature distribution of a standard thin disk model and investigating the expected images from different viewing angles and in different energy bands. The edge-blocking effect is also considered. Direct images of black hole systems may be obtained with future X-ray missions like MAXIM pathfinder.
Author
Relativistic Effects; Black Holes (Astronomy)

20040074203 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Properties of Minor Ions in the Solar Wind and Implications for the Background Solar Wind Plasma
Wagner, William, Technical Monitor; Esser, Ruth; May 2004; 6 pp.; In English
Contract(s)/Grant(s): NAG5-10996; No Copyright; Avail: CASI; A02, Hardcopy

The scope of the investigation is to extract information on the properties of the bulk solar wind from the minor ion observations that are provided by instruments on board NASA space craft and theoretical model studies. Ion charge states measured in situ in interplanetary space are formed in the inner coronal regions below 5 solar radii, hence they carry information on the properties of the solar wind plasma in that region. The plasma parameters that are important in the ion forming processes are the electron density, the electron temperature and the flow speeds of the individual ion species. In addition, if the electron distribution function deviates from a Maxwellian already in the inner corona, then the enhanced tail of that distribution function, also called halo, greatly effects the ion composition. This study is carried out using solar wind

models, coronal observations, and ion calculations in conjunction with the in situ observations.
Derived from text
Ion Charge; Mathematical Models; Solar Wind; Plasmas (Physics); Astrophysics

20040074247 Alabama Univ., Huntsville, AL, USA
Discovery of a Three-Layered Atmospheric Structure in Accretion Disks around Stellar-Mass Black Holes
Zhang, S. N.; Zhang, Xiaoling; Sun, Xuejun; Yao, Yangsen; Cui, Wei; Chen, Wan; Wu, Xuebing; Xu, Haiguang; Bulletin of the American Astronomical Society; Dec. 1999; Volume 31, pp. 1555; In English
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

We have carried out systematic modeling of the X-ray spectra of the Galactic superluminal jet sources GRS 1915+105 and GRO J1655-40, using our newly developed spectral fitting methods. Our results reveal, for the first time, a three-layered structure of the atmosphere in the inner region of the accretion disks. Above the conanonly known, cold and optically thick disk of a blackbody temperature 0.2-0.5 keV, there is a layer of warm gas with a temperature of 1.0-1.5 keV and an optical depth of around 10. Compton scattering of the underlying disk blackbody photons produces the soft X-ray component we comonly observe. Under certain conditions, there is also a much hotter, optically thin corona above the warm layer, characterized by a temperature of 100 keV or higher and an optical depth of unity or less. The corona produces the hard X-ray component typically seen in these sources. We emphasize that the existence of the warm layer seem to be independent of the presence of the hot corona and, therefore, it is not due to irradiation of the disk by hard X-rays from the corona. Our results suggest a striking structural similarity between the accretion disks and the solar atmosphere, which may provide a new stimulus to study the common underlying physical processes operating in these vastly different systems. We also report the first unambiguous detection of an emission line around 6.4 keV in GRO J1655-40, which may allow further constraining of the accretion disk structure. We acknowledge NASA GSFC and MFC for partial financial support. (copyright) 1999: American Astronomical Society. All rights reverved.
Author
Black Holes (Astronomy); Accretion Disks; X Ray Astronomy

20040074314 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Interstellar Dust Models Consistent with Extinction, Emission, and Abundance Constraints
Zubko, Viktor; Dwek, Eli; Arendt, Richard G.; New Concepts for Far-Infrared and Submillimeter Space Astronomy; April 2004, pp. 129-133; In English; See also 20040074260; No Copyright; Avail: CASI; A01, Hardcopy

We present new interstellar dust models which have been derived by simultaneously fitting the far ultraviolet to near infrared extinction, the diffuse infrared emission, and, unlike previous models, the elemental abundances in dust for the diffuse interstellar medium. We found that dust models consisting of a mixture of spherical graphite and silicate grains, polycyclic aromatic hydrocarbon (PAH) molecules, in addition to porous composite particles containing silicate, organic refractory, and water ice, provide an improved .t to the UV-to-infrared extinction and infrared emission measurements, while consuming the amounts of elements well within the uncertainties of adopted interstellar abundances, including B star abundances. These models are a signi.cant improvement over the recent Li & Draine (2001, ApJ, 554, 778) model which requires an excessive amount of silicon to be locked up in dust: 48 ppm (atoms per million of H atoms), considerably more than the solar abundance of 34 ppm or the B star abundance of 19 ppm.
Author
Cosmic Dust; Interstellar Chemistry

20040074327 NASA Glenn Research Center, Cleveland, OH, USA
Velocity and Temperature Measurement in Supersonic Free Jets Using Spectrally Resolved Rayleigh Scattering
Panda, J.; Seasholtz, R. G.; May 2004; 26 pp.; In English; 37th Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Contract(s)/Grant(s): WBS 714-08-14
Report No.(s): NASA/TM-2004-212391; AIAA Paper 99-0296; E-13968; No Copyright; Avail: CASI; A03, Hardcopy

The flow fields of unheated, supersonic free jets from convergent and convergent-divergent nozzles operating at M = 0.99, 1.4, and 1.6 were measured using spectrally resolved Rayleigh scattering technique. The axial component of velocity and temperature data as well as density data obtained from a previous experiment are presented in a systematic way with the goal of producing a database useful for validating computational fluid dynamics codes. The Rayleigh scattering process from air molecules provides a fundamental means of measuring flow properties in a non-intrusive, particle free manner. In the

spectrally resolved application, laser light scattered by the air molecules is collected and analyzed using a Fabry-Perot interferometer (FPI). The difference between the incident laser frequency and the peak of the Rayleigh spectrum provides a measure of gas velocity. The temperature is measured from the spectral broadening caused by the random thermal motion and density is measured from the total light intensity. The present point measurement technique uses a CW laser, a scanning FPI and photon counting electronics. The 1 mm long probe volume is moved from point to point to survey the flow fields. Additional arrangements were made to remove particles from the main as well as the entrained flow and to isolate FPI from the high sound and vibration levels produced by the supersonic jets. In general, velocity is measured within +/- 10 m/s accuracy and temperature within +/- 10 K accuracy.
Author
Temperature Measurement; Velocity Measurement; Supersonic Jet Flow; Flow Distribution; Flow Characteristics; Free Jets

91
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*.

20040068133 NASA Ames Research Center, Moffett Field, CA, USA
Obliquity Variations of Extrasolar Terrestrial Planets
Lissauer, Jack J.; Chambers, John E.; January 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A planet's obliquity, which is the angle between its orbital angular momentum and its rotational angular momentum, is an important factor in determining its climate and habitability. For small obliquities, as well as obliquities close to 180 degrees, the planet receives more radiant energy from its star at equatorial latitudes than near its poles, whereas the poles are heated the most for obliquities near 90 degrees. Jacques Laskar has analyzed possible obliquity variations of the planets in our Solar System. His study also considers the same planets with different rotational periods, and the Earth without the Moon. He finds, using frequency map analysis, that the obliquity of the Earth is stabilized by the Moon, and can vary by at most a few degrees. In contrast, the obliquity of Mars can range from 0 to 60 degrees, and a hypothetical moonless Earth's axial tilt could be close to 0 degrees or as large as 85 degrees. Numerical integrations by Laskar and others have shown that Mars' obliquity indeed varies over most of its permitted range on time scales of tens of millions of years. In contrast, our analysis shows that the obliquity of a moonless Earth appears to be confined to the range of approximately 12 - 38 degrees over time scales of 100 million years. Results of ongoing longer integrations will be presented, and their implications discussed.
Author
Extrasolar Planets; Terrestrial Planets; Obliqueness; Variations

20040068140 NASA Ames Research Center, Moffett Field, CA, USA
Vibrational Spectroscopy of Ions and Radicals Present in the Interstellar Medium and in Planetary Atmospheres: A Theoretical Study
Chaban, Galina M.; February 12, 2004; 1 pp.; In English; 227th ACS Meeting, 28 Mar. - 1 Apr. 2004, Anaheim, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Anharmonic vibrational frequencies and intensities are calculated for OH(H2O)n and H(H2O)n radicals (that form on icy particles of the interstellar medium), HCO radical (the main intermediate in the synthesis of organic molecules in space), NH2(-) and C2H(-) anions, H5(+) cation, and other systems relevant to interstellar chemistry. In addition to pure ions and radicals, their complexes with water are studied to assess the effects of water environment on infrared spectra. The calculations are performed using the correlation-corrected vibrational self-consistent field (CC-VSCF) method with ab initio potential surfaces at the MP2 and CCSD(T) levels. Fundamental, overtone, and combination excitations are computed. The results are in good agreement with available experimental data and provide reliable predictions for vibrational excitations not yet measured in laboratory experiments. The data should be useful for interpretation of astronomically observed spectra and identification of ions and radicals present in the interstellar medium and in planetary atmospheres.
Author
Interstellar Matter; Ions; Planetary Atmospheres; Radicals; Vibrational Spectra; Spectroscopy; Vibration

20040068145 Tokyo Univ., Japan

Contemporaneous Formation of Chondrules in the Al-26-MG-26 System for Ordinary and CO Chondrites

Kurahashi, E.; Kita, N. T.; Nagahara, H.; Morishita, Y.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Chronometer using the short-lived extinct-nuclide (26)Al has been applied to chondrules in order to obtain of their formation ages. Previous studies were mostly performed on Al-rich chondrules, which constitute only 1% of all chondrules, because of their high Al/Mg ratios. Recently, (26)Al ages of major ferromagnesian chondrules in least equilibrated ordinary chondrites (OC) have been obtained. However, (26)Al ages of ferromagnesian chondrules in least equilibrated carbonaceous chondrites (CC) are very limited. Particularly, age data of FeO-poor (Type I) chondrules in CC have been scarcely obtained, because of their fine textures and lack of phases with high Al/Mg (>100) ratios. In order to clarify the origin and formation processes of chondrules, we started systematic investigations on Type I chondrules in the most pristine CC (CO3.0 Yamato-81020), by examining textures, bulk chemical compositions, (26)Al ages and oxygen isotopic compositions. We find Type I chondrules in CC formed contemporaneously with ferromagnesian chondrules in OC.

Author

Chondrule; Chronology; Chondrites; Meteoritic Composition; Aluminum; Magnesium

20040068159 Tokyo Univ., Hongo, Japan

Evaporation and Accompanying Isotopic Fractionation of Sulfur from FE-S Melt During Shock Wave Heating

Tachibana, S.; Huss, G. R.; Miura, H.; Nakamoto, T.; Lunar and Planetary Science XXXV: Chondrules: The Never-Ending Story; 2004; 2 pp.; In English; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Chondrules probably formed by melting and subsequent cooling of solid precursors. Evaporation during chondrule melting may have resulted in depletion of volatile elements in chondrules. It is known that kinetic evaporation, especially evaporation from a melt, often leads to enrichment of heavy isotopes in an evaporation residue. However, no evidence for a large degree of heavy-isotope enrichment has been reported in chondrules for K, Mg, Si, and Fe (as FeO). The lack of isotopic fractionation has also been found for sulfur in troilites (FeS) within Bishunpur (LL3.1) and Semarkona (LL3.0) chondrules by an ion microprobe study. The largest fractionation, found in only one grain, was 2.7 +/- 1.4 %/amu, while all other troilite grains showed isotopic fractionations of <1 %/amu. The suppressed isotopic fractionation has been interpreted as results of (i) rapid heating of precursors at temperatures below the silicate solidus and (ii) diffusion-controlled evaporation through a surrounding silicate melt at temperatures above the silicate solidus. The kinetic evaporation model suggests that a rapid heating rate of >10(exp 4)-10(exp 6) K/h for a temperature range of 1000-1300 C is required to explain observed isotopic fractionations. Such a rapid heating rate seems to be difficult to be achieved in the X-wind model, but can be achieved in shock wave heating models. In this study, we have applied the sulfur evaporation model to the shock wave heating conditions of to evaluate evaporation of sulfur and accompanying isotopic fractionation during shock wave heating at temperatures below the silicate solidus.

Author

Chondrule; Meteoritic Composition; Chemical Fractionation; Sulfur; Impact Melts

20040068205 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Upcoming and Future Missions in the Area of Infrared Astronomy: Spacecraft and Ground-based Observations

Sittler, E. C., Jr.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 1-1 - 1-11; In English; See also 20040068186; No Copyright; Avail: CASI; A03, Hardcopy

The IRIS instrument on the Voyager spacecrafts made major discoveries with regard to the giant planets, their moons and rings and paved the way for future infrared observations for planetary missions within our solar system. The CIRS instrument of Cassini with much greater spectral-spatial resolution and sensitivity than that provided by IRIS is now rapidly approaching the Saturnian system with orbit insertion on July 1, 2004, for which CIRS is expected to provide an order of magnitude advance beyond that provided by IRIS. The Mars program is also presently dominated by infrared observations in the near to mid-infrared spectral bands for missions such as Mars Global Surveyor and its TES instrument and Odyssey with its THEMIS instrument. In the case of Earth science we have such missions as TIMED, which makes infrared observations of the thermosphere using the SABER instrument. With the newly formed New Frontiers Program we have the opportunity for $650M missions such as Kuiper Belt-Pluto Explorer and Jupiter Polar Orbiter with Probes. Under the Flagship line, once per decade, we have the opportunity for $1B missions for which Europa is presently being considered; for this mission infrared measurements could look for hot spots within the maze of cracks and faults on Europa s surface. On Kuiper Belt- Pluto there is an imaging near-IR spectrometer called LEISA. Another mission on the horizon is Titan Orbiter Aerorover Mission (TOAM) for which there is planned a state-of-art version of CIRS called TIRS on the orbiter that will map out the atmospheric

composition with unprecedented wavelength coverage and spectral-spatial resolution. This instrument will also provide temperature maps of the surface of Titan to look for hot spots where life may form. On the same mission there will be a descent imager on the Aerorover (i.e., balloon) similar to that provided by LEISA on the Pluto mission to provide compositional-topographical maps of Titan s surface. Other future mission will also be discussed. Improved thermal detectors could have important applications in solar physics, specifically in the detection of far-IR synchrotron emission from energetic electrons in solar flares. For infrared astronomy we have missions like SIRTF and JWST, which will cover the spectral range from near-IR to far-IR in the search and probing of both new and old planetary systems in our galaxy and the measurement of the most distant galaxies of our universe. SIRTF is scheduled to be launched in August 2003, while JWST will be launched next decade. Another mission is TPF, which will use interferometer techniques at infrared wavelengths to search for planetary systems beyond 2010. With regard to ground based telescopes we have, for example, the twin 10 meter Keck telescopes and the IRTF telescope at Mauna Kea. The Keck telescopes are presently using interferometer techniques. Over the next several decades there are plans for 50 meter to 200 meter telescopes providing near-IR to far-IR measurements with the eventual plan to combine all telescopes using interferometer techniques to provide unprecedented spectral-spatial resolution and sensitivity.
Author

Infrared Astronomy; Ground Based Control; Observation; Infrared Spectra; Infrared Radiation; Solar Flares

20040068396 NASA Ames Research Center, Moffett Field, CA, USA

Electrical Charging of Aerosols and Conductivity of Titan's Atmosphere

Borucki, W. J.; Whitten, R. C.; Tripathi, S. N.; Bakes, E. L. O.; Barth, E.; February 03, 2004; 1 pp.; In English; European Geosciences Union 1st General Assembly, 25-30 Apr. 2004, Nice, France

Contract(s)/Grant(s): UPN 853-15-01; No Copyright; Avail: Other Sources; Abstract Only

We have used recent data on graphitic cloud particles in the atmosphere of Titan to compute the electrical charging of the particles (radii ranging from 0.01 microns to 0.26 microns). The charging on the nightside was rather similar to that obtained earlier except that charge distributions on the particles are now computed and recently obtained cloud particle sizes and density distributions were employed. The negative charge on particles of 0.26 microns peaked at 9 at 150 km altitude. The computations were repeated for the dayside with the addition of photoelectron emission by the particles as a result of the absorption of solar UV radiation. Particles (except the very smallest) now became positively charged with particles of radius 0.26 microns being charged up to +47. Next, very small particles (radii approx. 3 x 10 (sup -4) microns) of polycyclic aromatic hydrocarbons (PAHs) were introduced and treated as sources of negative ions since they could be either neutral or carry one negative charge. Moreover, they are mobile so that they had to be treated like molecular size negative ions although much more massive. They had the effect of substantially reducing the electron densities in the altitude range 190 to 310 km to values less than the negative PAH densities and increasing the peak electron charge on the larger particles. Particles of radius 0.26 microns bore peak charges of approx. +47 at altitudes of approx. 250 km. The simulated effect of PAHs on the nightside proved to be much less pronounced; at the peak negative PAH density, it was less than the electron density. The physics governing these results will be discussed.
Author

Titan; Satellite Atmospheres; Aerosols; Electrical Resistivity; Electric Charge

20040070782 Analex Corp., Brook Park, OH, USA

Solar Powered Flight on Venus

Colozza, Anthony; Landis, Geoff, Technical Monitor; April 2004; 34 pp.; In English

Contract(s)/Grant(s): NAS3-00145; WBS 755-81-01

Report No.(s): NASA/CR-2004-213052; E-14488; No Copyright; Avail: CASI; A03, Hardcopy

Solar powered flight within the Venus environment from the surface to the upper atmosphere was evaluated. The objective was to see if a station-keeping mission was possible within this environment based on a solar power generating system. Due to the slow rotation rate of Venus it would be possible to remain within the day light side of the planet for extended periods of time. However the high wind speeds and thick cloud cover make a station-keeping solar powered mission challenging. The environment of Venus was modeled as a function of altitude from the surface. This modeling included density, temperature, solar attenuation and wind speed. Using this environmental model flight with both airships and aircraft was considered to evaluate whether a station-keeping mission is feasible. The solar power system and flight characteristics of both types of vehicles was modeled and power balance was set up to determine if the power available from the solar array was sufficient to provide enough thrust to maintain station over a fixed ground location.
Author

Planetary Environments; Venus Atmosphere; Solar Powered Aircraft; Venus Surface; Stationkeeping

20040070922 NASA Marshall Space Flight Center, Huntsville, AL, USA

Crystallization of a Li2O2SiO2 Glass under High Hydrostatic Pressures

Fuss, T.; Day, D. E.; Lesher, C. E.; Ray, C. S.; [2004]; 1 pp.; In English; 106th Annual Meeting of the American Ceramic Society, 18-21 Apr. 2004, Indianapolis, IN, USA

Contract(s)/Grant(s): NAG8-1465; No Copyright; Avail: Other Sources; Abstract Only

The crystallization behavior of a Li2O.2SiO2 (LS2) glass subjected to a uniform hydrostatic pressure of 4.5 or 6 GPa was investigated between 550 and 800 C using XRD, IR, Raman, TEM, NMR, and DTA. The density of the glass subjected to 6 GPa was between 2.52 plus or minus 0.01 and 2.57 plus or minus 0.01 grams per cubic centimeters, depending upon the processing temperatures, and was higher than that of the stoichiometric LS2 crystals, 2.46 plus or minus 0.01 grams per cubic centimeter. Thus, crystallization in 6 GPa glass occurred in a condition of negative volume dilatation, deltaV = V(sub glass) - V(sub crystal), while that for the 4.5 GPa glass occurred in the condition deltaV greater than 0. For deltaV greater than 0, which also includes the control glass at ambient (one atmosphere) pressure, the glasses always crystallize Li2Si2O5 (orthorhombic, Ccc2) crystals, but for deltaV less than 0 (6 GPa), the glasses crystallize Li2SiO3 crystals with a slightly deformed structure. The crystal growth rate vs. temperature curve moved to higher temperature with increasing pressure, and was independent of the sign of deltaV. These results for the effect of hydrostatic pressure on the crystallization of LS2 glass were discussed from thermodynamic considerations.

Author

Crystallization; Hydrostatic Pressure; Lithium Compounds; Silicon Dioxide; Glass; High Pressure

20040070958 Planetary Science Inst., Tucson, AZ, USA

Observing the Sky and Lunar Photo of the Day: Two New Astronomy Education Web Sites

Wood, C. A.; Brausch, J.; Kramer, R.; Ayiomamitis, A.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students and the General Public in Space Science Exploration; 2004; 1 pp.; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The Internet provides the most direct way for scientists to communicate with large numbers of people around the world, without the distortions often introduced by traditional media. Thus, the Internet is the ideal medium for large-scale scientific public outreach. Having previously reached as many as 4,000,000 unique visitors per year with VolcanoWorld (http://volcano.und.edu), a NASA-funded web site that provided information direct from PhD volcanologists, we have developed two new astronomy-related web sites to provide accurate and interesting information to teachers, students and the public.

Derived from text

Education; Websites; Lunar Photographs; NASA Space Programs; Astronomy; Volcanology

20040071004 Agnes Scott Coll., Decatur, GA, USA

Public Enthusiasm Generated by the 2003 Mars Opposition and Landing of the Exploration Rovers

Crane, A. N.; Albin, E. F.; Lunar and Planetary Science XXXV: Engaging K-12 Educators, Students and the General Public in Space Science Exploration; 2004; 1 pp.; In English; Lunar and Planetary Science XXXV, 15-19 Mar. 2004, Houston, TX, USA; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

Interest in Mars is at an all time high. For many weeks leading up to and after August 27th or, the date of opposition, record crowds flocked to observatories for a look at Mars. Public enthusiasm was just as high upon the landing on the two exploration rovers in January 2004. Even after the media "dropped" the event and moved on to other stories, the public response was still strong. It is suggested that such overwhelming public enthusiasm can be taken as good reason to seek a higher level of government funding for the exploration of the Red Planet. Observations and impressions of the public response to the 2003 close approach and exploration rover landings on Mars were taken from our affiliation with the Fernbank Science Center in Atlanta, Georgia -- a museum which houses a well equipped planetarium and observatory. Fernbank staff produced an original planetarium presentation entitled "Visions of Mars." Due to overflow crowds, special extended showings were offered. After the planetarium program, members of the public were invited to the observatory for a look at Mars. On many evenings, centered around opposition, the observatory remained open from 9:00 p.m. until 5:30 a.m. the following morning. On each of these nights, we estimate that at least 950 people saw Mars through our telescope. An important tool, the CCD video camera, proved invaluable in preparing observers for their actual observation of Mars. The Mars mania continues. Two Mars Exploration Rovers were launched toward the Red Planet in the summer of 2003. These probes, Spirit and Opportunity, landed on Mars in January 2004 .

Derived from text

Mars Exploration; Mars Roving Vehicles; Mars Landing

20040073504 NASA Marshall Space Flight Center, Huntsville, AL, USA

Development of Aerogel Molds for Metal Casting Using Lunar and Martian Regolith

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 7; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the last few years NASA has set new priorities for research and development of technologies necessary to enable long-term presence on the Moon and Mars. Among these key technologies is what is known as in situ resource utilization, which defines all conceivable usage of mineral, liquid, gaseous, or biological resources on a visited planet. In response to this challenge, we have been focusing on developing and demonstrating the manufacturing of a specific product using Lunar and Martian soil simulants (i.e., a mold for the casting of metal and alloy parts) which will be an indispensable tool for the survival of outposts on the Moon and Mars. In addition, our purpose is to demonstrate the feasibility of using mesoporous materials such as aerogels to serve as efficient casting molds for high quality components in propulsion and other aerospace applications. The first part of the project consists of producing aerogels from the in situ resources available in Martian and Lunar soil. The approach we are investigating is to use chemical processes to solubilize silicates using organic reagents at low temperatures and then use these as precursors in the formation of aerogels for the fabrication of metal casting molds. One set of experiments consists of dissolving silica sources in basic ethylene glycol solution to form silicon glycolates. When ground silica aerogel was used as source material, a clear solution of silicon glycolate was obtained and reacted to form a gel thus proving the feasibility of this approach. The application of this process to Lunar and Martian simulants did not result in the formation of a gel; further study is in progress. In the second method acidified alcohol is reacted with the simulants to form silicate esters. Preliminary results indicate the presence of silicon alkoxide in the product distillation. However, no gel has been obtained so further characterization is ongoing. In the second part of the project, the focus has been on developing a series of aerogel plates suitable for thin plate metal casting and ingot metal castings. The influence of aerogels on thin wall metal castings was studied by placing aerogel plates into the cavities of thin sections of resin bonded sand molds. An 1 based commercial alloy (356) containing 7 percent Si was poured into these molds. Post-solidification studies provide evidence that aerogel inserts significantly reduce the cooling rate during solidification. The advantage of a lower rate using aerogel inserts was reflected in the reduction of casting defects such as shrinkage porosity. Quantitative results support the hypothesis that using aerogels as a mold material can offer definite advantages when used as casting thin sections. As a separate effort, silica aerogel with cylindrical cavities have been prepared and will be evaluated for casting commercial alloys.

Author

Aerogels; Aerospace Engineering; Chemical Reactions; Casting; In Situ Resource Utilization; Minerals

20040073514 NASA Marshall Space Flight Center, Huntsville, AL, USA

Evolution of Local Microstructures: Spatial Instabilities in Coarsening Clusters

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 24; In English; See also 20040073490; No Copyright; A01, Hardcopy; Abstract only; Available from CASI only as part of the entire parent document.

Diffusion-limited capillarity-driven coarsening of precipitates is an important and intensively studied phenomenon. The classic coarsening theory developed by Lifshitz and Syozov and Wagner (LSW theory) is limited to infinitesimally small volume fractions, V(sub nu), therefore neglects all direct interparticle interactions. This work uses modeling and holographic imaging to compare coarsening rates in "high" volume fraction versus low volume fraction microstructures by observing mixed-dimensional droplets (spherical caps on a surface coarsening by two-dimensional diffusion) during ground-based investigations. The method involves filling a cell with selected homogeneous parent phase, and cooling below the consolute temperature to the isopycnic temperature in the two-phase region of a monotectic system. A microgravity holographic experiment is required for three-dimensional observations to minimize sedimentation during long-term coarsening. Determination of sizes and positions of the many droplets in the holographic images requires automation. We have developed software for automated data analysis, and demonstrated good agreement between regenerated maps and scaled photographs of the original holograms for mixed dimensional coarsening. The results of these experiments were presented in a formal microgravity Science Concept Review (SCR) on December 18, 2000.

Author

Microstructure; Computer Programs; Concentration (Composition); Gravitational Effects; Cluster Analysis; Spherical Caps

20040074123 Toronto Univ., Canada

The Origin of Chaos in the Outer Solar System

Murray, N.; Holman, M.; Science; 1999; Volume 283, pp. 1877; In English

Contract(s)/Grant(s): NAG5-10365; Copyright; Avail: Other Sources

No abstract available

Chaos; Solar System Evolution

20040074206 Arizona Univ., Tucson, AZ, USA

The Abundance and Isotopic Composition of Hg in Extraterrestrial Materials

Lauretta, D. S.; [2004]; 5 pp.; In English

Contract(s)/Grant(s): NAG5-11355; No Copyright; Avail: CASI; A01, Hardcopy

During the past three year grant period we made excellent progress in our study of the abundances and isotopic compositions of Hg and other volatile trace elements in extraterrestrial materials. As part of my startup package I received funds to construct a state-of-the-art experimental facility to study gas-solid reaction kinetics. Much of our effort was spent developing the methodology to measure the abundance and isotopic composition of Hg at ultratrace levels in solid materials. In our first study, the abundance and isotopic composition of Hg was determined in bulk samples of the Murchison (CM) and Allende (CV) carbonaceous chondrites. We have continued our study of mercury in primitive meteorites and expanded the suite of meteorites to include other members of the CM and CV chondrite group as well as CI and CO chondrites. Samples of the CI chondrite Orgueil, the CM chondrites Murray, Nogoya, and Cold Bokkeveld, the CO chondrites Kainsaz, Omans, and Isna, and the CV chondrites Vigarano, Mokoia, and Grosnaja were tested. We have developed a thermal analysis ICP-MS technique and applied it to the study of a suite of thermally labile elements (Zn, As, Se, Cd, In, Sn, Sb, Te, Hg, Au, Tl, Pb, and Bi) in geologic materials as well.

Derived from text

Mercury (Metal); Meteoritic Composition; Abundance; Isotope Ratios

20040074237 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Feasibility of Sensing Tropospheric Ozone with MODIS 9.6 Micron Observations

Prabhakara, C.; Iacovazzi, R., Jr.; Moon-Yoo, Jung; [2004]; 2 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

With the infrared observations made by the Moderate Resolution Imaging Spectrometer (MODIS) on board the EOS-Aqua satellite, which include the 9.73 micron channel, a method is developed to deduce horizontal patterns of tropospheric ozone in cloud free conditions on a scale of about 100 km. It is assumed that on such small scale, at a given instant, horizontal changes in stratospheric ozone are small compared to that in the troposphere. From theoretical simulations it is found that uncertainties in the land surface emissivity and the vertical thermal stratification in the troposphere can lead to significant errors in the inferred tropospheric ozone. Because of this reason in order to derive horizontal patterns of tropospheric ozone in a given geographic area a tuning of this method is necessary with the help of a few dependent cases. After tuning, this method is applied to independent cases of MODIS data taken over Los Angeles basin in cloud free conditions to derive horizontal distribution of ozone in the troposphere. Preliminary results indicate that the derived patterns of ozone resemble crudely the patterns of surface ozone reported by EPA.

Author

MODIS (Radiometry); Ozone; Troposphere; Earth Surface; Satellite Observation; Detection

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040068144 Stanford Univ., CA, USA

Simulation of Multiple Shocks in the Solar Atmosphere using a High-Order Shock-Capturing Scheme

Bryson, Steve; Kosovichev, A.; Levy, Doron; January 2004; 1 pp.; In English; SIAM 2004 Annual Meeting, 12 - 16 Jul. 2004, Portland, OR, USA; No Copyright; Avail: Other Sources; Abstract Only

We present a simulation of shock phenomena in the solar atmosphere using high-order shock capturing central-upwind schemes, based on the Euler equation in gravity. These simulations use observation-based initial conditions, with results matching observation. Various difficulties are highlighted, including very high gradients in the initial data, multiple scales, and initialization in hydrostatic equilibrium. We focus on the design of algorithms to address these problems, as well as the interaction with observational data.

Author

Solar Atmosphere; Computerized Simulation; Shock Waves; Upwind Schemes (Mathematics)

20040068206 L-1 Standards and Technology, Inc., USA

Scripps-NISTAR-New Instrumentation for a Challenging Mission: Earth Radiation Budget Measurements from L-1

Lorentz, Steven R.; Rice, J. P.; Valero, Francisco P. J.; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 1-11; In English; See also 20040068186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Space-based active cavity radiometers have traditionally been used to monitor solar irradiance, as in the ACRIM series of instruments and the VIRGO instrument on SOHO. They have also been used for Earth radiation budget experiments such as ERBE. Various improvements in radiometry at national standards laboratories such as NIST over the past few decades have opened up the possibility of making accurate total irradiance measurements from weaker sources such as the Earth through filtered channels, with electrical-substitution radiometer that will fly aboard the Deep Space Climate Observatory mission. The the Lagrange-1 point. Operation at L-1 affords the possibility of making simultaneous whole disk measurements, which is a new vantage point for Earth radiation budget measurements. This presentation will review the design and characterization of the Scripps-NISTAR instrument.

Author

Earth Radiation Budget; Solar Radiation; Thermal Radiation; Cavities

20040070773 Computational Physics, Inc., Springfield, VA, USA

Solar Occultation Retrieval Algorithm Development

Lumpe, Jerry D.; January 2004; 2 pp.; In English

Contract(s)/Grant(s): NNH04CC14C

Report No.(s): Quarterly-Report-1; No Copyright; Avail: CASI; A01, Hardcopy

This effort addresses the comparison and validation of currently operational solar occultation retrieval algorithms, and the development of generalized algorithms for future application to multiple platforms. initial development of generalized forward model algorithms capable of simulating transmission data from of the POAM II/III and SAGE II/III instruments. Work in the 2" quarter will focus on: completion of forward model algorithms, including accurate spectral characteristics for all instruments, and comparison of simulated transmission data with actual level 1 instrument data for specific occultation events.

Author

Algorithms; Solar Activity; Occultation

20040070810 Science Applications International Corp., San Diego, CA, USA

Understanding the Global Structure and Evolution of Coronal Mass Ejections in the Solar Wind

Riley, Pete; May 14, 2004; 24 pp.; In English

Contract(s)/Grant(s): NASW-02027

Report No.(s): SAIC-04/8010:APPAT-337; Rept-01-0157-04-5215-000; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the technical progress made during the first six months of the second year of the NASA Living with a Star program contract Understanding the global structure and evolution of coronal mass ejections in the solar wind, between NASA and Science Applications International Corporation, and covers the period November 18, 2003 - May 17,2004. Under this contract SAIC has conducted numerical and data analysis related to fundamental issues concerning the origin, intrinsic properties, global structure, and evolution of coronal mass ejections in the solar wind. During this working period we have focused on a quantitative assessment of 5 flux rope fitting techniques. In the following sections we summarize the main aspects of this work and our proposed investigation plan for the next reporting period. Thus far, our investigation has resulted in 6 refereed scientific publications and we have presented the results at a number of scientific meetings and workshops.

Derived from text

Coronal Mass Ejection; Solar Wind; Data Processing

20040070936 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Prominence Energetics Measured with SOHO/SUMER and TRACE

Kucera, T.; Landi, E.; 2004; 1 pp.; In English; 204th Meeting of the American Astronomical Society, 30 May - 3 Jun. 2004, Denver, CO, USA

Contract(s)/Grant(s): RTOP 432-03-52-17; No Copyright; Avail: Other Sources; Abstract Only

The mechanisms by which solar prominences are filled with plasma are still undetermined. In this study we perform a quantitative analysis of the thermal properties of moving features in prominences in order to put constraints on models of prominence formation and dynamics. In order to make such measurements of the quickly moving features seen in prominences

in the W we use the SOHO/SUMER spectrograph to take a time series of exposures from a single pointing position, providing a measurement of spectral line properties as a function of time and position along the slit. temperatures from 80,000 - 1.6 million K. These measurements are combined with TRACE movies in transition region and coronal temperature bands to obtain more complete information concerning prominence structure and motions. The resulting observations allow us to analyze the thermal and kinetic energy of the moving prominence sources as functions of time.
Author
Coronas; Line Spectra; Plasmas (Physics); Solar Prominences; Thermal Energy; Thermodynamic Properties

20040070946 NASA Marshall Space Flight Center, Huntsville, AL, USA
Modern Solar Mysteries
Hathaway, David H.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

100 years ago we thought that the Sun and stars shone as a result of slow gravitational contraction over a few tens of millions of years - putting astronomers at odds with geologists who claimed that the Earth was much, much older. That mystery was solved in the 1920s and 30s with the discovery of nuclear energy (proving that the geologists had it right all along). Other scientific mysteries concerning the Sun have come and gone but three major mysteries remain: 1) How does the Sun produce sunspots with an 11-year cycle? 2) What produces the huge explosions that result in solar flares, prominence eruptions, and coronal mass ejections? and 3) Why is the Sun's outer atmosphere, the corona, so darned hot? Recent progress in solar astronomy reveals a single key to understanding all three of these mysteries.
Author
Sun; Astronomy; Solar Atmosphere; Solar Physics

20040071040 NASA Marshall Space Flight Center, Huntsville, AL, USA
Recent Progress in Understanding the Sun's Magnetic Dynamo
Hathaway, David. H.; 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

100 years ago we thought that the Sun and stars shone as a result of slow gravitational contraction over a few tens of millions of years - putting astronomers at odds with geologists who claimed that the Earth was much, much older. That mystery was solved in the 1920s and 30s with the discovery of nuclear energy (proving that the geologists had it right all along). Other scientific mysteries concerning the Sun have come and gone but three major mysteries remain: 1) How does the Sun produce sunspots with an 11-year cycle? 2) What produces the huge explosions that result in solar flares, prominence eruptions, and coronal mass ejections? and 3) Why is the Sun's outer atmosphere, the corona, so darned hot? Recent progress in solar astronomy reveals a single key to understanding all three of these mysteries.The 11-year time scale for the sunspot cycle indicates the presence of a magnetic dynamo within the Sun. For decades this dynamo was though to operate within the Sun's convection zone - the outmost 30% of the Sun where convective currents transport heat and advect magnetic lines of force. The two leading theories for the dynamo had very different models for the dynamics of the convection zone. Actual measurements of the dynamics using the techniques of helioseismology showed that both of these models had to be wrong some 20 years ago. A thin layer of strongly sheared flow at the base of the convection zone (now called the tachocline) was then taken to be the seat of the dynamo. Over the last 10 years it has become apparent that a weak meridional circulation within the convection zone also plays a key role in the dynamo. This meridional circulation has plasma rising up from the tachocline in the equatorial regions, spreading out toward the poles at a top speed of about 10-20 m/s at the surface, sinking back down to the tachocline in the polar regions, and then flowing back toward the equator at a top speed of about 1-2 m/s in the tachocline itself. Recent dynamo models that include this meridional flow now appear to have some power for predicting the size of future sunspot cycles.
Author
Coronas; Sun; Sunspots; Solar Magnetic Field

20040073450 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thermal and Nonthermal Contributions to the Solar Flare X-Ray Flux
Dennis, Brian R.; Phillips, K. J. H.; Sylwester, Janusz; Sylwester, Barbara; Schwartz, Richard A.; Tolbert, A. Kimberley, et al.; [2004]; 1 pp.; In English; COSPAR (Committee on Space Research), 16 Jul. - 1 Aug. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The relative thermal and nonthermal contributions to the total energy budget of a solar flare are being determined through analysis of RHESSI X-ray imaging and spectral observations in the energy range from approx. 5 to approx. 50 keV. The classic ways of differentiating between the thermal and nonthermal components - exponential vs. sources - can now be combined for

individual flares. In addition, RHESSI's sensitivity down to approx. 4 keV and energy resolution of approx. 1 keV FWHM allow the intensities and equivalent widths of the complex of highly ionized iron lines at approx. 6.7 keV and the complex of highly ionized iron and nickel lines at approx. 8 keV to be measured as a function of time. Using the spectral line and continuum intensities from the Chianti (version 4.2) atomic code, the thermal component of the total flare emission can be more reliably separated from the nonthermal component in the measured X-ray spectrum. The abundance of iron can also be determined from RHESSI line-to-continuum measurements as a function of time during larger flares. Results will be shown of the intensity and equivalent widths of these line complexes for several flares and the temperatures, emission measures, and iron abundances derived from them. Comparisons will be made with 6.7-keV Fe-line fluxes measured with the RESIK bent crystal spectrometer on the Coronas-F spacecraft operating in third order during the peak times of three flares (2002 May 31 at 00:12 UT, 2002 December 2 at 19:26 UT, and 2003 April 26 at 03:OO UT). During the rise and decay of these flares, RESIK was operating in first order allowing the continuum flux to be measured between 2.9 and 3.7 keV for comparison with RHESSI fluxes at its low-energy end.
Author
Solar Flares; Coronas; Energy Budgets; X Ray Imagery; Temperature Effects

20040073469 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fitting Flux Ropes to a Global MHD Solution: A Comparison of Techniques, Appendix 1
Riley, Pete; Linker, J. A.; Lionello, R.; Mikic, Z.; Odstrcil, D.; Hidalgo, M. A.; Cid, C.; Hu, Q.; Lepping, R. P.; Lynch, B. J., et al.; [2004]; 19 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NASW-02027; CIT-PC251439; NAG5-6912; Copyright; Avail: CASI; A03, Hardcopy

Flux rope fitting (FRF) techniques are an invaluable tool for extracting information about the properties of a subclass of CMEs in the solar wind. However, it has proven difficult to assess their accuracy since the underlying global structure of the CME cannot be independently determined from the data. In contrast, large-scale MHD simulations of CME evolution can provide both a global view as well as localized time series at specific points in space. In this study we apply 5 different fitting techniques to 2 hypothetical time series derived from MHD simulation results. Independent teams performed the analysis of the events in "blind tests", for which no information, other than the time series, was provided. F rom the results, we infer the following: (1) Accuracy decreases markedly with increasingly glancing encounters; (2) Correct identification of the boundaries of the flux rope can be a significant limiter; and (3) Results from techniques that infer global morphology must be viewed with caution. In spite of these limitations, FRF techniques remain a useful tool for describing in situ observations of flux rope CMEs.
Author
Solar Wind; Coronas; Magnetic Clouds; Magnetohydrodynamics

20040074176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
RHESSI Results on Energetic Particles in the Solar Atmosphere
Dennis, Brian R.; [2004]; 1 pp.; In English; CESRA, 5-12 Jun. 2004, UK, UK; No Copyright; Avail: Other Sources; Abstract Only

Since launch on 5 February, 2002, the Reuven Ramaty High Energy Solar Spectroscopic Imager has recorded well over 10,000 X-ray flares and at least 6 gamma-ray line flares. I will review some of the major results of the analysis of a small fraction of these observations of particular interest to solar radio astronomers. In particular, I will present X-ray evidence for the generation of current sheets during impulsive X-ray flares and for magnetic reconnection as the main energy release mechanism. I will also demonstrate the close association between several large flares and the accompanying coronal mass ejections. The energetic importance of accelerated electrons and ions as compared to the total energy appearing in the thermal plasma and CME mass motions will be discussed. Possible explanations will be presented for the spatial separation between the hard X-ray footpoints and the centroid of the gamma-ray line source in the July 23,2002, gamma-ray line flare.
Author
Solar Atmosphere; Magnetic Field Reconnection; Gamma Rays; Energetic Particles; X Rays; Coronal Mass Ejection

20040074182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Energetics of Three Solar Flares Observed by RHESSI
Holman, G. D.; Dennis, B. R.; Sui, Linhui; [2004]; 1 pp.; In English; AAS Meeting 2004, 30 May - 3 Jun. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

We compare the energy content of the thermal plasma and suprathermal electrons in three solar flares observed by the

Ramaty High Energy Solar Spectroscopic Imager (RHESSI). Fits of computed isothermal and thick-target bremsstrahlung spectra to RHESSI X-ray spectra are used to deduce the instantaneous energy content of the X-ray-emitting plasma and the accumulated energy in suprathermal electrons throughout the three flares. We minimize the energy in the suprathermal electrons by assuming that the electron distributions have a low-energy cutoff that is no lower than the highest cutoff energy that provides a good fit to the X-ray spectra. The energetics of the 2002 April 15 M1 flare and the 2002 April 21 X2 flare are computed and compared with results for the 2002 July 23 X5 flare. We find that for all three. flares the energy in nonthermal electrons is comparable to the energy contained in the thermal plasma.
Author
Thermal Plasmas; Electron Distribution; Solar Flares

20040074184 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Energetic Electrons in Solar Flares - As Viewed in X-Rays
Holman, Gordon D.; [2004]; 1 pp.; In English; COSPAR, 17-30 Jul. 2004, Paris, France
Report No.(s): COSPAR04-A-02374; No Copyright; Avail: Other Sources; Abstract Only

Hard X-ray observations provide the most direct diagnostic we have of the suprathermal electrons and the hottest thermal plasma present in solar flares. The Ramaty High Energy Solar Spectroscopic Imager (RHESSI) is obtaining the most comprehensive observations of individual solar flares ever available in hard X-rays. For the first time, high-resolution spectra are available for a large number of flares that accurately display the spectral shape and its evolution and, in many cases, allow us to identify the transition from the bremsstrahlung X-rays produced by suprathermal electrons to the bremsstrahlung at lower energies emitted by thermal plasma. Also, for the first time, images can be produced in arbitrary energy bands above 3 keV, and spectra of distinct imaged components can be obtained. I will review what we have learned from RHESSI observations about flare suprathermal electron distributions and their evolution Next, I will present computations of the energy deposited by these suprathermal electrons in individual flares and compare this with the energy contained in the hot thermal plasma. I will point out unsolved problems in deducing both suprathermal electron distributions and the energy content of the thermal plasma, and discuss possible solutions. Finally, I will present evidence that electron acceleration is associated with magnetic reconnection in the corona.
Author
Coronas; Electron Distribution; Emittance; Energy Bands; Magnetic Field Reconnection; Solar Flares; Thermal Plasmas

20040074235 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Flares Observed with the Ramaty High Energy Solar Spectroscopic Imager (RHESSI)
Holman, Gordon D.; [2004]; 1 pp.; In English; Meeting of the APS, Apr. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Solar flares are impressive examples of explosive energy release in unconfined, magnetized plasma. It is generally believed that the flare energy is derived from the coronal magnetic field. However, we have not been able to establish the specific energy release mechanism(s) or the relative partitioning of the released energy between heating, particle acceleration (electrons and ions), and mass motions. NASA's RHESSI Mission was designed to study the acceleration and evolution of electrons and ions in flares by observing the X-ray and gamma-ray emissions these energetic particles produce. This is accomplished through the combination of high-resolution spectroscopy and spectroscopic imaging, including the first images of flares in gamma rays. RHESSI has observed over 12,000 solar flares since its launch on February 5, 2002. I will demonstrate how we use the RHESSI spectra to deduce physical properties of accelerated electrons and hot plasma in flares. Using images to estimate volumes, w e typically find that the total energy in accelerated electrons is comparable to that in the thermal plasma. I will also present flare observations that provide strong support for the presence of magnetic reconnection in a large-scale, vertical current sheet in the solar corona. RHESSI observations such as these are allowing us to probe more deeply into the physics of solar flares.
Author
Energetic Particles; High Temperature Plasmas; Imaging Techniques; Magnetic Field Reconnection; Solar Flares; Solar Magnetic Field

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20040068190 California Univ., Berkeley, CA, USA
A Thermal Infrared Heterodyne Receiver with Applications to Astronomy
Hale, David D. Snyder; International Thermal Detectors Workshop (TDW 2003); February 2004, pp. 7-16 - 7-19; In English; See also 20040068186; No Copyright; Avail: CASI; A01, Hardcopy

A method for detection of thermal infrared radiation from astronomical sources is discussed from an instrumentation point of view. This method utilizes heterodyne detection, whereby light collected by a telescope is spatially mixed with single-mode radiation from an infrared laser local oscillator onto a HgCdTe photodiode. The operating wavelength range of the receiver is adjustable from approximately 9 to 12 microns, with an intermediate frequency response of the photodiode and associated electronics spanning from 200 to 2800 MHz, or 2.6 GHz in each sideband. The instrumentation which will be discussed is currently in use by the UC Berkeley Infrared Spatial Interferometer (ISI) at the Mount Wilson Observatory. Each of the three ISI elements consists of a 1.65m telescope with complete heterodyne receiver, and is capable of operating as the front end to a variety of different instruments. The sensitivity of the receiver to measuring weak stellar sources will be discussed and contrasted with homodyne receiver performance. Actual spectroscopic and interferometric measurements of astronomical sources will be mentioned.
Author
Homodyne Reception; Thermal Radiation; Receivers; Radiation Measurement; Infrared Interferometers; Frequency Response; Telescopes; Detection

20040070717 Colorado Univ., Boulder, CO, USA
The X-Ray Variable Sky
Stringfellow, Guy; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-3394; No Copyright; Avail: CASI; A01, Hardcopy

A novel approach to search for rapid time variability of every source, whether persistent or transient, within the entire ROSAT detector field has been developed. Semi-automated software statistically tests the photon arrival time event list for source variability and reports significant (greater than 5 sigma) variable enhancement in the photon count rate on time scales ranging from 5-500 seconds. The computational algorithms have been thoroughly tested, and are able to discriminate between false detections induced by instrumental effects, and real X-ray variable sources (XRVs); when carefully scrutinized by the PI. The analysis has proven to be successful, with both periodic and transient XRVs having been found. Some of these are entirely new discoveries, while others have been detected in previous X-ray missions, yet their nature remained elusive since source identification and analysis had yet to be performed. On average, one new (unidentified) XRV is found per ROSAT PSPC field analyzed. In some cases the XRVs show only a transient signature (a burst type event) with no persistent X-ray or other known (optical) counterpart. The ambitious goal of this project was to process as much of the ROSAT PSPC archive data as feasibly possible to discover XRVs and analyze this data.
Derived from text
Computer Programs; X Ray Sources; Photons; Augmentation; Algorithms; X Ray Astronomy

20040070817 Ohio Univ., Athens, OH, USA
The Physics of AGN, a Deep Understanding of the Quasar 3C 273
Courvoisier, T.; Bottcher, Markus; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-13205; No Copyright; Avail: CASI; A01, Hardcopy

Upon our successful AO-1 proposal no. 120023, the quasar 3C 273 has been observed with INTEGRAL in 3 epochs in January 2003. The first observation, on January 5, 2003, with a total INTEGRAL exposure of 1.2 x 10(exp 5) s, was simultaneous with RXTE and XMM- Newton observations. Two more INTEGRAL observations were carried out on January 11, 2003 (exposure: lo4 s) and January 17, 2003 (exposure: 1.1 x 10(exp 5) s). The source was detected with high significance by all INTEGRAL instruments, the OMC, JEM-X, SPI, and IBIS/ISGRI. Being one of the first INTEGRAL observations simultaneous with XMM and RXTE, our observations were also used to fix the cross calibration with those instruments. The combined spectrum resulting from the XMM-Newton, JEM-X, RXTE, SPI and ISGRI X-ray / soft gamma-ray observations is consistent with a straight power-law of photon index Gamma = (1.73 +/- 0.015) between 3 keV and at least 200 keV. A possible detection in the 200 keV - 500 keV band by SPI can not be confirmed with our observations. The normalization of

the X/gamma-ray spectrum is (2.24 +/- 0.05) x 10(exp -2) photons /sq cm keV at 1 keV. The source showed a moderate amount of optical variability as observed with the OMC onboard INTEGRAL. No evidence for variability at X-rays and gamma-rays could be reported, which may have been a result of insufficient photon statistics. The X-/gamma-ray spectrum observed in our 2003 observations is consistent with previously measured and modelled broadband spectral energy distributions of 3C 273. It has been included in the U.S. lead Col's work on spectral and variability modelling of gamma-ray blazars, supporting the trend of flat-spectrum radio quasars such as 3C 273 being 7-ray dominated due to a strong contribution from Compton upscattering of external radiation by ultrarelativistic electrons in a relativistic jet. 3C 273 is a particularly convincing example for such a picture since it provides very direct evidence for a strong external radiation field by virtue of its obvious big blue bump, most likely originating in a very luminous accretion disk.
Author
Cross Correlation; Gamma Ray Spectra; Images; Photons; Quasars; Radiation Distribution; Spectral Energy Distribution

20040071007 Universities Space Research Association, Huntsville, AL, USA
Changes in the X-Ray Emission from the Magnetar Candidate 1E 2259+586 During its 2002 Outburst
Woods, P. M.; Kaspi, V. M.; Thompson, C.; Gavrill, F. P.; Marshall, H. L.; Chakrabarty, D.; Flanagan, K.; Heyl, J.; Hernquist, L.; The Astrophysical Journal; April 10, 2004; Volume 605, pp. 378-399; In English; Copyright; Avail: CASI; A03, Hardcopy

An outburst of more than 80 individual bursts, similar to those seen from Soft Gamma Repeaters (SGRs), was detected from the anomalous X-ray pulsar (AXP) 1E 2259+586 in 2002 June. Coincident with this burst activity were gross changes in the pulsed flux, persistent flux, energy spectrum, pulse profile, and spin-down of the underlying X-ray source. We present Rossi X-Ray Timing Explorer and X-Ray Multi-Mirror Mission observations of 1E 2259+586 that show the evolution of the aforementioned source parameters during and following this episode and identify recovery timescales for each. Specifically, we observe an X-ray flux increase (pulsed and phase-averaged) by more than an order of magnitude having two distinct components. The first component is linked to the burst activity and decays within approx. 2 days, during which the energy spectrum is considerably harder than during the quiescent state of the source. The second component decays over the year following the glitch according to a power law in time with an exponent -0.22 +/- 0.01. The pulsed fraction decreased initially to approx. 15% rms but recovered rapidly to the preoutburst level of approx. 23% within the first 3 days. The pulse profile changed significantly during the outburst and recovered almost fully within 2 months of the outburst. A glitch of size Delta(sib (nu)max) = (4.24 +/- 0.11) x 10(exp -6) was observed in 1E 2259+586, which preceded the observed burst activity. The glitch could not be well fitted with a simple partial exponential recovery. An exponential rise of approx. 20% of the frequency jump with a timescale of approx. 14 days results in a significantly better fit to the data; however, contamination from a systematic drift in the phase of the pulse profile cannot be excluded. A fraction of the glitch (approx. 19%) was recovered in a quasi-exponential manner having a recovery timescale of approx. 16 days. The long-term postglitch spin-down rate decreased in magnitude relative to the preglitch value. The changes in the source properties of 1E 2259+586 during its 2002 outburst are shown to be qualitatively similar to changes seen during or following burst activity in two SGRs, thus further solidifying the common nature of SGRs and AXP's as magnetars. The changes in persistent emission properties of 1E 2259+586 suggest that the star underwent a plastic deformation of the crust that simultaneously impacted the superfluid interior (crustal and possibly core superfluid) and the magnetosphere. Finally, the changes in persistent emission properties coincident with burst activity in 1E 2259+586 enabled us to infer previous burst-active episodes from this and other AXP's. The nondetection of these outbursts by all-sky gamma-ray instruments suggests that the number of active magnetar candidates in our Galaxy is larger than previously thought.
Author
X Ray Sources; Emission; Pulsars; Superfluidity; Soft Gamma Repeaters; Magnetars; Energy Spectra

20040071008 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The O(+) Density Trough at 5000 km Altitude in the Polar Cap
Zeng, W.; Horwitz, J. L.; Craven, P. D.; Rich, F. J.; Moore, T. E.; Journal of Geophysical Research; 2004; ISSN 0148-0227; Volume 109; 14 pp.; In English
Contract(s)/Grant(s): NCC8-65; NSF ATM-99-11916; UPN 370-17-43; Copyright; Avail: Other Sources

At altitudes near 5000 km over the southern polar cap region of the terrestrial magnetosphere/ionosphere, the Thermal Ion Dynamics Experiment (TIDE) on board the Polar satellite has observed O(+) ion density trough regions, in which the densities were at least one order of magnitude lower than the surrounding O(+) densities. In the 0" density trough regions, the estimated O+ densities were generally lower than 0.01 per cc. The boundaries between normal density level regions and the trough density regions were usually abrupt transitions. From 1 December 1997 to 30 November 1998, polar cap O(+) troughs in Polar/TIDE observations occurred at a frequency of about 48%. Statistical examination of the Polar

perigee observations from 1 December 1997 to 30 November 1998 shows that the Polar perigee passes evenly covered the southern polar cap region, while the O(+) density trough was always located on the nightside portion of the polar cap magnetosphere/ionosphere, and that invariant latitude spans of such troughs could be as large as 23 deg. in extent. The trough occurrence displayed a strong seasonal dependence; in the winter season (e.g., for July in the Southern Hemisphere) the O(+) ion density trough occurrence frequency ranged up to 92%, while in the summer season (e.g., for January in the Southern Hemisphere) it decreased to as low as 15%. Our statistical results show that the trough occurrence was generally anticorrelated with solar wind dynamic pressure in the solar wind dynamic pressure range 0.8 - 2.6 nanopascal. The O(+) ion density trough occurrence appeared relatively independent of the geomagnetic Kp index, IMF Bz, and By conditions. However, as suggested by the seasonal dependence, the O(+) ion density trough occurrence was strongly related to the solar zenith angle (SZA). In the SZA range 50 deg. to 125 deg., the trough occurrence increased monotonically with SZA. In addition, we sought to determine consistent density and velocity signatures at lower altitudes associated the O(+) ion density trough at 5000 km by examining the near-simultaneous O(+) densities and vertical velocities observed by the DMSP satellite group orbiting at 840 km altitude. However, consistent correlations between the dual altitudes were not reliably established from the present examinations.
Author
Oxygen Ions; Density; Polar Caps; Altitude; Dynamic Pressure; Ion Density (Concentration); Solar Wind

20040071148 American Astronomical Society, USA
The BATSE Earth Occultation Catalog of Low Energy Gamma-Ray Sources
Harmon, B. A.; Wilson-Hodge, C. A.; Fishman, G. J.; Paciesas, W. S.; Zhang, S. N.; Finger, M. H.; Connaughton, V.; Koshut, T. M.; Henze, W.; McCollough, M. L., et al.; American Astronomical Society; [2004]; Vol. 33, pp. 1496; In English; 199th AAS Meeting, [2004], unknown
Contract(s)/Grant(s): NAG5-7927; No Copyright; Avail: Other Sources; Abstract Only

The Burst and Transient Source Experiment (BATSE),aboard the COmptOn Gamma Ray Observatory (CGRO), provided a record of the hard X-ray/low energy gamma ray sky between April 1991 and June 2000. During that time, a catalog of known sources was derived from existing catalogs such as HEAO A-4 (Levine et al. 19841, as well as new transient sources discovered with RATSE and other X-ray monitors operating in the CGRO era. The Earth Occultation Technique (Harmon et al. 2001, astro-ph/0109069) was used to monitor a combination of these sources, mostly galactic, totaling about 175 objects. The catalog will present the global properties of these sources and their probability of detection (>lO mCrab, 20-100 keV) with BATSE. Systematic errors due to unknown sources or background components are included. Cursory analyses to search for new transients (35-80 mCrab in the 20-100 keV band) and super-orbital periods in known binary sources are also presented. Whole mission light curves and associated data production/analysis tools are being delivered to the HEASARC for public use.
Author
Catalogs (Publications); Gamma Ray Bursts

20040074195 City Univ. of Hong Kong, Kowloon, Hong Kong
A New Method to Use Chandra Data to Resolve the X-Ray Halos Around Point Sources and Its Application to Cygnus X-1
Yao, Y.; Zhang, S. Nan; Zhang, X. L.; Feng, Y. X.; May 2003; 1 pp.; In English; American Astronomical Society Meeting 202, May 2003
Contract(s)/Grant(s): NAG5-7927; Copyright; Avail: Other Sources; Abstract Only

The excellent angular resolution, good energy resolution and broad energy band make Chandra ACIS the best instrument for studying the X-ray halos around some galactic x-ray point sources caused by the dust scattering of X-rays in the interstellar medium, but direct images of bright sources of b r i g h t sources obtained with ACIS usually from severe pile- UP - Making use of the fact that an isotropic image could be reconstructed from it's projection on any direction, we can reconstruct the images of the X-ray halos from data obtained with the regular HETGS and/or the CC mode. With the reconstructed high resolution images, we can probe the X-ray halos as close as 1 arcsecond to their associated point sources.
Author (revised)
Interstellar Matter; Image Analysis; Halos; Galactic Radiation

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20040070866 California Univ., Los Angeles, CA, USA

Some Informal Remarks on the M-Form Society

Ouchi, William G.; NASA Symposium on Productivity and Quality: Strategies for Improving Operations in Government and Industry; [1984]; 11 pp.; In English; See also 20040070839; No Copyright; Avail: CASI; A03, Hardcopy

The paper describes the business-government relationship in Japan and compares it to similar relationships in the USA. In particular, the paper analyzes the impact that this relationship has on joint research and development in both defense and non-defense sectors.

Author

Gross National Product; Commerce

20040073507 NASA Marshall Space Flight Center, Huntsville, AL, USA

Program for the Increased Participation of Minorities in NASA-Related Research

Biological and Physical Space Research Laboratory 2002 Science Review; December 2003, pp. 9; In English; See also 20040073490; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The goal of this program is to increase the participation of minorities in NASA related research and "Science for the Nation s Interest". Collaborative research projects will be developed involving NASA-MSFC, National Space Science and Technology Center (NSSTC), other government agencies, industries and minority serving institutions (MSIs). The primary focus for the MSIs will be on Alabama A&M University and Tuskegee University, which are in partnership with the NSSTC. These schools have excellent Ph.D. programs in physics and materials science and engineering, respectively. The first phase of this program will be carried out at Alabama A&M University in the "Research and Development Office" in collaboration with Dr. Dorothy Huston, Vice President of Research and Development. The development assignment will be carried out at the NSSTC with Sandy Coleman/ RS01 and this will primarily involve working with Tuskegee University.A portion of the program will be devoted to identifying and contacting potential funding sources for use in establishing collaborative research projects between NASA-MSFC, other government agencies, NSSTC, industries, and MSIs. These potential funding sources include the National Science Foundation (NSF), National Institute of Health (NIH), Department of Defense (DOD), Army, Navy, and Air Force. Collaborative research projects will be written mostly in the following research areas: a. Cosmic radiation shielding materials b. Advanced propulsion material c. Biomedical materials and biosensors d. In situ resource utilization e. Photonics for NASA applications

Author

Research and Development; Technologies; Minorities

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